NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

UNDERGRADUATE PROGRAMME

Choice Based Credit System (CBCS)

(Academic Year 2021-22)

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Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So, it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point,Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
   - **2.1 Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
   - **2.2 Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
   - **2.3 Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

     P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course: The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

- **3.1** AE Compulsory Course (AECC): Environmental Science, English Communication / MIL Communication.
- **3.2** AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of courses

	Theory+ Practical	Theory + Tutorial
I. Core Course		
(14 Papers)	14X4= 56	14X5=70
Core Course Practical / Tutorial*		
(14 Papers)	14X2=28	14X1=14
II. Elective Course		
(8 Papers)		
A.1. Discipline Specific Elective	4X4=16	4X5=20
(4 Papers)		
A.2. Discipline Specific Elective Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		
B.1. Generic Elective/ Interdisciplinary	4X4=16	4X5=20
(4 Papers)		
B.2. Generic Elective Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		

- **Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6th Semester**

III. Ability Enhancement Courses

1. **Ability Enhancement Compulsory**		
(2 Papers of 2 credit each)	2 X 2=4	2 X 2=4
Environmental Science		
English/MIL Communication		
2. **Ability Enhancement Elective** (Skill Based)		
(Minimum 2)	2 X 2=4	2 X 2=4
(2 Papers of 2 credit each)		
Total credit	**140**	**140**

* wherever there is a practical there will be no tutorial and vice-versa

BCA (Bachelor Computer Application)

Core Papers (C): (Credit: 06 each) (1 period/week for tutorials or 4 periods/week for practical)

1. STUGCS1/C01: Computer Organization and Architecture (4 + 2)
2. STUGCS1/C02: Programming in C (4 + 2)
3. STUGCS2/C03: Operating System (4 + 2)
4. STUGCS2/C04: Programming in C++ (4 + 2)
5. STUGCS3/C05: Data Structure (4 + 2)
6. STUGCS3/C06: Computer Network (4 + 2)
7. STUGCS3/C07: Programming in JAVA (4 + 2)
8. STUGCS4/C08: Design analysis and Algorithm (4 + 2)
9. STUGCS4/C09: Software Engineering (4 + 2)
10. STUGCS4/C10: Database Management System (4 + 2)
11. STUGCS5/C11: Dot (.) NET Framework (4 + 2)
12. STUGCS5/C12: Computer Graphics (4 + 2)
13. STUGCS6/C13: Artificial Intelligence (4 + 2)
14. STUGCS6/C14: Theory of Computation (4 + 2)

Discipline Specific Elective Papers: (Credit: 06 each) - DSE 1-4

(4 papers to be selected: 02 each for Odd semester and Even semester as listed below)

1. STUGCS/DSE01: Cloud computing (4 + 2)
2. STUGCS /DSE02: Cryptography and Network Security (4 + 2)
3. STUGCS /DSE03: Python (4) + Lab (4)
4. STUGCS /DSE04: Big Data (5) + Tutorial (1)
5. STUGCS /DSE05: Numerical Analysis(4) + Lab (4)
6. STUGCS /DSE06: Information Security Cyber Law(4) + Lab (4)
7. STUGCS /DSE07: Information Security (4) + Lab (4)
8. STUGCS /DSE08: Data Mining (4) + Lab (4)
9. STUGCS /DSE09: Operation Reseach (5) + Tutorial (1)
10. STUGCS /DSE12: Dissertation/ Project

Skill Enhancement Courses (02 to 04 papers) (Credit: 02 each)- SEC1 to SEC4

1. STUGCS/SEC01: Management Information System
2. STUGCS /SEC02: Web Technology
3. STUGCS /SEC03: Software Engineering
4. STUGCS /SEC04: Theory of Computation
5. STUGCS /SEC05: Microprocessor
6. STUGCS /SEC06: Digital Image Processing
7. STUGCS /SEC07: Machine Learning

8. STUGCS /SEC08: Data Mining
9. STUGCS /SEC09: Networking Programming

Generic Elective Papers (GE): (Credit: 06 each)

1. STUGCS/GE01: Internet Technologies (4) + Lab (4)
2. STUGCS /GE02: E-Commerce (4) + Lab (4)
3. STUGCS /GE03: Hypertext Pre-Processor (4) + Lab (4)
4. STUGCS /GE04: Mobile Computing (4) + Lab (4)

Bachelor of Computer Application

Profile

- BCA course of Noida International University aims to enhance the students development skills and increase the employment areas.
- Making the students ready for the corporate world in aspects of handling different responsibilities.
- True leadership is being imparted on every student to make them take responsibilities and perform their duties.
- Hard work, punctuality and discipline are the main aspects of education in our institute.
- The bond of work and relations, on being a gentle is the basics of our education.

Program Offered: Graduate

- BCA – Bachelor of Computer Application - 3 Years

VISION

BCA Course of NIU is an exclusive platform to provide internship cum training to under graduate students. It aims to train students in technical knowledge and programming skills. It helps the students in sharpening their development skills. It focuses on developing android and web based application. This will help the students in gaining their full command in programming skills. The current scenario speaks up the need and requirement of technical skills.

MISSION

BCA Course from NIU aims to work towards Student skill development, Entrepreneurship Development and deliver a sustainable learning platform in Information Technology. Skill development initiatives will actualize the inert potential of the students. We aim to development talented, employment ready youth for the nation. Our nation has to meet the raising aspiration of young graduates. Our efforts is in a view to enhance the quality of technical education for the country.

- To enhance the technical skills of students.
- Provide corporate ready students.
- Certification Programs, technical sessions with going course enhance the student's ability.
- Regular interaction with industries helps the students in building up their views and choose a better platform.
- Personal Assistance in final year projects and internal assessment.

PEOs of BCA programme are:

BCA programme of Noida International University will prepare its students

- **PEO 1:** To gain the potential in software development field. Efficient faculty members, easily available study resources and availability of different platform encourages the students to be a part of the development field.
- **PEO 2:** For research and implementation new techniques with different sceneries. Wide availability of networking lets the students come up with new and different variant of ideas and methodologies which is being imparted in the students.
- **PEO 3:** To entrepreneurship and industry based model. Students are provided with enormous resources that lead them stand as independent and self-developed individual.

PROGRAM OUTCOME

On completion of BCA degree, the graduates will be able to:

1. **PO1**. Gain proper employment in the fields of development and technical strategies.
2. **PO2.** Sustain in the competitive and corporate environment leading a enhanced strategies in development.
3. **PO3**. Handle different fields , people in terms of jobs, technical assistance and monitoring datas.
4. **PO4.** Work on large and huge databases which is the main aspects of social networking platform in the current scenario.
5. **PO5.** Gain inertia in development and monitoring strategies in development and maintenance field.
6. **PO6.** Update, alter, and modify the current existing technologies to new and upgraded ones.
7. **PO7.** Handle the research strategies, higher education and building a better platform for coming generations.
8. **PO8.** Will be able to handle new technologies, strategies and formation based structures.
9. **PO9**. Impart and elaborate new and existing technologies to the new generations.
10. **PO10.**test and identify bugs in the technical aspects of an organization.
11. **PO11.**present a better and enhanced strategies in development, testing and maintenance field.
12. **PO12.** To create and develop new fields in computer application leading to dynamic platforms and scenarios.

PROGRAM SPECIFIC OUTCOME (PSO)

PSO1: Students get familiar with technologies like Dot Net Framework which helps them working on windows web sites as well as application. Using sp.net students can work and maintain web sites where as using dot net and C Sharp technologies students can develop applications.

PSO2: Database management system helps in the students in working on different sorts of data. Students can work on back end as well as work as system administrator by which they can secure the system.

PSO3: Students get familiar with various back end languages like PHP in accordance with web technologies which helps them in development of different applications.

PSO4: Students can handle manual as well automated testing of applications as well web sites which gives an extra benefit in todays technical background.

PSO5: Students can easily work on support projects which leads to a better and secured technical set ups.

PSO6: Students get familiar in all the basic programming levels which helps in dealing a new technologies in now time.

PSO7 : Students gain command over their communicative power during their advanced technical skills sessions which helps them taking over their higher designation.

PSO8: Enlightening the students with overall computer structure helps students in working on architecture of a system.

PSO9 : The networking skills of a students is sharpened and he can handle different networking issues in any organizations.

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for B.Sc. (Computer Sciences)
Effective from the Session: 2021-2022

BCA (Bachelor Computer Application) 1st Year
SEMESTER-I

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS1 /C01	Computer Organization and Architecture	4	0	0	20	20	40	60	100	4	C1
2	STUGCS1 /C01	Programming in C	4	0	0	20	20	40	60	100	4	C2
3	STUGCS1 /GE1	Internet Technology	4	0	0	20	20	40	60	100	4	GE1
4	STUGCS1 /AECC1	Environmental Sciences	2	0	0	20	20	40	60	100	2	AEC C1
Practical												
1	SPUGCS1 /C01	Computer Organization and Architecture	0	0	2			25	25	50	2	C1
2	SPUGCS1 /C01	Programming in C	0	0	2			25	25	50	2	C2
3	SPUGCS1 /GE1	Internet Technology	0	2	0			25	25	50	2	GE1
Total										**550**	**20**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

BCA (Bachelor Computer Application) 1st Year
SEMESTER-II

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS2/ C03	Operating System	4	0	0	20	20	40	60	100	4	C3
2	STUGCS2/ C04	Programming in C++	4	0	0	20	20	40	60	100	4	C4
3	STUGCS2/ GE02	E-Commerce/ Discrete Mathematics	4	0	0	20	20	40	60	100	4	GE2
4	STUGCS2/ AECC2	Technical Communicatio n	2	0	0	20	20	40	60	100	2	AEC C2
Practical												
1	SPUGCS2/ C03	Operating System	0	0	2			25	25	50	2	C3
2	SPUGCS2/ C04	Programming in C++	0	0	2			25	25	50	2	C4
3	SPUGCS2/ GE02	E-Commerce/ Discrete Mathematics	0	2	0			25	25	50	2	AEC C2
Total										**550**	**20**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

BCA (Bachelor Computer Application) 2nd Year
SEMESTER-III

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total	External Exam			
1	STUGCS3 /C05	Data Structure	4	0	0	20	20	40	60	100	4	C5
2	STUGCS3 /C06	Computer Network	4	0	0	20	20	40	60	100	4	C6
3	STUGCS3 /C07	Programming in JAVA	4	0	0	20	20	40	60	100	4	C7
4	STUGCS3 /SEEC1	Management Information System	2	0	0	20	20	40	60	100	2	SEC1
5	STUGCS3 /GE3	Hypertext Pre-processing/E-commerce	4	0	0	20	20	40	60	100	4	GE3
Practical												
1	SPUGCS3 /C05	Data Structure	0	0	2			25	25	50	2	C5
2	SPUGCS3 /C06	Computer Network	0	0	2			25	25	50	2	C6
3	SPUGCS3 /C07	Programming in JAVA	0	0	2			25	25	50	2	C7
4	SPUGCS3 /GE3	Hypertext Pre-processing/E-commerce	0	2	0			25	25	50	2	GE3
Total										**700**	**26**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

NOIDA INTERNATIONAL UNIVERSITY

BCA (Bachelor Computer Application) 2nd Year
SEMESTER-IV

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS4 /C08	Design analysis and Algorithm	4	0	0	20	20	40	60	100	4	C8
2	STUGCS4 /C09	Software Engineering	4	0	0	20	20	40	60	100	4	C9
3	STUGCS4 /C10	Database Management System	4	0	0	20	20	40	60	100	4	C10
4	STUGCS4 /SEEC2	Web Technology	2	0	0	20	20	40	60	100	2	SEC2
5	STUGCS4 /GE4	Mobile Computing	4	0	0	20	20	40	60	100	4	GE4
Practical												
1	SPUGCS4 /C08	Design analysis and Algorithm	0	0	2			25	25	50	2	C8
2	SPUGCS4 /C09	Software Engineering	0	0	2			25	25	50	2	C9
3	SPUGCS4 /C10	Database Management System	0	0	2			25	25	50	2	C10
4	SPUGCS4 /GE4	Mobile Computing	0	2	0			25	25	50	2	GE4
Total										**700**	**26**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

BCA (Bachelor Computer Application) 3rd Year
SEMESTER-V

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS5 /C11	Dot (.) NET Framework	4	0	0	20	20	40	60	100	4	C11
2	STUGCS5 /C12	Computer Graphics	4	0	0	20	20	40	60	100	4	C12
3	STUGCS5 /DSC1	Cloud computing	4	0	0	20	20	40	60	100	4	DSC1
4	STUGCS5 /DSC2	Data Mining	4	0	0	20	20	40	60	100	4	DSC2
Practical												
1	SPUGCS5 /C11	Dot (.) NET Framework	0	0	2			25	25	50	2	C11
2	SPUGCS5 /C12	Computer Graphics	0	0	2			25	25	50	2	C12
3	SPUGCS5 /DSC1	Cloud computing	0	0	2			25	25	50	2	DSC1
4	SPUGCS5 /DSC2	Data Mining	0	2	0			25	25	50	2	DSC2
Total										**600**	**24**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

NOIDA INTERNATIONAL UNIVERSITY

BCA (Bachelor Computer Application) 3rd Year
SEMESTER-VI

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS 6/C13	Artificial Intelligence	4	0	0	20	20	40	60	100	4	C13
2	STUGCS 6/C14	Theory of Computation	4	0	0	20	20	40	60	100	4	C14
3	STUGCS 6/DSC3	Cryptography and Network Security	4	0	0	20	20	40	60	100	4	DSC3
4	STUGCS 6/DSC4	Project	0	0	4	20	20	40	110	150	6	DSC4
Practical												
1	SPUGCS 6/C11	Artificial Intelligence	0	0	2			25	25	50	2	C13
2	SPUGCS 6/C12	Theory of Computation	0	0	2			25	25	50	2	C14
3	SPUGCS 6/DSC3	Cryptography and Network Security	0	0	2			25	25	50	2	DSC3
Total										**600**	**24**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective
OVERALL CREDIT SCHEME

S. No.	SEMESTER	Theory Total	Practical Total	Subject Total	Total Credit
1	I	400	150	550	20
2	II	400	150	550	20
3	III	500	200	700	26
4	IV	500	200	700	26
5	V	400	200	600	24
6	VI	400	200	600	24
			Grand Total	**3700**	**140**

BCA (Bachelor Computer Application) 1st Year
SEMESTER-I

Course Code: STUGCS1/C01 Course Name: Computer Organization and Architecture
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:

- To facilitate the students, learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.
- To facilitate the students to be familiarized with the hardware components and concepts related to the input-output organization.
- To facilitate the students to be familiarized with the hardware components and concepts related to the memory organization.
- To facilitate the students to be familiarized with the concepts related to the 8086 micro controller like pin diagram, different types of registers and addressing modes.

Course Description:

- Computer architecture is a specification detailing how a set of software and hardware technology standards interact to form a computer system or platform. computer architecture refers to how a computer system is designed and what technologies it is compatible with. There are three categories of computer architecture:
- System Design: This includes all hardware components in the system, including data processors aside from the CPU, such as the graphics processing unit and direct memory access. It also includes memory controllers, data paths and miscellaneous things like multiprocessing and virtualization Instruction Set Architecture (ISA): This is the embedded programming language of the central processing unit. It defines the CPU's functions and capabilities based on what programming it can perform or process. This includes the word size, processor register types, memory addressing modes, data formats and the instruction set that programmers use.
- Micro architecture: Otherwise known as computer organization, this type of architecture defines the data paths, data processing and storage elements, as well as how they should be implemented.

Course Contents:

- **Unit –I:** Basis Computer Architecture, Functional Organization Register Organization, Arithmetic and Logic Unit, Central Processing Unit Register Organization, Arithmetic and Logic Unit, Central Processing Unit, Instruction formats. CPU Architecture, instruction format, addressing mode, stacks and handling interrupts. Assembly Language Elementary Problems.
- **Unit II:** Address Modes: Data Transfer and Manipulation, interrupts RISC/ CISC architecture, Register transfer and macro operations, Register Transfer Languages (RTL). Arithmetic, Logic and Shift Macro-operations, Sequencing Macro-program sequences.
- **UNIT III:** Memory and storage: Processor Vs Memory speed: Cache Memory, Associative Memory, Virtual Memory and Memory Management , Pipeline and Vector Processing.
- **UNIT IV:** Input/output organization: Peripheral devices, I/O Asynchronous Data transfer: Strobe Control, Data transfer schemes (Programmed, Initiated, DW, Transfer) .
- **UNIT V:** Memory Hierarchy, Main Memory, Auxiliary Memory, Cache Memory

Course learning outcome:

- **CO1. :** this unit is for understanding function and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer.
- **CO2.:** Machine instructions, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.
- **CO3. :** Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Microprogrammed control unit
- **CO4.:** Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Address t l ti H d t f t translation, Hardware support for memory manage
- **CO5.** : Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O Interrupt controlled I/O and DMA controlled I/O I/O interfaces Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infiniband, I/O peripherals - Input devices, Output devices, Secondary storage devices.

Text books :

- Moris Mano, "Computer System Architecture", PHI Publications, 2002
- R. P. Jain, "Modern Digital Electronics", TMH, 3rd Edition, 2003

Reference Books:

- Computer System Architecture (Third Edition),. Morris Mono - Pearson Prentice Hall,2007. .

Online links for study & reference materials :

- http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS1/C02 **Course Name: Programming in C**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:

- The course is intended to create an understanding of the fundamentals of high level structural programming concepts through the medium of C language.
- C language is a general purpose, procedural computer programming language

Course Description:

- The course is used to demonstrate the understanding of computer programming languages.
- Able to define data types and use them in simple data processing applications also student must be able to understand the concept of array of structures.

Course Contents:

Unit-I

Fundamental: H/W and S/W part of computer system, Computer Block Diagram, online processing, time sharing system, real time system, batch system, multiprogramming, multiprocessing, SPOOLING, distributed data processing. Element of computer file, types of files, file processing activities, file design factors, access methods, pros and cons of file organization.

Unit-II

MS office: Introduction to MS Office; Introduction to MSWord; Features & area of use. Working with MS Word.; Menus & Commands; Toolbars & Buttons; Shortcut Menus, Wizards & Templates; Creating a New Document; Different Page Views and layouts; Applying various Text Enhancements; Working with – Styles, Text Attributes; Paragraph and Page Formatting; Text Editing using various features; Bullets, Numbering, Auto formatting, Printing & various print options.

Unit-III

MS Excel: Introduction and area of use; Working with MS Excel.; concepts of Workbook & Worksheets; Using Wizards; Various Data Types; Using different features with Data, Cell and Texts; Inserting, Removing & Resizing of Columns & Rows; Working with Data & Ranges; Column Freezing, Labels, Hiding, Splitting etc.; Using different features with Data and Text; Use of Formulas, Calculations & Functions; Cell Formatting including Borders & Shading; Working with Different Chart Types; Printing of Workbook.

Unit-IV

Elements of C: C character set, identifiers and keywords, Data types: declaration and definition, storage classes in C, Type conversion, Types of error, 'C' macro, macro vs function.

Operators: Arithmetic, relational, logical, bitwise, unary, assignment and conditional operators and their hierarchy & associativity. Data input/output.

Control statements: Sequencing, Selection: if and switch statement; alternation, Repetition: for, while, and do- while loop; break, continue, goto.

Unit-V

Functions: Definition, prototypes, passing parameters, recursion.
Data Structures: arrays, structure, union, string.
Pointers: Declaration, operations on pointers, array of pointers, pointers to arrays.
String & file handling, Streams, String I/ O, File Operations, Formatted I/O, Character I/ O, **Line I/O, Block I/O, File positioning, File handling.**

Course Learning Outcomes (CLOs):

CLO-1: Problem solving through computer programming,

CLO-2: Familiarity of programming environment in Linux operating system

CLO-3: Ability to use different memory allocation methods.

CLO-4: Ability to deal with different input/output methods.

CLO-5: Ability to use different data structures.

References:

- Joe Habraken, Microsoft Office 2000, 8 in 1 by, Prentice Hall of India
- Deitel & Deitel: C How to Program (Prentice Hall), 1996.
- Yashwant Kanetker, Let us C, BPB Publications.
- R. B. Patel, Fundamental of Computers and Programming in C, Khanna Book Publishing Company PVT.LTD. Delhi, India, 1st edition, 2008, ISBN: 13: 978- 81- 906988- 7- 0, pp. 1- 962.
- Gottfried, Programming with C, Tata McGraw Hill.
- Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd Ed., Prentice Hall of India.

Online links for study & reference materials :
https://lecturenotes.in/download/note/18532-note-for-cprogramming-by-anshuman

Assessment Method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS1/GE1 **Course Name: Internet Technology**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:
Study on internet protocols, client/server applications and web services. Designing and applications of internet and intranet systems.

Course Description:
This course deals on the practical application of internetworking technologies to private intranets for information management and public internets for electronic Commerce students will learn theoretical details, strategies for designing sites, Techniques for creating their technical infrastructures, methods for developing Content, and techniques for site deployment and management.

Unit-I: Introduction

- History and Development of Internets and Intranets
- IANA, RIR/NIR/LIR and ISPs for internet number management
- Internet Domain and Domain Name System
- Internet Access Overview
- Internet Backbone Networks: Optical Backbone, Marine Cables, Teleports, Satellite and Terrestrial Links

Unit-II: Internet Protocol Overview

- TCP/IP and the IP Layer overview
- IPv4 and IPv6 Address Types and Formats
- IPv4 and IPv6 Header Structure
- Internet RFCs

Unit-III: Protocols and client/server applications

- Standard protocols: SMTP, E-mail, Message (RFC22), PGP, POP, IMAP, HTTP, FTP
- N-Tiered Client/Server Architecture
- Universal Internet Browsing
- Multiprotocol Support

Unit-IV: Designing internet systems and servers

- D0esigning of Internet System Network Architecture
- Choice of platforms

- Sever Concepts: WEB, Proxy, RADIUS, MAIL
- Cookies
- Load Balancing: Proxy Arrays
- Server Setup and Configuration Guidelines
- Security and System Administration Issues, Firewalls and Content Filtering.

Unit-V: Internet and Intranet Systems Development

- Introductions
- Benefits and drawbacks of intranets
- Protocols, Structure and Scope of Networks
- Intranets Resources Assessments: Network Infrastructure, Clients and Server
- Resources
- Intranet Implementation Guidelines
- Content Design, Development, Publishing and Management
- Intranet Design with Open Source Tools: DRUPAL, JUMLA
- Tunneling Protocols: VPN

Course Learning Outcomes (CLOs):

CLO 1: At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
CLO 2: Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
CLO 3: Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
CLO 4: One internal exam will be conducted as a part of internal theory evaluation.
CLO 5: Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
CLO 6: Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
CLO 7: The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
CLO 8: Experiments shall be performed in the laboratory related to course contents. Learning Outcome: After Studying that subject students would have capability to make own web site and host their own web site on internet. Also students would have enough knowledge about what are the technologies used in internet.

Reference Books:

1. Steven Holzner,"HTML Black Book" Dremtech press.

2. Web Technologies, Black Book, dreamtech Press

3. Web Applications: Concepts and Real World Design, Knuckles, Wiley-India

4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel. Pearson.

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS1/AECC1 **Course Name: Environmental Sciences**
Course Credit Hour: 2hr **Total Contact Hour: 30hr**

Course Objective:
The Compulsory course on Environmental Science at Undergraduate level aims to train students to cater to the need for ecological citizenship through developing a strong foundation on the critical linkages between ecology-society-economy.

Course Description:
Graduates will evolve into ecologically informed and socially responsible citizens who are empowered to protect the natural resources while ensuring sustainable lifestyle and developmental model.

Course Contents:

Unit 1: Introduction to Environmental Studies (2 lectures)

- Multidisciplinary nature of environmental studies
- Scope and importance; Concept of sustainability and sustainable development

Unit 2: Ecosystem (8 lectures)

- Definition and concept of Ecosystem Structure of ecosystem (biotic and abiotic components); Functions of Ecosystem Physical (energy flow), Biological (food chains, food web, ecological succession) and Biogeochemical (nutrient cycling) processes. Concepts of productivity, ecological pyramids and homeostasis.
- Types of Ecosystem – Tundra, Forest, Grassland, Desert, Aquatic (ponds, streams, lakes, rivers, oceans, estuaries) – their importance and threats on them with relevant examples from India Ecosystem services (Provisioning, Regulating, Cultural and Supporting). Basics of Ecosystem restoration

Unit 3: Natural Resources (6 lectures)

- Land resources and landuse change Land degradation, soil erosion and desertification
- Forest resources and causes of deforestation; impacts of mining and dam building on environment, forests, biodiversity and tribal populations
- Water resource: Use and over exploitation of surface and ground water, floods, drought conflicts over water (international & inter-state)
- Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs
- Case studies: National Solar Mission, Cauvery river water conflict etc

Unit 4: Biodiversity and Conservation (8 lectures)

- Definition of Biodiversity; Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India
- India as a mega-biodiversity nation; Endemic and endangered species of India; IUCN Red list; biodiversity hotspots
- Value of biodiversity: Ecological, economic, social, ethical, aesthetic and informational value of biodiversity with examples; sacred groves and their importance with example
- Current mass extinction crisis; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasion with emphasis to Indian biodiversity
- Biodiversity conservation strategies: in-situ and ex-situ methods of conservation; Biosphere reserves; Keystone and Flagship species; Species reintroduction and translocation
- Case studies: Project Tiger, Vulture breeding program etc

Unit 5: Environmental pollution (8 lectures)

- Environmental pollution (Air, water, soil, thermal and noise): causes, effects and controls; Air and water quality standards
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste
- Pollution case studies: Ganga Action plan (GAP), Delhi air pollution and public health issues etc

Field work/ Practicals (Equal to 5 lectures)

- Field visit to any of the ecosystems found in Delhi like Delhi Ridge/ Sanjay lake/ Yamuna river and its floodplains etc. or any nearby lake or pond, explaining the theoretical aspects taught in the classroom
- Visit to any biodiversity park/ reserve forests/ protected area/ zoo/ nursery/ natural history museum in and around Delhi, explaining the theoretical aspects taught in the classroom
- Visit to a local polluted site (Urban/Rural/Industrial/Agricultural), Wastewater treatment plants
- Study of common plants, insects, birds and basic principles of identification
- Organize a seminar/ conference/ workshop/ panel discussion on relevant topics for enhancing awareness, capacity building and critical reasoning among students

Course Learning Outcomes (CLOs):

The course will empower the undergraduate students by helping them to:

CLO-1 Gain in-depth knowledge on natural processes that sustain life, and govern economy.

CLO-2: Predict the consequences of human actions on the web of life, global economyand quality of human life.

CLO-3: Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.

CLO-4: Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participating actively in solving current environmental problems and preventing the future ones.

CLO-5: Adopt sustainability as a practice in life, society and industry.

Text books:

- William P. Cunningham, Mary Ann Cunningham, Barbara Woodworth Saigo, Environmental Science: A global concern, McGrawHill 2003 ¬
- William Cunningham, Mary Cunningham, Principles of Environmental Science: Seventh Edition, Mc Graw Hill 2014 UGC DOCUMENT ON LOCF ENVIRONMENTAL SCIENCE 24
- Rogers PP, Jalal, KF, Boyd JA, An introduction to sustainable development, Earthscan

Reference books:

- Roosa SA, Sustainable Development Handbook, CRC Press 2008 ¬
- Atkinson G., Dietz S., Neumayer E., Agarwala M, Handbook of Sustainable Development, Edward Elger, 2014 ¬
- Robbins P., Hintz J., Moore S.A., Environment and Society: A critical introduction, Wiley Blackwel 2014

Online links for study & reference materials:
https://www.hzu.edu.in/bed/E%20V%20S.pdf

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1	- 05%
Assignment -2	- 05%
Assessment-3(Mid-Exam)	- 20%
Assignment-3/Quiz-1	- 05%
Assignment-4	- 05%
Total Internal Assessment	**- 40%**

BCA (Bachelor Computer Application) 1st Year
SEMESTER-II

Course Code: STUGCS2/C03 **Course Name: Operating System**
Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:
To study concepts related to operating systems, like process management, concurrency and control of processes, deadlocks, memory management, processor and disk scheduling, parallel processing, and file system organization and implementation. Also to study different methods for protection and security that is becoming vital now-a-days.

Course Description:
- To master the basic concepts related to operating systems. To learn in detail about process management.
- To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.
- To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.

Course Contents :
Unit 1 : Operating system and function, Evolution of operating system, Batch, Interactive, multiprogramming, Time Sharing and Real Time System, multiprocessor system, Distributed system, System protection. Operating System . Operating System structure, Operating System Services, System Program and calls.
Unit II : Process concept, State model, and process scheduling, job and process synchronization, structure of process management, Threads interprocess Communication and Synchronization: Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Hardware Synchronization, Critical Regions, Conditional critical region, Monitor, Inter Process Communication. CPU Scheduling: Job scheduling functions, Process scheduling, Scheduling Algorithms, Non Preemptive and preemptive. Strategies, Algorithm Evaluation, Multiprocessor Scheduling. Deadlock: System Deadlock Model, Deadlock Characterization, Methods for handling deadlock, Prevention strategies, voidance and Detection, Recovery from deadlock combined approach.
Unit III : Single Contiguous Allocation: H/W support, S/W support, Advantages and disadvantages, Fragmentation, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Swapping, Overlays.
Unit IV : Principles of I/O hardware, Device controller, Device Drivers, Principles of I/O hardware, Device controller, Device Drivers, Memory mapped I/O, Direct Access Memory, Interrupts, Interrupt Handlers, Application I/O interface, I/O Scheduling, Buffering, Caching,

Spooling, Disk organization, Disk space management, Disk allocation Method, Disk Scheduling, disk storage.

Unit V : File Concept, File Organization and Access Mechanism, File Directories, Basic file system, File Sharing, Allocation method, Free space management. Policy Mechanism, Authentication, Internalexcess Authorization.

Course learning outcome :

- **CLO1 :** To master the basic concepts related to operating systems. To learn in detail about process management.
- **CLO2:** : To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.
- **CLO3**: To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.
- **CLO4** :To familiar with file system implementation. To understand mass storage management functions of operating systems.
- **CLO5:** To familiar with Protection and security aspects of operating systems. To expose to other operating systems like distributed OS, Multi-processor OS, RTOS and Mobile OS.

Text books :

Operating System by Galvin.
Operating System by Taneun Bomb
Operating system by William Stalling.

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS2/C04 **Course Name: Object Oriented Programming in C++**
Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective(s)

1. Understand and use the basic programming constructs of C++
2. Manipulate various C++ data types, such as arrays, strings, and pointers
3. Isolate and fix common errors in C++ programs
4. Use memory appropriately, including proper allocation/deal location procedures
5. Apply object-oriented approaches to software problems in C++
6. Write small-scale C++ programs using the above skills

Course Description:

Understand fundamentals of object-oriented **programming** in **C++**, including defining classes, invoking methods, using class libraries and also be aware of the important topics and principles of software development.

Course Content

Unit I:

Introduction:

What is object oriented programming? Why do we need object oriented Programming characteristics of object-oriented languages C and C++.

C++ Programming basics: Output using cout. Directives. Input with cin. Type bool. The setw manipulator. Type conversions.

Unit II:

Functions : Returning values from functions. Reference arguments. Overloaded function. Inline function. Default arguments. Returning by reference.

Object and Classes :

Making sense of core object concepts (Encapsulation, Abstraction, Polymorphism, Classes, Messages Association, Interfaces) Implementation of class in C++, C++ Objects as physical object, C++ object as data types constructor. Object as function arguments. The default copy constructor, returning object from function. Structures and classes. Classes objects and memory static class data. Const and classes.

Unit III:

Arrays and string arrays fundamentals. Arrays as class Member Data: Arrays of object, string, The standard C++ String class Operator overloading:

Overloading unary operations. Overloading binary operators, data conversion, pitfalls of operators overloading and conversion keywords. Explicit and Mutable.

Inheritance:

Concept of inheritance. Derived class and based class. Derived class constructors, member function, inheritance in the English distance class, class hierarchies, inheritance and graphics shapes, public and private inheritance, aggregation: Classes within classes, inheritance and program development.

Unit IV:

Pointer:

Addresses and pointers. The address of operator and pointer and arrays. Pointer and Faction pointer and C-types string. Memory management: New and Delete, pointers to objects, debugging pointers.

Virtual Function:

Virtual Function, friend function, Static function, Assignment and copy initialization, this pointer, dynamic type information.

Unit V:

Streams and Files:

Streams classes, Stream Errors, Disk File I/O with streams, file pointers, error handling in file I/O with member function, overloading the extraction and insertion operators, memory as a stream object, command line arguments, and printer output.

Templates and Exceptions:

Function templates, Class templates Exceptions

Course Learning Outcomes (CLOs):

CLO-1: Design the process of interaction between Objects and System w.r.t. Object Oriented Paradigm.

CLO-2: Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.

CLO-3: Analyze basic programming concepts in Java with different object related issues and various string handling functions as well as basic I/O operations.

CLO-4: Discuss basic Code Reusability concept w.r.t. Inheritance, Package and Interface

CLO-5: Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java

Reference books:

1. Horstmann, Big Java, Wiley India
2. Herbert Schieldt, “The Complete Reference: Java”, TMH, 7th Edition.
3. Nino,” An Introduction to Programming and Object Oriented Design using Java, w/CD”, Wiley India
4. James Rumbaugh etal, “Object Oriented Modeling and Design”, PHI
5. Bjarne Stroustrup, “C++ Programming Language”, Addison Wesley, 3rd Edition.

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS2/GE02 **Course Name: E-Commerce**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Objectives

1. To impart knowledge on E-Commerce and its various applications.
2. To understand E-Commerce framework and business model applications of E-Commerce.
3. To understand e-payment mechanisms.

Course Description:
Identify and analyze nature & inherent difficulties in the security of the Information System. Analyze various threats and attacks, corresponding counter measures and various vulnerability assessment and security techniques in an organization

Course Contents:
Unit 1
Introduction: Electronic Commerce **-** Technology and Prospects, Definition of E-Commerce, Economic potential of electronic commerce, Incentives for engaging in electronic commerce, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, Impact of E-commerce on business.
Network Infrastructure for E- Commerce: Internet and Intranet based E-commerce-Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY).
Unit II
Mobile Commerce: Introduction, Wireless Application Protocol, WAP technology, Mobile Information device, Mobile Computing Applications.
Unit III
Web Security: Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.
Unit IV
Encryption: Encryption techniques, Symmetric Encryption- Keys and data encryption standard, Triple encryption, Asymmetric encryption- Secret key encryption, public and private pair key encryption, Digital Signatures, Virtual Private Network.
Unit V
Electronic Payments: Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking. EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda.

Course Learning Outcomes (CLOs):
CLO-1: Define and differentiate various types of Ecommerce.
CLO-2: Define and describe E-business and its Models
CLO-3: Describe Hardware and Software Technologies for Ecommerce.
CLO-4: Understand the basic concepts of E-Commerce and identify different technologies used in E-Commerce.
CLO-5: Apply different tools used in E-Commerce.

References

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.
2. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH
3. P. Loshin, John Vacca, "Electronic commerce", Firewall Media, New Delhi

Online links for study & reference materials :

- http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS2/AECC2 **Course Name: Technical communication**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:
- To create an understanding in the mind of the student regarding formal and professional communication practiced in a professional environment.

Course Description:
- In the present industrial scenario, the role of instrumentation is becoming more vital day by day specially in case of industrial automation. More advanced, precise and complex instrumentations are being employed in the industry. These advance instruments require communication of data from equipment/machines to instruments and vice versa for process and quality control.

Course Contents:
- **Unit - I: (Business Communication): Difference** between general and business communication, this should cover general and technical writing, oral communications and listening skill
- **Unit - II: (Expression)** Practical communication skill development, business presentation with multimedia,speaking skill, prepared speech, extempore speech
- **Unit - III :(Reading Skills)** Reading skill: comprehension test, technical report writing: precise, technical/businessletter, organization of writing material, poster presentation

- **UNIT-IV (Literature): Of** Studies: Francis Bacon
- **UNIT-V (Presentation): Writing** technical document, preparing software user manual, preparing project documentation.

Course learning outcome:

- **CO1.** this unit is for understanding general business communication.
- **CO2.** this unit is for understanding skill development and confidence development.
- **CO3.** reading skills are extremely important for any type of business communication.
- **CO4.** Understand the core values that shape the ethical behavior of an engineer and exposed awareness on professional ethics and human values.
- **CO5.** writing technical documentation

Text books:
- Business Correspondence and report writing, Sharma TMH.
- Business Communication strategies, Monopoly, TMH.
- English for Technical Communication ,Laxminarayanan,Scitech
- Business Communication, Kaul,PHI

Online links for study & reference materials :

- https://mgdic.files.wordpress.com/2016/12/3361704-industrial-data-communication.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

BCA (Bachelor Computer Application) 2nd Year
SEMESTER-III

Course Code: STUGCS3/CO5 **Course Name : Algorithm and Data Structure**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective:

- The objective of the course is to teach programming (with an emphasis on problem solving) and introduce elementary data structures. The student should, at a rudimentary level, be able to prove correctness (loop invariants, conditioning, etc) and analyze efficiency (using the `O' notation).

Course Description :

- Design correct programs to solve problems.
- Choose efficient data structures and apply them to solve problems.
- Analyze the efficiency of programs based on time complexity.
- Prove the correctness of a program using loop invariants, pre-conditions and post-conditions in programs

Course Contents:

- **Unit – I: Arrays:** Representation of single and multidimensional arrays; sparse arrays - lower and upper triangular matrices and Tri-diagonal matrices.
- **Unit II: Stacks and Queues:** Introduction and primitive operations on stack, Stack application, Infix, postfix, prefix expressions; Evaluation of postfix expression, Conversion from infix to postfix, Introduction and primitive operation on queues.
- **Unit III: Lists:** Introduction to linked lists; Sequential and Linked lists, operations such as traversal, insertion, deletion, searching, Two way lists and Use of headers. **Trees**: Introduction and terminology and Use of headers. **Trees**: Introduction and terminology Traversal of binary trees; Recursive algorithms for tree operation such as traversal, insertion, deletion; threaded trees, binary search trees, trees in search algorithm, B- tree, B + tree and applications.
- **Unit IV: Sorting Techniques:** Insertion sort, selection sort, merge sort, heap sort. Searching Techniques : Linear search, binary search , hashing.
- **Unit V :** File Structure: physical storage devices and their characteristics, constituents of a file viz. fields, records, fixed and variable length records, primary and secondary keys; file operations, basic file system operations, file organizations: serial sequential, index sequential , direct, inverted, hashing function and collision handling methods.

Course learning outcome:

CLO1: This unit is to review problem of solving computers, Abstraction, Elementary Data types, Algorithm design – Correctness via Loop invariants as a way of arguing correctness of programs, preconditions, post conditions associated with a statement develop understanding of basic character sets keywords and identifiers used for the c programming dataset. Learning objective of this unit is define data types and use them in simple data processing applications.

CLO2 : Introduction to stacks , arrays and queues. Difference and various use case.

CLO3: This unit is to introduce lists and tree terminology. introduction to graphs and trees.

CLO4: Various sorting techniques like insertion sort, bubble sort.

CLO5: This unit is for learning different modes of file storage, records and their usage.

Text books :

Data Structures and Algorithm Analysis in C++, by Mark Allen Weiss (Pearson 2007)

Reference books :

- Data structures and Algorithms in C++ -- by Adam Drozdek (1994 2001).
- How to solve it by Computer -- by R G Dromey (PHI 1982, Paperback 2008).
- Fundamentals of Data Structures in C -- by Horowitz, Sahni and Anderson-Freed (Silicon Press 2007).
- Data Structure Using C and C++ -- by Y. Langsam, M. J. Augenstein and A. N. Tanenbaum (Pearson Education, 2nd Edition, 2015).

Online links for study & reference materials :

https://slideplayer.com/slide/5987087/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS3/CO6 **Course Name: Computer Networks**
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- Course will work with data communication and switching techniques.
- The course work on networks and different layers of network and data processing.

Course Description:

- Course will work on transferring of messages from one port to another.
- Course will introduce the structure of Media Access Protocols.
- Ability to distinguish various data transmission and modulation techniques.
- Ability to analyses the impact of various channel impairments on data transmission.
- Ability to identify different data networks and the networking hardware

Course Contents:

Unit-I

Data communications concepts: Digital and analog , parallel and serial, synchronous and asynchronous, simplex, half duplex, duplex, multiplexing, Transmission media: Wired (physical): Twisted pair, Coaxial cable, Optical Fiber.

Communication switching techniques: Circuit switching, message switching, packet switching.

Unit-II

Introduction to Computer Network : Network Topologies, Types of Network, OSI and TCP/IP Models: Layers and their functions, comparison of models.

Data Link Layer Fundamentals: Framing, Basics of Error Detection, Forward Error Correction, Cyclic Redundancy Check codes for Error Detection.

Unit-III

Media Access Protocols : The advantages of Multiple-Access Sharing of Channel Resource, ALOHA, Carrier Sense Multiple Access (CSMA), CSMA with Collision Detection (CSMA/CD), Token Ring, Token Bus, Asynchronous Transfer Mode (ATM).

Unit-IV

Network Layer: Host to Host Delivery: IP Addressing and Routing, Gateway, N/W Layer Protocols: ARP, IPV4, ICMP, IPV6.

Transport Layer: Process-to-Process Delivery: UDP, TCP Congestion Control & Quality of Service.

Unit-V

Application Layer: Client Server Model, Domain Name System (DNS), E-mail (SMTP), File Transfer (FTP) and Model TCP/IP.

Course Learning Outcomes(CLOs) :

CLO-1 : Students will be able to work on different servers and communication models.

CLO-2 : Students will be able to work on Lam Man and Wan network.

CLO-3 : The students will be able to install a network system.

CLO-4 : Students will be able to host an application and web sites.

CLO-5 : Ability to identify basic components of data communication system

Text books :

- A.S. Tanebaum : Computer Networks (4th ed.), Prentice-Hall of India.
- W. Tomasi : Introduction to Data Communications and Networking, Pearson, Education.

Reference books :

- P.C. Gupta : Data Communications and Computer Networks, Prentice-Hall of India.
- Behrouz Forouzan and S.C., Fegan : Data Communications and Networking, McGraw Hill.
- L.L. Peterson and B.S. Davie : Computer Networks : A system Approach, Morgan Kaufmann.
- William Stalilngs : Data and Computer Communications, Pearson Education.

Online links for study & reference materials :

https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : STUGCS3/CO7 **Course Name :** Programming in Java
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective(s)

1. Be able to explain the difference between object oriented programming and procedural programming.
2. Be able to program using more advanced C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling, etc.
3. Be able to build classes using appropriate encapsulation and design principles
4. Be able to apply object oriented or non-object oriented techniques to solve bigger computing problems

Course Description:

Understand fundamentals of object-oriented **programming** in **Java**, including defining classes, invoking methods, using class libraries and also be aware of the important topics and principles of software development.

Course Contact

Unit I

Object Modeling: Objects and classes, links and association, generalization and inheritance, aggregation, abstract class, multiple inheritance, meta data, candidate keys, constraints. Dynamic Modeling: Events and states, operat ions, nested state diagrams and concurrency, advanced dynamic modeling concepts, a sample dynamic model.

Unit II

Functional Modeling: Data flow diagram, specifying operations, constraints, a sample functional model. OMT (object modeling techniques) methodologies, examples and case studies to demonstrate methodologies, comparisons of methodologies, SA/SD, JSD.

Unit III

Java Programming: Introduction, Operator, Data types, Variables, Methods & Classes, Multithread Programming, I/O, Java Applet.

Unit IV

Java Library: String Handling, Input/Output exploring Java.io, Networking, Exception Handling, Event Handling, Introduction to AWT, Working with window, Graphics, AWT Controls, Layout Manager and Menus, Images.

Unit V

Software Development using Java:

Java Swing, Migrating from C++ to java, Application of java, JDBC.

Course Learning Outcomes (CLOs):

CLO-1: Design the process of interaction between Objects and System w.r.t. Object Oriented Paradigm.

CLO-2: Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java

CLO-3: Analyze basic programming concepts in Java with different object related issues and various string handling functions as well as basic I/O operations.

CLO-4: Discuss basic Code Reusability concept w.r.t. Inheritance, Package and Interface
CLO-5: Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java

Reference books:

1. Horstmann, Big Java, Wiley India
2. Herbert Schieldt, "The Complete Reference: Java", TMH, 7th Edition.
3. Nino," An Introduction to Programming and Object Oriented Design using Java, w/CD", Wiley India
4. James Rumbaugh etal, "Object Oriented Modeling and Design", PHI
5. Bjarne Stroustrup, "C++ Programming Language", Addison Wesley, 3rd Edition.

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS3/GE3 **Course Name: Hypertext Preprocessor**
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- To give an idea of web development and back end of a web site and application.
- Dealing with connection and communication with the databases.

Course Description :

- It will work on managing the database system for a server .
- Manipulating and security issues will be dealt in .

Course Contents :

Unit-I

Introduction to PHP Evaluation of Php: Basic Syntax Defining variable and constant Php, Data types, Operator and Expression, Handling Html Form With Php, Capturing Form.

Unit-II

Data Dealing with Multi-value filed: Generating File uploaded form, Redirecting a form after submission, Decisions and loop Making, Decisions Doing Repetitive task with looping, Mixing Decisions and looping with Html.

Unit-III

Function: What is a function, Define a function Call by value and Call by reference, Recursive function.

String: Creating and accessing String, Searching & Replacing String, Formatting String, String Related Library function.

Unit-IV

Array: Anatomy of an Array, Creating index based and Associative array, Accessing array, Element Looping with Index based array, Looping with associative array, using each() and foreach(), Some useful Library function.

Unit-V

Working with file and Directories: Understanding file & directory, Opening and closing a file, Copying ,renaming and deleting a file, Working with directories, Building a text editor, File Uploading & Downloading, Generating Images with PHP.

Course Learning Outcomes(CLOs) :

CLO-1 :The students will be able to develop web site .

CLO-2 :Students will be able to work on back end of a web site and application. .
CLO-3 :Students will be able to communicate with database server.

CLO-4 :Students can work on different back end of a web sites or applications.
CLO5 : Students will be able to manage critical risk strategy of the development cycle.

Text books :

- Raghurama Krishnan : PHP, Johannes Gehrke, TMH.
- Siberschatz, Korth : Learn PHP, McGraw Hill, latest edition.

Reference books :

- C.J. Date : Introduction to Hypertext, Pearson, Education.
- Elmasri Navathe : Server Scripting PHP,

Online links for study & reference materials :

https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

NOIDA INTERNATIONAL UNIVERSITY

BCA (Bachelor Computer Application) 2nd Year
SEMESTER-IV

Course Code: STUGCS4/C08 **Course Name: Design Analysis and Algorithm**
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Objectives

1. To understand the Object-based view of Systems
2. To develop robust object-based models for Systems
3. To inculcate necessary skills to handle complexity in software design

Course Description:

System Analysis and Design is a specification detailing how a set of software and hardware technology standards interact to form a computer system or platform. System Analysis and Design refers to how a computer system is designed and what technologies it is compatible with. There are three categories of computer architecture:

Course Contents:

Unit 1 :

Introduction to SAD Fundamentals of System, Important Terms related to Systems, Classification of Systems, Real Life Business Subsystems, Real Time Systems, Distributed Systems, Development of a successful System, Various Approaches for development of Information Systems Structured Analysis and Design Approach, Prototype, Joint Application Development.

Unit 2 :

Process of System Development Systems Development Life Cycle: Phases of SDLC, Project Identification and Selection, Project Initiation and planning, Analysis, Logical Design, Physical Design, Implementation, Maintenance, Product of SDLC Phases, Approaches to Development, Prototyping, Joint Application Design, Participatory Design, Case Study

Unit 3 :

Introduction to Documentation of Systems Concepts and process of Documentation: Types of Documentation, System Requirements Specification, System Design Specification, Test Design Document, User Manual, Different Standard for Documentation, Documentation and Quality of Software,

Unit 4:

Process of System Planning Fact finding Techniques: Interviews, Group Discussion, Site Visits, Presentations, Questionnaires, Issues involved in Feasibility Study, Technical

Feasibility, Operational Feasibility, Economic Feasibility, Legal Feasibility, Cost Benefit Analysis, Preparing Schedule, Gathering Requirements of System, Joint Application Development, Prototyping

Unit 5 :
Modular and Structured Design Design Principles: Top Down Design, Bottom Up Design, Structure Charts, Modularity, Goals of Design, Coupling, Cohesion. Criteria for Report Design, Relevance, Accuracy, Clarity, Timeliness, Cost

Course Learning Outcomes (CLOs):
CLO-1: Ability to analyze and model software specifications.
CLO-2: Ability to abstract object-based views for generic software systems.
CLO-3: Ability to deliver robust software components
CLO-4: Ability to identify the issues related to performance improvement
CLO-5: Ability to distinguish performance tradeoff between different memory units and instruction sets

Reference:
1. Sara Baase and Allen Van Gelde, "Computer Algorithms, Introduction to Design and Analysis", 3rd Edition, Pearson Education, Delhi, 2002.
2. Aho, Hoporoft and Ullman, "The Design and Analysis of Computer Algorithm", Pearson Education, Delhi, 2001.
3. Basu S.K.,"Design Methods and Analysis of Algorithms", PHI, 2006.
4. Brassad and Bratley,"Fundamentals of Algorithms", PHI, 1995.
5. Sanjoy Dasgupta, Christos Papadimitriou, Umesh vazirani, "Algorithms", TMG, 2007.

Online links for study & reference materials :
https://www.dei.unipd.it/~capri/SI/MATERIALE/DWDM0405.pdf
Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS4/CO9 **Course Name: Software Engineering**
Course Credit Hour: 4hr **Total Contact Hour : 60hr**

Course Objective:

- Software Engineering (SE) comprises the core principles consistent in software construction and maintenance: fundamental software processes and life-cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools. iterative development, interpretation of requirements and use case documents into code; application of design notation in UML and use of commonly-used design patterns. Current industry-strength programming languages, technologies and systems feature highly in the practical components, electives and projects of the course, but they are also taught with a view to understanding and applying principles underlying their more ephemeral character.

Course Description:

- Knowledge of basic SW engineering methods and practices, and their appropriate application.
- Describe software engineering layered technology and Process frame work. 3
- A general understanding of software process models such as the waterfall and evolutionary models. Understanding of software requirements and the SRS documents. Understanding of the role of project management including planning, scheduling, risk management, etc.
- Describe data models, object models, context models and behavioral models. Understanding of different software architectural styles. Understanding of implementation issues such as modularity and coding standards. Understanding of approaches to verification and validation including static analysis, and reviews.

Course Contents:

Unit I: Introduction Software life cycle models: Waterfall, Prototype, evolutionary and spiral models, overview Quality standards like ISO 9001, SEI-CMM.

UNIT II: Software Metrics and Project Planning Size Metrics like LOC, Token Count, Function Count, Design Metrics, Data Structure Metrics, Information Flow Metrics. Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management.

UNIT III: Software Requirement Analysis, design and coding Problem Analysis, Software Requirement and Specifications, Behavioral and **non-** behavioral requirements, Software Prototyping Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design Top-down and bottom-up structured programming, Information hiding.

UNIT IV : **Software Reliability, Testing and Maintenance** Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Software process, Functional testing: Boundary value analysis, Equivalence class testing decision table testing, Cause effect graphing, Structural testing: path testing, Data flow and mutation testing, unit testing, integration and system testing, Debugging, testing Tools, & Standards. Management of maintenance, Maintenance process, Maintenance Models, Reverse Engineering, Software RE-Engineering.

UNIT V : Introduction to UML, Use Case Diagrams, Class Diagram: State Diagram in UML Activity Diagram in UML.

Sequence Diagram in UML Collaboration Diagram in UML.

Course learning outcome :

CLO1 : Understand basic SW engineering methods and practices, and their appropriate application.

CLO2: Understand u of software process models such as the waterfall and evolutionary 10 models.

CLO3: problem analysis and description, This unit is to introduce Discuss data models, object models, context models and behavioral models.

CLO4 : Understand of different software architectural styles and Process frame work.

CLO5: this unit is for learning different modes of file storage. Records and their usage.

Text books :

- K. K. Aggarwal & Yogesh Singh, .Software Engineering., 2nd Ed, New AgeInternational, 2005.
- R. S. Pressman, ―Software Engineering – A practitioner's approach‖, 5th Ed., McGrawHill Int. Ed., 2001.

Online links for study & reference materials :

https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS4/SEEC2 **Course Name: Web Technology**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Objectives: The objective of this course to make a student will be familiar with client server architecture and able to develop a web application using java technologies. Students will gain the skills and Project based experience needed for entry into web application and development career

Course Description:

- The course will deal with software development cycle and phases of development in a web application.

- The course will deal with the cost and maintenance cycle of a web site and its server. The security issues and back end of the web site is dealt in the section.

Course Contents:

Unit-I

Introduction to Internet Basic : The Basic of the Internet, Concepts of Domain, IP Addressing, Resolving Domain Names, Overview of TCP/IP and its Services, WWW, web projects, web applications, Web Team, planning & process development.

Unit-II

Designing Pages with HTML: Introduction to HTML, Essential Tags, Deprecated Tags, Tags and Attributes, Text Styles and Text Arrangements, Text, Effects, Exposure to Various Tags, Color and Background of Web Pages, Lists and their Types, Attributes of Image Tag.

Unit-III

Link: Hypertext, Hyperlink and Hypermedia, Links, Anchors and URLs, Links to External Documents, Different Section of a Page and Graphics, Footnote and e-Mailing, Creating Table, Frame, Form and Style Sheet.

Unit-IV

DHTML: Dynamic HTML, Document Object Model, Features of DHTML, CSSP (Cascading Style Sheet Positioning) and JSSS (JavaScript assisted Style Sheet), Layers of Netscape, The ID Attribute, DHTML Events.

Unit-V

Web Page: Web Page Basics, Web Terminologies, Phases of Planning and Building Web Sites, The FTP, HTTP and WPP, Features, Web Page Views, Adding Pictures, Backgrounds, Links.

Scripting language: Java script and VB script JDBC database.

Course Learning Outcomes(CLOs) :

CLO-1 :The students will be able to work on **web development and application development.**

CLO-2 :Students will be able to develop software model .
CLO-3 :Students will be able to work on different data analyzing model.
CLO-4 :Students can work in testing phase of software .
CLO5 : Students will be able to manage critical risk strategy of the development cycle.

Text books :

- Web Development TMH.
- Nasib Singh : Learn HTML, Khanna Book Publishing Co. (P) Ltd. N. Delhi.
- Jalote, Pankaj : An Integrated Approach to HTML, Narosa Publications.
- Chhillar Rajender Singh : HTML, Metrics, Excel Books.

.

Reference books :

- Ghezzi, Carlo : Fundaments of HTML, PHI.
- Fairely, R.E. : HTMLEngineering Concepts, McGraw-Hill.
- Lewis, T.G.: Learn CSS, McGraw-Hill.

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Online links for study & reference materials :
https://noidatut.com/
Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS4/GE4 **Course Name: Mobile Computing**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:

- To give an idea of mobile applications and development phase and of mobile applications.
- To deal with different signal handling mechanisms related to mobile network and PCS architecture.

Course Description:

- The course will deal with Mobile development cycle and phases of development in a different application.
- The course will deal with the cost and maintenance cycle of a network.

Course Contents:

Unit-I: Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Unit-II: Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Bluetooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

Unit-III: Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.

Unit-IV: Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

Unit-V: Adhoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad-Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

Course Learning Outcomes(CLOs) :

CLO-1 :The students will be able to work on Mobile development and application development.

CLO-2 :Students will be able to develop network model .

CLO-3 :Students will be able to work on different data analyzing model.

CLO-4 :Students can work in testing phase of software .
CLO5 : Students will be able to manage critical risk strategy of the development cycle.

Text books :

- Web Development TMH.
- Nasib Singh : Learn HTML, Khanna Book Publishing Co. (P) Ltd. N. Delhi.
- Jalote, Pankaj : An Integrated Approach to HTML, Narosa Publications.
- Chhillar Rajender Singh : HTML, Metrics, Excel Books.

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Reference books :

- Ghezzi, Carlo : Fundaments of HTML, PHI.
- Fairely, R.E. : HTMLEngineering Concepts, McGraw-Hill.
- Lewis, T.G.: Learn CSS, McGraw-Hill.

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Online links for study & reference materials :
https://noidatut.com/
Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

BCA (Bachelor Computer Application) 3rd Year
SEMESTER-V

Course Code : STUGCS5/C11 **Course Name : DOT NET Framework**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :
- Dot Net Framework helps the students in developing applications and web sites.
- To get appropriate programming methodologies, functions, procedures.

Course Description :
- The course covers basics of dot net and its components.
- Course will help the students in mastering the programming concepts.

Course Contents :
UNIT - I
C# Fundamentals: Basic classes, declarations, conditionals, loops, arrays, strings, enumerations, structures, and Encapsulation, inheritance, polymorphism, Structured exception handling. Understanding interface types

UNIT - II
Delegates, Events, and Lambdas: basics of each -- very important for event driven (GUI), Understanding the garbage collector, creating and working with .NET assemblies.

UNIT - III
Windows Forms and WPF: Basic windows programming: forms, component class, control class, control events, menus, status bars, tool bars, interacting with the registry. Indexers, Operator Overloading, Custom Type Conversion, Extension Methods, Anonymous Types, Pointer Types

UNIT - IV
Input, Output, and Serialization: System.IO, Directory and File Types, StreamReaders and StreamWriters, working with binary data, configuring objects for serialization, Working with and creating custom generic types.

UNIT - IV

Processes, AppDomains, Contexts, Threading, Type Reflection, Late Binding, Attribute-based programming: Advanced topics from the text will be discussed as time permits. We can decide as a class on what to explore if we get to this point.

Course Learning Outcomes(CLOs) :

CLO-1 :The students will be able to work on different server, web sites and applications.

CLO-2 :Students will be able to develop the backend of any project.

CLO-3 :Students will have the idea of encryption , decryption and maintain the database and all the security parameters.

CLO-4 :Students can work as system administrator and technical support.

Text books :

1. C Sharp and Dot net framework by Andrew Troelsen
2. C Sharp in Depth by Jon Skeet
3. Pro VB 2008 and the .NET 3.5 Platform (Windows.Net) by Andrew Troelsen

Reference books :

Programming Entity Framework by Julia
Learning Visual Basic .NETJesse Liberty
Beginning VB.NET Databases by Thearon Willis
Professional VB 2005 with .NET 3.0 (Programmer to Programmer) by Bill Evjen, Billy Hollis, Bill Sheldon, and Kent Sharkey

Online links for study & reference materials :

https://noidatut.com/view-nts.php?vntpntsfxxvisurz=b6d767d2f8ed5d21a44b0e5886680cb9

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : STUGCS5/C12 **Course Name : Computer Graphics**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective:

- Course will help the students understand the graphics controller of a system.
- The course will help the students developing the graphical structure for a system.

Course Description :

- Course will work on to deal with Graphics applications of a system.
- Designing and graphical structure will be dealt in the module.

Course Contents :

Unit-I

Graphics Primitives: Introduction to computer graphics, Basics of Graphics systems, Application areas of Computer Graphics, overview of graphics systems, video-display devices, and raster-scan systems, random scan systems.

Unit-II

Output Primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms.

Filled area primitives: Scan line polygon fill algorithm, boundary fill and flood-fill algorithms.

Unit-III

2-D Geometrical Transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, .

2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping

algorithms, Sutherland –Hodgeman polygon clipping algorithm..

Unit-IV

3-D Object Representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces, polygon-rendering methods..

Unit-V

3-D Geometric Transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations.

3-D Viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

Course Learning Outcomes(CLOs) :
CLO-1 : Students will be able develop graphics application.

CLO-2 : Students will be able to work on designing model of a system. .

CLO-3 : The students will be able code new graphics and pictures for the system.

CLO-4 : Students will be able to understand the technologies behind the display units .

CLO-5 : Analyze and compare the different kinds of user interfaces in order to be able to decide which one will be more efficient and ergonomic according to the required specifications of the application to be developed

Text books :

- Donald Hearn and M. Pauline Baker : Computer Graphics, PHI Publications.
- Plastock : Theory & Problem of Computer Gaphics, Schaum Series.

Reference:

- Donald Hearn and M. Pauline Baker : Computer Graphics, PHI Publications.
- Plastock : Theory & Problem of Computer Gaphics, Schaum Series.
- Foley & Van Dam : Fundamentals of Interactive Computer Graphics, Addison-Wesley.
- Newman : Principles of Interactive Computer Graphics, McGraw Hill.

Online links for study & reference materials :
https://noidatut.com/
Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS5/DSC1 **Course Name: Cloud Computing**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:

- Course will help the students understand the methodologies and concepts of computing and servers.
- The course will help the students maintaining a server, difference between technology and methodology.

Course Description:

- Course will work on to deal with infrastructure, software and platform.
- Course will work on different services like Iaas, Paas, Saas and its implementation methodologies.

Course Contents:

Unit 1: Overview of Cloud Computing: Introduction to Cloud, features of Cloud (Benefits and disadvantages), architecture or cloud computing, types of service delivery in cloud, their providers and examples of software for computing, types of service delivery in cloud, their providers and examples of software for each type (IaaS, PaaS, SaaS) Cloud Deployment models: Public, Private and hybrid Cloud.

Unit 2: Cloud Computing concepts: Virtualization: introduction to virtualization, characteristics of virtualization, how is virtualization achieved, what is hypervisor, types of hypervisor (type 1 and type 2), Multitenancy and its advantages and disadvantages, migration in cloud.

Unit 3: Distributed Systems: Introduction to distributed systems, How are distributed systems manages, Introduction to map reduce framework, importance of map reduce, understanding how it works with an example. Introduction to Hadoop, What is Hadoop, WHY Hadoop HDFS, Traditional file system vs HDFS, Big data: what is big data, features of big data, study sample dataset for big data, techniques and tools for handling big data, Hive.

Unit 4: Saas
What is Saas, Agile programming, Introduction to OOP, Introduction to Ruby, simple programming using Ruby, Ruby on Rails.

Unit 5: Cloud security risks in cloud, types of threat in cloud, ways of handling the threats, covert channel attacks in cloud, detection mechanisms for threats, ways of making cloud secure.

Course Learning Outcomes (CLOs) :

CLO-1: Students will be able to work on servers, networking and security issues.

CLO-2: Students will be able to handle the backend of a network.

CLO-3 : The students will be able to work with organization in line and outline communication.

CLO-4 : Students will be able to develop and host domains and applications.

Text books :

Cloud computing by A. S Aggarwal.

Reference books :

Towards Expert Systems for Enhancing Quality of Services in Cloud Computing Research by Dr. Aadarsh Malviya.

Cloud Computing and its Services by Manoj Desai.

Online links for study & reference materials :

https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS5/DSC2 **Course Name: Data Mining**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:
Understand the fundamentals of data mining and its application in various business and social domains. It is an introduction to the field of data mining (also known as knowledge discovery from data, or KDD for short). It focuses on fundamental data mining concepts and techniques for discovering interesting patterns from data in various applications It emphasizes techniques for developing effective, efficient, and scalable data mining tools

Course Description:

- Understand the fundamentals of data mining and its functionalities
- Obtain knowledge in different data mining techniques and algorithms
- Discuss about various application domains of data mining
- Understand advanced mining
- Apply on different case studies

Unit-I
Data Warehousing: Introduction- Definition and description, need for data ware housing, need for strategic information, failures of past decision support systems, OLTP vs DWH-DWH requirements-trends in DWH-Application of DWH.

Unit-II
Data Warehousing Architecture: Reference architecture- Components of reference architecture Data warehouse building blocks, implementation, physical design process and DWH deployment process. A Multidimensional Data, Model Data Warehouse Architecture.

Unit-III
Data Mining: Data mining tasks-Data mining vs KDD- Issues in data mining, Data Mining metrics, Data mining architecture - Data cleaning- Data transformation- Data reduction - Data mining primitives.

Association Rule Mining: Introduction - Mining single dimensional Boolean association rules from transactional databases - Mining multi-dimensional association rules.

Unit-IV
Classification and Prediction: Classification Techniques - Issues regarding classification and prediction - decision tree - Bayesian classification –Classifier accuracy – Clustering – Clustering Methods - Outlier analysis.

Unit-V

Applications and Other Data Mining Methods: Distributed and parallel Data Mining Algorithms, Text mining- Web mining.

Course learning outcome:

CLO1: Illustrate the concepts of data mining and data warehousing concepts and techniques.
CLO2: Apply data mining techniques using data mining tools.
CLO3: Implement different data mining techniques and algorithms
CLO4: Do web mining and spatial mining
CLO5: Implement data ware house

Books Recommended:

1. Jiawei Han and Micheline Kamber, " Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, USA, 2006.
2. Berson,"DataWarehousing, Data Mining and OLAP", Tata McGraw Hill Ltd, New Delhi, 2004.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, , Pearson Education.
4. Arun K Pujari,"Data mining techniques", Oxford University Press, London, 2003.
5. Dunham M H,"Data mining: Introductory and Advanced Topics". Pearson Education, New Delhi, 2003.
6. Mehmed Kantardzic," Data Mining Concepts, Methods and Algorithms", John Wiley and Sons, USA, 2003.
7. Soman K. P., DiwakarShyam, Ajay V., Insight into Data mining: Theory and Practice, PHI 2006

Online links for study & reference material
https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/download-course-materials/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

BCA (Bachelor Computer Application) 3rd Year
SEMESTER-VI

Course Code : STUGCS6/C11 **Course Name : Artificial intelligence**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective:

This course provides fundamental knowledge on artificial intelligence (AI) concepts. It includes study of AI foundations, sub-areas and applications. It followed the study of problem-solving methods in AI using search techniques. Game playing has always intrigued AI researchers and hence this topic is also covered. Knowledge representation and reasoning is the core of any automated AI systems and thus one unit has been dedicated to elaborately discuss about logic concepts

Course Description :
Advanced knowledge representation methods like case grammars and semantics web are briefly touched upon in the last units along with the concepts of natural language processing.

Course Contents :
Unit 1 INTRODUCTION - Overview of Artificial intelligence – Problems of AI, AI technique, Tic – Tac – Toe problem.Problems, Problem space and search.
Unit II : Heuristic Search Techniques, Knowledge representation issues. Representing knowledge space and search.
Unit III : Symbolic reasoning under uncertainty. Statistical reasoning, Weak slot and filer structures. Strong Slot and filler structures.
Unit IV : Game planning –Minimax search procedure, adding alpha beta cut-off's, iterative deepening,Planning. Natural language processing, Understanding.
Unit V : Expert systems- expert system shells, knowledge acquisition, Basic knowledge of programminglanguage like Prolog & LISP.

Course learning outcome:
CLO1: Learn the fundamentals of AI. Gain Insights into information and uninformed search techniques with illustrations.
CLO2: Understand principles of knowledge representation basics and advanced methods like case grammars and semantic web.
CLO3 : Apply propositional and predicate logic to infer sentences in knowledge representation.
CLO4: Understand the use and applications of expert systems.
CLO5 : Apply probability theory to draw conclusions using Naïve Bayes and Bayesian networks.

Text books :

- Artificial Intelligence, Ritch & Knight,TMH.
- Introduction to Artificial Intelligence and Expert Systems, Patterson PHI.
- Logic and Prolog Programming, Saroj Kaushik, New Age International Expert Systems.

Online links for study & reference material

https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/download-course-materials/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS6/C12 **Course Name : Theory of Computation**
Course Credit Hour: 4hr **Total Contact Hour : 60hr**

Course Objective:
Theory provides a simple, elegant view of the complex machine that we call a computer. Theory possesses a high degree of permanence and stability, in contrast with the ever-changing paradigms of the technology, development, and management of computer systems. Further, parts of the theory have direct bearing on practice, such as Automata on circuit design, compiler design, and search algorithms; Formal Languages and Grammars on compiler design; and Complexity on cryptography and optimization problems in manufacturing, business, and management.

Course Description:

- Introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
- Enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

Course Contents:
UNIT 1: Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic Finite Automata (DFA)-Formal Definition, simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transmission, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.
Unit II: Regular expression (RE) , Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Klein's Theorem, Regular expression toFA, DFA to Regular expression, Arden Theron, Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy Machine Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.
UNIT III: Context free grammar (CFG) and Context Free Languages Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure Properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.
Unit IV: Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.

Unit V : Turing Machines(TM): Basic Model, Definition and representation, Instantaneous Description Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Decidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

Course Learning Outcome:

CLO1 : Automata, computability, and complexity ,Mathematical tools, Definitions, theorems, and proofs.

CLO2: Definition, Operators of regular expression and their precedence, Algebric laws for regular expression and their precedence, Algebric laws for regular expressions, Kleens' Theorem , Regular expression to FA and DFA to regular expression.

CLO3 : Understand recursive and recursively enumerable Languages.

CLO4: Description and definition, Instanteus Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack.

CLO5: Understand Turing Machines and the simple primitive mechanisms needed for all computation

Text books :

Hopcroft, Ullman, "Introduction to Automata Theory,Languages and Computation",Pearson Education.

K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science : Automata, Languagesand Computation", PHI Learning Private Limited, Delhi India.

Reference books:

Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
Y.N.Singh "Mathematical Foundation of Computer Science", New Age International.

Online links for study & reference materials :

http://www.cs.virginia.edu/~robins/cs3102/CS3102

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code STUGCS6/DSC3 **Course Name : Cryptography& Network Security**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective:
- Cryptography and network security works on encryption and decryption of data.
- It works on the security and communication section of the applications and web portals.

Course Description:
- The course covers basics of security and networking issues.
- Course will help the students in mastering the programming concepts and security issues.

Course Contents:

UNIT I
Security trends, Attacks and services, Classical crypto systems, Different types of ciphers Ceaser, Transposition and Hill Cipher, sequences Group, Ring and Field, Congruence's Chinese Remainder Theorem, Modular exponentiation, Fermat and Eulers theorem.

UNIT II
Simple DES, Differential cryptanalysis, DES – Modes of operation – Triple DES –AES – RC4 - RSA – Attacks – Primality test, factoring.

UNIT IV
Authentication applications, Kerberos, X.509, PKI, Electronic Mail security, PGP, S/MIME IP security, Web Security, SSL, TLS, SET

UNIT V
System security, Intruders, Malicious software, viruses, Firewalls, Security Standards

UNIT V
System security, Intruders, Malicious software, viruses, Firewalls, Security Standards

Course Learning Outcomes(CLOs) :
CLO-1 :The students will be able to work on different server, web sites and applications.

CLO-2 :Students will be able to develop the backend of any project.

CLO-3 :Students will have the idea of encryption , decryption and maintain the database and all the security parameters.

CLO-4 :Students can work as system administrator and technical support.

Text books :
William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, New Jersey.

Reference books :

1. Johannes A. Buchmann, "Introduction to cryptography", Springer- Verlag.
2. Atul Kahate, "Cryptography and Network Security", TMH
3. Mahtab Alam, "Information Security and Cryptography, BOOKSHELF.

Online links for study & reference materials :

https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF AGRICULTURE & ENVIRONMENTAL SCIENCES

SYLLABUS OF COURSES TO BE OFFERED

UNDERGRADUATE PROGRAMME (AGRICULTURE)

Effective from (Academic Year 2019-20)

NOIDA INTERNATIONAL UNIVERSITY DEPARTMENT OF AGRICULTURE (SOS) B.Sc. AGRICULTURE

Semester-wise distribution of courses

I Semester		
1	Fundamentals of Horticulture	2 (1+1)
2	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)
3	Fundamentals of Soil Science	3(2+1)
4	Introduction to Forestry	2 (1+1)
5	Comprehension & Communication Skills in English	2 (1+1)
6	Fundamentals of Agronomy	4(3+1)
7	Introductory Biology*	2 (1+1)
8	Agricultural Heritage*	1(1+0)*
9	Rural Sociology & Educational Psychology	2 (2+0)
10	Human Values & Ethics (non gradial)	1(1+0)**
11	NSS/NCC/Physical Education & Yoga Practices**	2 (0+2)**
TOTAL ***R: Remedial course; **NC: Non-gradial courses**		**18+03*+03****

II Semester

1	Fundamentals of Genetics	3(2+1)
2	Agricultural Microbiology	2(1+1)
3	Soil and Water Conservation Engineering	2(1+1)
4	Fundamentals of Crop Physiology	2(1+1)
5	Fundamentals of Agricultural Economics	2(2+0)

6	Fundamentals of Plant Pathology	4(3+1)
7	Fundamentals of Entomology	4(3+1)
8	Fundamentals of Agricultural Extension Education	3(2+1)
9	Communication Skills and Personality Development	2(1+1)
Total		**24(16+8)**
III Semester		
1	Crop Production Technology – I *(Kharif Crops)*	2 (1+1)
2	Fundamentals of Plant Breeding	3 (2+1)
3	Agricultural Finance and Cooperation	3 (2+1)
4	Agri- Informatics	2(1+1)
5	Farm Machinery and Power	2 (1+1)
6	Production Technology for Vegetables and Spices	2 (1+1)
7	Environmental Studies and Disaster Management	3(2+1)
8	Statistical Methods	2(1+1)
9	Livestock and Poultry Management	4 (3+1)
Total		**23(14+9)**
IV Semester		
1	Crop Production Technology –II *(Rabi Crops)*	2(1+1)
2	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
3	Renewable Energy and Green Technology	2(1+1)
4	Problematic Soils and their Management	2(2+0)
5	Production Technology for Fruit and Plantation Crops	2(1+1)
6	Principles of Seed Technology	3(1+2)
7	Farming System & Sustainable Agriculture	1(1+0)
8	Agricultural Marketing Trade & Prices	3(2+1)
9	Introductory Agro-meteorology & Climate Change	2(1+1)
10	Elective Course	3 credit
Total		**19(11+8) + 3**
VSemester		
1	Principles of Integrated Pest and Disease Management	3(2+1)
2	Manures, Fertilizers and Soil Fertility Management	3 (2+1)
3	Pests of Crops and Stored Grain and their Management	3 (2+1)
4	Diseases of Field and Horticultural Crops and their Management -I	3 (2+1)
5	Crop Improvement-I *(Kharif Crops)*	2 (1+1)
6	Entrepreneurship Development and Business Communication	2 (1+1)
7	Geoinformatics and Nano-technology and Precision Farming	2 (1+1)
8	Practical Crop Production – I (*Kharif* crops)	2 (0+2)

9	Intellectual Property Rights	1(1+0)
10	Elective Course	3 credit
Total		**21(12+09)+ 3**
VI Semester		
1	Rainfed Agriculture & Watershed Management	2 (1+1)
2	Protected Cultivation and Secondary Agriculture	2 (1+1)
3	Diseases of Field and Horticultural Crops and their Management-II	3 (2+1)
4	Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)
5	Management of Beneficial Insects	2 (1+1)
6	Crop Improvement-II *(Rabi crops)*	2 (1+1)
7	Practical Crop Production –II (*Rabi* crops)	2 (0+2)
8	Principles of Organic Farming	2 (1+1)
9	Farm Management, Production & Resource Economics	2 (1+1)
10	Principles of Food Science and Nutrition	2(2+0)
11	Elective Course	3 credits
Total		**21 (11 + 10)+ 3**

VII Semester			
No.	**Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)**		
	Activities	**No. of weeks**	**Credit**
1	General orientation & On campus training by different faculties	1	
2	Village attachment	8	14
	Unit attachment in Univ./ College. KVK/ Research Station Attachment	5	
3	Plant clinic	2	02
	Agro-Industrial Attachment	3	04
4	Project Report Preparation, Presentation and Evaluation	1	
Total weeks for RAWE & AIA		**20**	**20**

Agro- Industrial Attachment: The students would be attached with the agro-industries for aperiod of 3 weeks to get an experience of the industrial environment and working**.**

 Educational tour will be conducted in break between IV & V Semester or VI & VII Semester

Assessment Method:

	Theory				Practical	
	Internal Assessment	Mid Term Examination	End Term Examination	Maximum Marks	Practical Examination	Maximum marks
Marks	20	20	60	100	50	50
%	20%	20%	60%	100 %	100 %	100 %

B.Sc. (Hons.) Agriculture

I-Semester

S.NO	Course Code	Subject	Sessional Exam			Evaluation Scheme				Credit
						External Exam	PRACTICAL		Subject Total	
			CA	TA	Total		INTERNAL	EXTERNAL		
1	ATUG-101	Fundamentals of Horticulture	20	20	40	60	25	25	150	2 (1+1)
2	ATUG-102	Fundamentals of Plant Biochemistry and Biotechnology	20	20	40	60	25	25	150	3(2+1)
3	ATUG-103	Fundamentals of Soil Science	20	20	40	60	25	25	150	3(2+1)
4	ATUG-104	Introduction to Forestry	20	20	40	60	25	25	150	2 (1+1)
5	ATUG-105	Comprehension & Communication Skills in English	20	20	40	60	-	-	100	2 (2+0)
6	ATUG-106	Fundamentals of Agronomy	20	20	40	60	25	25	150	4(3+1)
7	ATUG-107	Introductory Biology*	20	20	40	60	25	25	150	2 (1+1)
8	ATUG-108	Agricultural Heritage*	20	20	40	60	-	-	100	1(1+0)*
9	ATUG-109	Rural Sociology & Educational Psychology	20	20	40	60	-	--	100	2 (2+0)
10	ATUG-110	Human Values & Ethics (non gradial)	20	20	40	60	-	-	100	1(1+0)**
11	ATUG-111	NSS/NCC/Physical Education & Yoga Practices**					25	25	50	2 (0+2)**
				***R: Remedial course; **NC: Non-gradial courses**						

Course Code : ATUG-101 **Course Name :** Fundamentals of Horticulture
Course Credit Hour : 2hr **Total Contact Hour :** 40hr

Course Objective :

- To identify and research career opportunities in the horticulture industry as well as emerging trends.
- To identify and practice safe use of tools, equipment and supplies used in horticulture careers.
- To propagate, grow, and maintain plants in horticulture production systems.

Course Description :

This course deals with the knowledge of horticulture in a brief and prescribed manner. Different branches, its scope and importance will be explained to the students. Different methods of propagation will be discussed and also performed by students practically. Seed dormancy, seed germination and various external and internal factors for their germination will be described. This course will explain about the sexual reproduction in plants. Various role of medicinal and aromatic plants will be discussed. Irrigation – methods and application of fertilizer in horticultural crops will be disucssed.

Course Contents :

Unit-1: Horticulture **-** Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops.

Unit-II: Plant propagation-methods and propagating structures; Seed dormancy, Seed germination, principles of orchard establishment; Principles and methods of training and pruning.

Unit-III: Juvilinity and flower bud differentiation, unfruitfulness, pollination, pollinizers and pollinators, fertilization and parhenocarpy.

Unit-IV: Medicinal and aromatic plants; importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

Course Learning Outcomes(CLOs) :

CLO1. To grasp the uses for different horticulture plants. They will be able to evaluate plant selection and identification for local landscape application.

CLO2. To understand the function of plant parts in propagation and can evaluate the sexual and asexual methods of plant propagation. Learn about environmental factors for optimal plant growth.

CLO3. To learn about the pollination, types and different pollinators. They will learn about fertilization and parthenocarpy.

CLO4. To understand the role and importance of medicinal and aromatic plants.

CLO5. To learn the methods of fertilization application in horticultural crops and to understand the importance of plant bio-regulators in horticulture.

Text books :

Chadha, K.L. (2002). Handbook of Horticulture. ICAR, New Delhi. Jitendra Singh (2011). Basic Horticulture. Kalyani Publications, New Delhi **Reference books :**

Singh, H.P. Advances in Horticulture Biotechnology Vol.-7: Diagnostics for Horticulture crops. Westville

Singh, H.P. Advances in horticulture Biotechnology, Vol-1: Fruit Crops. Westville

Online links for study & reference materials :

https://www.agrimoon.com/wp-content/uploads/Fundamentals-of-Horticulture.pdf

Course Code: ATUG-102 **Course Name:** Fundamentals of Plant Biochemistry and Biotechnology

Course Credit Hour: 2 Hr **Total Contact Hour:** 20 hours

Course Objective:

The overall objective of this course is to provide an environment for students to develop critical thinking on plant biotechnological tools for plant improvement. This will create awareness on the importance of plant diversity and its conservation both insitu and exsitu. Principles and applications of plant biotechnology in agriculture for crop improvement will be covered.

Course Description:

The course focuses on the biochemistry and biotechnology of plants. The course will give a brief understanding of fundamentals of plant biochemistry, metabolism of carbohydrates and lipids. The course introduces the various aspects and application of plant tissue culture to the learners. Various steps or stages in the process if micropropagation or tissue culture will be explained using videos. The course emphasizes critical thinking and application of transgenic plants or GMO's in crop improvement

Course Contents:

Unit-1 **(5 hours)**

Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Poly saccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids.

Unit-2 **(5 hours)**

Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins. Enzymes: General properties; Classification; Mechanism of action; Michaelis&Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.

Unit-3 **(5 hours)**

Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids;

Unit-4 **(5 hours)**

Somaclonal variation and its use in crop improvement; cryo-preservation; Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

Course Learning Outcomes (CLOs):

On completion of the course the students will be

CO-1: To understand the scope of plant biotechnology in agriculture.
CO-2: To understand the applications of tissue culture and plant biotechnology those have resulted in great advances for agriculture and society.
CO-3: The students do understand the importance of plant diversity and their conservation through invitro propagation and maintainance.

Text Books:

B. D. Singh (2006). Plant Biotechnology, Kalyani Publications, ISBN 8127227889, 9788127227883.

Reference Books:

H. S. Chawla (2002). Introduction to Plant biotechnology, Science Publishers, ISBN 1578082285, 9781578082285.

S. K. Verma and Mohit Verma. A text book of plant physiology, biochemistry and biotechnology. S. Chand Publishing, ISBN 9788121906272

Course Code: ATUG-103 **Course Name: Fundamentals of Soil Science**

Course Credit Hour: 3 **Total Contact Hour: 40 hr Course Objective:**

- To provide a better appreciation of the distribution and variability of soils and their properties across the landscape
- A knowledge of how these properties are created and how they effect landscape processes (both at a large and small scale)
- A preliminary ability to investigate soil characteristics
- An understanding how we manage (or not) soils and their properties for a multitude of

objectives.

Course Description:

The Soil Science Fundamentals Review Course is designed to provide an overview of the fundamental concepts in soil science: Genesis, Classification and Morphology, Physics Chemistry, Fertility, Biology, and Land Use. Instructors will use the Fundamentals Performance Objectives (POs) as a guide for discussing topics within each section, but will not go through each objective individually. However, students are encouraged to ask questions regarding specific POs if needed.

Course Contents:

UNIT-1 Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity.

UNIT-2 Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth,

UNIT-3 Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloidsinorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties.

UNIT-4 Soil organisms: macro and micro organisms, their beneficial and harmful effects; Soil pollution - behaviour ofpesticides and inorganic contaminants, prevention and mitigation of soil pollution

Practical

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Estimation of organic matter content of soil.

Course Learning Outcomes (CLOs):

CLO-1: Explain principles of soil formation and classification CLO-2: Determine soil physical, chemical, and biologica properties.
CLO-3: Understand the relationship between crops and soils.
CLO-4: Understand how to utilize the principles of soil and water conservation.
CLO-5: Interpret soil analysis
CLO-6: Understand how to determine the need for fertilizer application

Text books:

Soil Science Fundamentals Exam – Performance Objectives This document can be downloaded for free from the SSSA website: https://www.soils.org/files/certifications/fundamentals-performance-objectives.pdf

Reference books:

Schoeneberger, P.J., Wysocki, D.A., Benham, E.C., and Broderson, W.D. (editors), 2002. NRCS, National Soil Survey Center, Lincoln, NE.
Soil Survey Staff. 1999. USDA-NRCS, Washington, DC Agriculture Handbook 436.

Online links for study & reference materials:
http://ecoursesonline.iasri.res.in/course/view.php?id=125

Course Code : ATUG-104 **Course Name :** Introduction to Forestry
Course Credit Hour : 2hr **Total Contact Hour :** 40hr

Course Objective :

- The overall objective of this course is to provide knowledge about forest ecosystem concept, classification, forest policies, productivity and vegetation forms and natural regeneration of tree species.
- It will acquaint students with the forest mensuration in which students will be able to measure different parameters such as height, diameter of forest trees.

Course Description :

Forests and other natural resources play a very important role in our world. They provide timber, fodder, fuel, medicines, resin, gums, wood etc. In addition they also provide shelter to birds and animals and have various ecological benefits. The aim of this course is to make students understand about the scientific establishment of forests by natural and artificial regeneration methods. They will also learn different tending operations used in forestry. Students will learn more about forest ecology, management, and conservation. They will learn more about forestry related careers and important issues facing forestry professionals tod

Course Contents :

Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations.

Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning.

Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method; Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees.

Agroforestry – definitions, importance, criteria of selection

of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of two important fast growing tree species of the region.

Course Learning Outcomes(CLOs) :

CLO-1 : To understand objectives of silviculture and agroforestry.

CLO-2 : To understand natural and artificial regeneration methods of forests.

CLO-3 : To learn about the different tending operations in forests.

CLO-4 : Students will be able to measure diameter, height of different forest trees by using different methods.

CLO-5: To learn about the different cultivation methods, their effects and benefits.

Text books :

K. T. Parthiban, N. Krishnakumar & M. Karthick (2018). Introduction to forestry & agroforestry, Scientific Publishers, ISBN 9387991741, 9789387991743.

Dwivedi A.P. (2006). A textbook of silviculture, International book distributors Dehradun, ISBN-10 : 8170891981 ISBN-13 : 978-8170891987.

Reference books :

Agroforestry: systems & practices (Sunil Puri& Pankaj Panwar). New India Publishing Agency, ISBN-10 : 8189422626 ISBN-13 : 978-8189422622

Online links for study & reference materials : https://mail.google.com/mail/u/1/#search/forest+mensuration/QgrcJHsbdJHWvKSCQxhPgJBxxmrKlGjZlgL?projector=1&messagePartId=0.6

Course Code: ATUG-105 **Course Name: English Communication –I**
Course Credit Hour: 3 **Hour: 40 hr**

The Course Outcomes (COs).
On completion of the course the students will be
.
CO–1 Understanding importance of English language.

CLO-1: To Understand the importance of English language
CLO-2: How to pronciate correctly.
CLO-4: How to make active voic to passive
CLO-5: Vocabulary will be impoved

Text Books:

Singh R.P., An Anthology of Short stories, O.U.P. New Delhi. For Undergraduate

Reference Books:

Kumar, Sanjay. &Pushp Lata. “Communication Skills” New Delhi: Oxford University Press.
Carnegie Dale. “How to win Friends and Influence People” New York: Simon & Schuster.
Harris, Thomas. A. “I am ok, You are ok” New York: Harper and Row.
Goleman, Daniel. “Emotional Intelligence” Bantam Book.

Course Code: ATUG-106 **Course Name:** Fundamentals of Agronomy
Course Credit Hour: 3Hrs. **Total Contact Hour:** 40 hours

Course Objective:

- The course aims to provide the fundamental knowledge of agronomy which includes seeds; sowing of seeds; tillage; Agroclimatic zones. It aims to train the student in the basic concept of Agriculture discussed above.

Course Description:

- This course introduces the fundamental concepts of Agronomy like practices before sowing, types of seeds; seed rate of different crop; soil type; calculation of fertilizer requirement.

Course Contents:

Unit1 **(10 lectures)**

Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, soil-plant-water relationship.

Unit2 **(8 lectures)**

Crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, water logging

Unit 3: **(8 lectures)**

Weeds- importance, classification, crop weed competition, concepts of weed management-principles and methods.

Unit4 **(8 lectures)**

Herbicides- classification, selectivity and resistance, allelopathy. Growth and development of crops, factors affecting growth and development, plant ideotypes, principles, adaptation and distribution of crops.

Unit5 **(6 lectures)**

Crop rotation and its crop management technologies in problematic areas, harvesting and threshing of crops.

Course Learning Outcomes (CLOs):
On completion of the course the students will be

CO - 1	Understanding the scope and practices of Agronomy.
CO- 2	Demonstrating the methods of irrigation, crop rotation, weeding in different crops
CO- 3	Applying the method of seed sowing, tillage, weeding, irrigation, and crop management in problematic areas
CO- 4	Analyzing the effect of weed-crop competition on agricultural productivity.

Text Books:
Handbook of Agriculture: Indian Council of Agricultural Research, New Delhi.
Principles of Agronomy - S. R. Reddy. Kalyani Publisher
Reference Books:
Manures and Fertilizers - K. S. Yawalkar, J.P. Agrawal and S. Bokde Agri-Horticultural Pub. House.
Fundamentals of Agronomy Gopal Chandra De. Oxford and IBH Publishing Co. PVT. LTD

Course Code:ATUG-107 **Course Name: Introductory Biology**
Course Credit Hour: 1 Hr **Total Contact Hour: 10 hours**

Course Objective:

The student will be able to explain the characteristics of living things and the levels of life. Students will understand how life has certain characteristics and begins at a molecular level.

Course Description:

Introductory Biology is a general biology course for nonmajors and provides an overview of the structure and function of living organisms. Topics covered in this course include essential information about characteristics of life, the scientific method, cell structure and function, genetics, microbiology, and comparative biology. Students will take from this course an understanding of the basic concepts in biology and role of plants and animals in agriculture.

Course Contents:

Unit-1 **(3 hours)**

Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics.

Unit-2 **(3 hours)**

Binomial nomenclature and classification Cell and cell division. Morphology of flowing plants. Seed and seed germination.

Unit 3- **(5 hours)**

Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

Course Learning Outcomes (CLOs):

On completion of the course the students will be

CO-1:	Describe elements of the scientific study of living things.
CO-2:	Discuss cells, including their elements, organization, and membranes.
CO-3:	Describe how scientists classify and systematize the study of plants.

Text Books:

P. S Dhami, G. Chopra and H. N. Srivastava (2020). A text book of Biology. Pradeep Publications.

Reference Books:

Handbook of Biology (2014). Arihant Publications.

Course Code : ATUG-108 **Course Name :Agriculture heritage**
Course Credit Hour : 1hr **Total Contact Hour : 10 hr**

Course Objective :
Agricultural Heritage is to promote student understanding, awareness about sustainable agriculture and to safeguard the social, cultural, economic and environmental goods and services these provide to family farmers, smallholders, indigenous peoples and local communities

Course Description :
Students will learn on the historical dynamics of the agrarian system. Agricultural Heritage Systems Programme from a Social-ecological Systems Perspective.

Course Contents :

Unit 1:
Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture; Past and present status of agriculture and farmers in society

Unit 2:
Development of Human Culture and Beginning of Agriculture Journey of Indian agriculture and its development from past to modern era; Plant production and protection through indigenous traditional knowledge.

Unit 3:
Ancient Agricultural Techniques Crop voyage in India and world; Agriculture scope; Importance of agriculture and agricultural resources available in India; Crop significance and classifications

Unit 4:
Current Scenario of Agriculture National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects

Course Learning Outcomes(CLOs) :
CLO-1 : Understand the Indian agricultural heritage practices
CLO2. Understand the development of human culture and beginning of agriculture CLO3. To gain the knowledge about ancient agricultural Techniques CLO4.Understand the national setup of agriculture in India
CLO5. The information about current scenario of agriculture.

Text books :
D. Kumari, Manimuthu Veeral. 2014. Text Book on Agricultural Heritage of India. Agrotech Publishing Academy
Nene, Y.L., Choudhary, S.L. and Saxena, R.C. 2010. Textbook on Ancient History of Indian Agriculture, Asian Agri-History Foundation

Reference books :
E-References: http://icar.res.in ww.webcast.gov.in ww.icar.org.in/nasm.html
Online links for study & reference materials :
ICAR. Introductory Agriculture. ICAR e-course. Indian Council of Agricultural Research, New Delhi.

Course Code : ATUG-109 **Course Name :** Rural Sociology and educational psychology
Course Credit Hour : 2 hr **Total Contact** Hour : **30 hr**

Course Objective :

- To impart knowledge to the students on sociological and psychological aspects of rural people.
- To acquaint students with some important features of rural society.

Course Description:

Definition and scope of rural sociology will be discussed in detail with the students. The difference between rural and urban community will be explained in detail. In this a group of students will be divided into smaller units for a short period called buzz session and discussion will be done. Social institution and different groups can be explained by giving various examples and using power point presentations. All the topics such as personality, learning, motivation and intelligence will be discussed by using audio visuals aids such as animations and video lectures.

Course Contents :

Unit 1: Sociology and Rural sociology: Definition and scope, its significance in agriculture extension.

Unit 2: Social Ecology, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development.

Unit 3: Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence.

Course Learning Outcomes (CLOs) :

CLO-1 : Students will understand the characteristics of rural society, social institutions, culture, social values and relevance in agricultural extension.

CLO-2 : Students will understand the educational psychology, learning and teaching situation.

CLO-3 : Students will be able to access the personality types, emotions of human beings and motivation.

Text books :

Mondal, S. (2019). Rural sociology and educational psychology, Kalyani Publishers, ISBN: 9789327281392, 932728139X.

Velusamy, R. (2018). Textbook on Rural sociology and educational psychology, Daya Publishing House, ISBN-10 : 9789351249412, ISBN-13: 978-9351249412.

Reference books :

Sharma, O. P. and Somani, L. L. (2012). Fundamentals of rural sociology and educational psychology, Agrotech Publications, ISBN: 9788183212496.

Online links for study & reference materials :

http://rajneeshrajoria.weebly.com/uploads/4/9/0/6/49069889/rural_sociology.pdf

Course Code : ATUG-110 **Course Name :** Human values and Ethics

Course Credit Hour : 1hr **Total Contact Hour :** 20 hr

Course Objective :

- To help the students to appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Value based living in a natural way.
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
- To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Course Description :

Understanding happiness and prosperity correctly- A look at basic Human Aspirations. Right understanding of five human values i. e. love, non-violence, truth, right conduct and peace by conducting seminars in class and discussion.

Course Contents :

Unit-1: Happiness & prosperity; Human values & ethics; concept, definition, significance & sources; Fundamental values: Right conduct, peace, truth, love & non-violence.

Unit-2: Ethics: professional, environmental, ICT; Sensitization towards others particularly senior citizens, developmentally challenged & gender.

Unit-3: Spirituality; positive attitude and scientific temper; Team work and volunteering; Rights and responsibilities; Road safety; Human relations and family harmony.

Unit-4: Modern challenges and value conflict: Sensitization against drug abuse and other social evils; developing personal code of conduct (SWOT analysis); Management of anger and stress.

Course Learning Outcomes(CLOs) :

CLO-1 : Students will be familiar with the basic vocabulary and fundamental theories of ethics.

CLO-2 : To appreciate the rights of others, to inspire moral and social values and loyalty.

CLO-3 : Understand the value of harmonious relationship based on trust and respect in their life and profession

CLO-4 : Students will learn to value their argumentative opponents as valuable resources in ethical reasoning.

Text books :

R. R. Gaur, R. Sangal and G. P. Bagaria (2010). A foundation course in human values & professional ethics, Excel Books , ISBN-10 : 9788174467812, ISBN-13 : 978-8174467812.

S. Srivastava (2010). Human values and professional ethics, Scitech Publications, ISBN 8183714498, 9788183714495.

Reference books :

S. S. Mathur (2010). Education for values, environment and human rights. RSA International. ISBN: 9789380158471.

S. B. Gogate (2010). Human Values & Professional Ethics, Vikas Publishing House Pvt. Ltd., Noida, ISBN-10 : 8125937137 ISBN-13 : 978-8125937135

Online links for study & reference materials : https://lecturenotes.in/download/note/18532-note-for-applied-physics-phy-by-anshuman

B.Sc. (Hons.) Agriculture
II-SEMESTER

S.NO	Course Code	Subject	Sessional Exam			Evaluation Scheme				Credit
						External Exam	PRACTICAL		Subject Total	
			CA	TA	Total		INTERNAL	EXTERNAL		
1	ATUG-201 (T+P)	Fundamentals of Genetics	20	20	40	60	25	25	150	3(2+1)
2	ATUG-202 (T+P)	Agricultural Microbiology	20	20	40	60	25	25	150	2(1+1)
3	ATUG-203 (T+P)	Soil and Water Conservation Engineering	20	20	40	60	25	25	150	2(1+1)
4	ATUG-204 (T+P)	Fundamentals of Crop Physiology	20	20	40	60	25	25	100	2(1+1)
5	ATUG-205 (T+P)	Fundamentals of Agricultural Economics	20	20	40	60	-	-	-	2(2+0)
6	ATUG-206 (T+P)	Fundamentals of Plant Pathology	20	20	40	60	25	25	150	4(3+1)
7	ATUG-207 (T+P)	Fundamentals of Entomology	20	20	40	60	25	25	150	4(3+1)
8	ATUG-208 (T+P)	Fundamentals of Agricultural Extension Education	20	20	40	60	25	25	150	3(2+1)
	(T+P) : THEORY + PRACTICAL **(T): THEORY ONLY**									**22**

Course Code: ATUG 201 **Course Name: Fundamentals of Genetics**
Course Credit Hour: 4hr **Total Contact Hour: 40hr**

Course Objectives:

- To impart knowledge to the students on the ultra structure of cell and cell organelles, various principles of hereditary and variation, principles of genetics and their applications in plant breeding for improving agricultural productivity

Course Description:

- This course provides a stair-step introduction of genetics from the basic concepts to exploring more complex topics, Sex determination, Blood group genetics, linkage and crossing over concepts, mutation genetic disorder and gene concept including molecular biology, gene mapping and screening, and reverse and forward genetic research.

Course Contents:

Unit-1 **(10 Hours)**

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity, Cell division – mitosis, meiosis, Probability and Chi-square, Dominance relationships, gene interaction.

Unit-2 **(10 Hours)**

Multiple alleles, pleiotropism and pseudo-alleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural changes in chromosome,

Unit-3 (12 Hours)

Mutation, classification, Methods of inducing mutation & CIB technique, mutagenic agents and induction of mutation, Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Epistatic interactions with examples, Cytoplasmic inheritance. Genetic disorders,. Nature, structure & replication of genetic material

Unit-4 (8 Hours)

Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

Course Learning Outcomes (CLOs):

CLO-1: Understand the basic concepts of the ultra structure of cell, cell organelles, chromosomes and nucleic acids.
CLO-2: Apply the principles of inheritance to plant breeding

CLO-3: Acquaint with the fundamentals of chromosomal and cytoplasmic inheritance CLO-4: Sex determination, mutations, chromosomal aberrations and Gene concept: Gene structure, function and regulation

CLO-5: Learning about Gene concept, structure and function.

Text books:

Pundhan Singh, 2006, Genetics, Kalyani Publishers, Ludhiana

Singh, B.D. 2015. Fundamentals of Genetics, Kalyani Publishers, Ludhiana

Reference books:

Gupta, P.K.2007. Genetics, Rastogi Publications, Meerut

Online links for study & reference materials:

Course Code : ATUG-202 **Course Name :** Agriculture Microbiology

Course Credit Hour : 2hr **Total Contact Hour : 20** hr

Course Objective :

- Students will be able to understand basic and advanced techniques of various instrumentation like pH meter, spectroscopy, colorimetric, microscopy, chromatography, molecular techniques.
- The students would acquire basic knowledge of research data collection, processing and presentation of data and application of bioinformatics, biostatistics tools.
- The student will be able to demonstrate ability to provide advanced concept of microbial technology pharmaceutical technology, food microbiology process.
- The students will be able to demonstrate understanding of basic and advanced knowledge in agriculture microbiology disciplines

Course Description :

- Microbiology is an applied science, helping agriculture, health and medicine and maintenance of the environment, as well as the biotechnology industry. Microbiologists study the role of microbes at the level of the agriculture, at the level of the cell and at the level of proteins and genes. Microorganisms are extremely important in our everyday lives. Some are responsible for a significant proportion of the diseases affecting not only humans, but also plants and animals, while others are vitally important in the maintenance and modification of our environment. Still others play an essential role in industry, where their unique properties have been harnessed in the production of food, beverages and antibiotics.

knowledge in recent trends in microbiology especially in microbiology..

Course Contents :

Unit-1

Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth.

Unit-2

Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposon.

Unit-3

Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza.

Unit-4

Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro- waste.

Course Learning Outcomes(CLOs) :

CLO-1 :To understand microbial world, cell structure, Bacterial genetics.
CLO-2 : To Understand the role of microbes in soil fertility and crop production.
CLO-3 :To Understand the Biological nitrogen fixation.
CLO-4 :To Understand the Microbes in human well being.

D. J. BAGYARAJ, Agricultural microbiology,second edition,PHI Learning Pvt. Ltd.
R.P. Pareek,Agricultural microbiology, Scientific Publishers

Reference books

N.S. Subba Rao,Advances in Agricultural microbiology, Elsevier

Online links for study & reference materials : http://agrimoon.com/agricultural-microbiology-icar-ecourse-pdf-book/

Course Code: **ATUG-203**
Course Name: **Soil and Water Conservation Engineering**
Course Credit Hour: **2 Hr** **Total Contact Hour: 20 hr**

Course Objective:

The course aims to provide the fundamental knowledge of Soil and Water Conservation Engineering. It enables to understand the basics of soil its conservation and engineering

Course Description:

This course gives the fundamental concepts soil & water conservation engineering .Measurement of soil erosion - Runoff plots, soil samplers. Water erosion control measures - agronomical measures - contour farming, strip cropping

Course Contents:

Theory

UNIT 1: (5 LECTURES)

Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures.

UNIT 2: (5 LECTURES)

Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund.

UNIT 3: (5 LECTURES)

Graded bund and bench terracing. Grassed water ways and their design. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

UNIT 4: (5 LECTURES)

General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem on wind erosion.

Course Learning Outcomes (CLOs)

CO – 1 Understanding the classification, cause and type of soil erosion

CO – 2 Applying and analyzing the control measures for soil erosion

CO – 3 Understanding and analyzing soil loss by USLE (universal soil loss equation)

Text Books:

Principles of soil conservation and water management Hanumappa Ramappa Arakeri, Roy LutherDonahue Rowman &Allanheld

Reference Books:

Principles of Soil Conservation and Management,Humberto Blanco-Canqui, Rattan Lal,Springer.

Advances in Soil and Water Conservation Francis J. PierceCRCPress.

Integrated Watershed Management in Rainfed Agriculture, Suhas P. Wani, Johan Rockstrom, KanwarLal Sahrawat, CRCPress

Course Code : ATUG-204 **Course Name :** Fundamentals of Crop physiology

Course Credit Hour : 1hr **Total Contact Hour :** 20hr

Course Objective :

To impart the students with basic knowledge of cell physiology and plant nutrition with relevance to agriculture.To learn about various plant metabolic processes and functions in plants.

Course Description :

The aim of this course is to give students a greater understanding of the various physiological processes in plants such as respiration, photosynthesis, glycolysis, TCA cycle, plants water relations etc., plant responses and environmental factors affecting growth and productivity of the agricultural crops we depend on. Students will learn about basic concepts in crop growth and development. The course will enable students to use the knowledge of crop physiology to answer practical questions. Basic concepts underlying crop physiology will be demonstrated through laboratory exercises.

Course Contents:

Unit-1:

Introduction to crop physiology and its importance in Agriculture, Plant cell: an Overview.

Unit-2:

Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology.

Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms.

Unit-3:

Photosynthesis: Light and Dark reactions, C3, C4 and CAM plants Respiration: Glycolysis, TCA cycle and electron transport chain Fat Metabolism: Fatty acid synthesis and Breakdown.

Unit-4:

Plant growth regulators: Physiological roles and agricultural uses; Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity.

Course Learning Outcomes(CLOs) :

CLO-1 : To know the importance of Physiology in Agriculture and Horticulture.

CLO-2 : To get fundamental ideas on various basic plant metabolic functions such as Diffusion and Osmosis, Plant Water Relations, Mineral Nutrition, Photosynthesis, Respiration, Fat Metabolism, Plant Growth and Development.

CLO-3 : To have information about plant cell and plant growth regulators.

CLO-4 : To learn about the growth and development in plants and use of growth parameters on crop productivity.

Text books :

Vanangamudi M, Dr. Purohit S. S. (2017). A Textbook Of Crop Physiology, AGROBIOS, ISBN: 9788177546064.

S. C. Datta (2011). Plant Physiology, New Age International (P) Ltd., ISBN-10: 8122405178, ISBN-13: 9788122405178.

Reference books :

Sunil Kumar (2015). Handbook Of Plant And Crop Physiology, Scitus Academics LLC, ISBN-10 : 1681170272, ISBN-13 : 978-1681170275.

Online links for study & reference materials :

https://drive.google.com/file/d/1KrshFAQZMgNbfCdkGAbI-Cv4fDpnAiz7/view

Course Code :ATUG-205 **Course Name : Fundamentals of Agricultural Economics**
Course Credit Hour : 2 **Total Contact Hour : 30 hrs**

Course Objective :
This course is intended to provide an overview of Agricultural economic theory and its applications. It intends to provide fundamental concepts and models in the theory of production and costs and sets out to provide a basic understanding of price and / or output determination under different types of market structures including factor markets

Course Description :
The purpose of this course is to introduce students to the use of economic tools and concepts in the analysis and evaluation of public policies affecting agriculture, food, natural resources, and the environment. Emphasis is placed on social valuation, civic responsibility, ethics and the practical analysis of public policy issues. The course is divided into two parts:

Course Contents :

Unit- 1
Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare

Unit-2
Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. Demand: meaning, law of demand, schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle.

Unit-3
Law of variable proportions and law of returns to scale. Cost: concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, elasticity of supply. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement.

Unit- 4
Population: Importance, Malthusian and Optimum population theories, natural and socio- economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, supply, general price index, inflation and deflation. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. Tax: meaning, direct and indirect taxes, agricultural taxation, VAT. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

Course Learning Outcomes(CLOs) :
CLO-1 : Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation and reflection.
CLO-2 : Explain ethical principles, civics, and stewardship, and their importance to society.
CLO-3 : Write texts in various forms, with an identified purpose, that respond to specific audience needs, incorporate research or existing knowledge, and use applicable documentation and appropriate conventions of format and structure.
CLO-4 : Students will achieve an understanding of ethics, civic responsibility and the importance of public deliberation and analysis for society through class discussions, readings, problem sets and research conducted as the basis for a major student project that will constitute the schoo.l

Text books :
David M Kreps 1990. A Course in Microeconomic Theory. Princeton University Press. Dewitt KK. 2002.
Modern Microeconomics. The Macmillan Press. Silberberg E & Suen W. 2001. The Structure of Economics - A Mathematical Analysis. McGraw-Hill.
Microeconomic Theory: A Mathematical Approach. McGraw-Hill
Economic Theory. Sultan Chand & Co. Henderson JM & Quandt RE.2000
Reference books :
Fundamentals of Agricultural Economics by Verma P K (Author)
Fundamentals Of Agricultural Extension Education (Prinsika)

Course Code: ATUG-206 **Course Name: Fundamentals of Plant Pathology**

Course Credit Hour:3 **Total Contact Hour: 45 hr**

Course objective

This course is intended to provide an overview of plant pathology & its importance. It will provide fundamental concepts of fungi, bacteria, viruses, nematodes.

Course description

The course is designed to equip the basic knowledge of plant pathogens and important concepts so that students could easily save the crops from pathogens.

Course content

Unit 1: **(15 lectures)**

Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Pathogenesis. Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes.

Unit 2: **(10 lectures)**

Fungi: general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub- divisions, orders and classes.

Unit 3: **(10 lectures)**

Bacteria and mollicutes: General morphological characters. Basic methods of classification and reproduction. Viruses: nature, structure, replication and transmission. Study of phanerogamic plant parasites. Nematodes: General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne, Anguina, Radopholus etc.)

Unit 4: **(10 lectures)**

Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants. Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Course Learning Outcomes (CLOs):

CO-1: Understanding the basic aspects of plant health and disease caused by parasitic and non-parasitic pathogens

CO-2: Understanding the plant disease management through chemical, cultural and biological practices

CO-3: Identifying the importance of microorganisms in agriculture

Text Books:

Plant Pathology – P.D. Sharma. Rastogi Publications.

Principles of plant Pathology – R.S.SIngh

Reference Books:

Plant pathology by G. N. Agrios, Elsevier Academic press,London.

Introductory Plant Pathology by M. N. Kamat, Prakash Publ, Jaipur(l967).

Plant diseases by R. S. Singh. Oxford and IBH Publishing.

Course Code: ATUG-207 **Course Name: Fundamentals of Entomology**
Course Credit Hour: 4 **Total Contact Hour: 40 hr**

Course Objective:
Identify terrestrial arthropods to Class by visual inspection. Identify insects to Order by inspection, and identify common forms to Family. Be able to identify unknown insects by use of standard taxonomic keys.

Course Description:
The program is designed to increase personal knowledge about insects, the most diverse group of animals on earth, and their importance to mankind and our environment. It will allow the student to appreciate the role of insect biology and diversity in relation to all forms of animal life. Course Contents:

UNIT-1
History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom Classification of phylum Arthropoda up to classes. Relationship of class Insecta with other classes of Arthropoda. Harmful and Beneficial insect.

UNIT-2
Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Metamorphosis in insects.

UNIT-3
Types of larvae and pupae Structure of male and female genital organs; Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs, like simple and compound eyes, chemoreceptor.

UNIT-4
Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors– temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance.

Course Learning Outcomes (CLOs):
CLO-1 Student will have knowledge of insect identification, morphology, physiology and behavior.
CLO-2 Students will acquire, analyze, and synthesize entomological information
CLO-3 Students will demonstrate oral or written proficiency in the entomological sciences
CLO-4 To Introduce entomology (definitions, objective, concept, scope and importance)
CLO-5 To Understand roles the insect to cause damage to plant.

Text books:
Borror, D.J., C. A. Triplehorn, and N. F. Johnson. 1992. An introduction to the study of insects. Sixth ed. Saunders College Publishing.
Williams, S. C. 2001.General Entomology a course reader and laboratory manual.

Reference books:
Bland, R. G. and H. E. Jaques. How to know the insects. Wm C. Brown.
Elzinga, R. J. Fundamentals of Entomology.Prentice Hall
Powell, J. A. and C. L. Hogue.California Insects.Natural History Guides 44. Univ. California Press.

Course Code : ATUG-208 **Course Name : Fundamentals of Agricultural extension education**
Course Credit Hour : 3hr **Total Contact Hour : 48hr**

Course Objective :
To learn how we can help rural people in planning and implementation of their family and village and for increasing agricultural production, improving existing village craft and industries.
Course Description :
This course deals with objectives, principles, philosophy and dimesions of extension. Students will be informed about the historic efforts of planning and implementation of extension programmes which can provide them insights to develop future extension programmes
Course Contents :
Unit 1:
Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning-Meaning, Process, Principles and Steps in Programme Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.);
Unit 2:
Various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.). New trends in agriculture extension: privatization extension, cyber extension/ e- extension, market-led extension, farmer-led extension, expert systems, etc.Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India.
Unit 3:
Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel;
Unit 4:
Extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies; communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories

Course Learning Outcomes(CLOs) :
CLO-1 : Education; Extension Programme planning Meaning, Process, Principles and Steps in Programme Development.
CLO-2 : Extension systems in India: Extension efforts in Pre-independence era. CLO-3 : New trends in agriculture extension: privatization extension.
CLO-4 : Monitoring and evaluation – concept and definition, monitoring, and evaluation of extension programmes. Transfer of Technology- Concept and models.
Text books :
R. K. Talukdar and U. Barman (2014). Fundamentals of Agriculture Extension Education, Agrobios Publications, ISBN 9788177544428.
Reference books :
L. L. Somani (2009). Extension Education And Communication. Agrotech Publications, ISBN 9788183211406.
J. M. Deshmukh and V. G. Dhulgand. Text Book on Fundamentals of Agricultural Extension Education. Weser Books, ISBN 978-3-96492-011-9.
Online links for study & reference materials :
https://study.kreshee.com/wp-content/uploads/2020/07/Fundamentals-of-extnsion-education.pdf
http://nsdl.niscair.res.in/jspui/bitstream/123456789/307/1/AGRICULTURAL%20EXTENSION%20EDUCATION.pd

B.Sc. (Hons.) Agriculture III SEMESTER

S.NO	Course Code	Subject	Sessional Exam			Evaluation Scheme				Credit
						External Exam	PRACTICAL		Subject Total	
			CA	TA	Total		INTERNAL	EXTERNAL		
1	ATUG-301	Crop Production Technology – I (Kharif Crops) **(T+P)**	20	20	40	60	25	25	150	**2 (1+1)**
2	ATUG-302	Fundamentals of Plant Breeding (FPB) **(T+P)**	20	20	40	60	25	25	150	**3(2+1)**
3	ATUG-303	Agricultural Finance and Cooperation(AF) **(T+P)**	20	20	40	60	25	25	150	**3(2+1)**
4	ATUG-305	Farm Power and Machinery(FPM) **(T+P)**	20	20	40	60	25	25	100	**2 (1+1)**
5	ATUG-306	Production Technology for Vegetables and Spices **(T+P)**	20	20	40	60	25	25	150	**2(1+1)**
6	ATUG-307	Environmental Studies and Disaster Management **(T+P)**	20	20	40	60	25	25	150	**3 (2+1)**
7	ATUG-308	Statistical Methods **(T+P)**	20	20	40	60	25	25	150	**2(2+1)**
8	ATUG-309	Livestock and Poultry Management **(T+P)**	20	20	40	60	25	25	150	**4 (3+1)**
										21

Course Code : ATUG-301 **Course Name : Crop production-I (Kharif crop)**
Course Credit Hour : 2hr **Total Contact Hour : 38 hr**

Course Objective :
Acquire skill in crop production.Control measures for weed, insect-pest disease for enhanced yield. Ensuring sound use of natural resources, reducing soil erosion, and improving soil quality.

Course Description :
This course expresses the basic principles involved in the production of field crops stressing the importance of field crop management and other agronomic practices that can bring about improve crop yield under good management practices.

Course Contents :

Unit-1

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops Cereals – rice, maize, sorghum, pearl millet and finger millet

Unit-2

Pulses-pigeonpea, mungbean and urdbean

Unit-3

oilseeds crops- groundnut, and soybean

Unit-4

Fibre crops- cotton & jute

Unit-5

Forage crops-sorghum, cowpea, cluster bean and napier

Course Learning Outcomes(CLOs) :

CLO-1. Identify the major crops produced in India

CLO2. Identify the major crops produced in the world

CLO3. Understand the factors that affect which crops are grown

CLO4. Understand the agronomic practices

CLO5. Understand the plant protection measures

Text books :

Chatterjee, B.N. 1989. Forage Crop Production- Principles and Practices, Oxford and IBH.New Delhi, ISBN= 8120403983

Chidda Singh, Prem Singh and Rajbir Singh. 2003. Modern Techniques of Raising Field Crops (2nd ed.). Oxford and IBH, New Delhi,ISBN=8120415997

Prasad, R. (ed.). 1999. A Text Book of Rice Agronomy, Jain Brothers, New Delhi,

Reference books :

ICAR [Indian Council of Agricultural Research],6th revised Hand Book of Agriculture. ICAR, New Delhi,

Course Code: ATUG 302 **Course Name:** Fundamentals of Plant Breeding
Course Credit Hour: 4hr **Total Contact Hour:** 40hr

Course Objectives:

The impart knowledge to the students on the principles and procedure of plant breeding in self and cross pollinated crops for development of the high yielding varieties/ hybrids with the help of various conventional and modern molecular approaches

Course Description:

This course examines the historical principles to plant improvement. Topics include breeding objectives, mating systems, selection, testing and germplasm in self and cross pollinated crops for development of the high yielding varieties/ hybrids with the help of various conventional and modern molecular approaches

Course Contents:

Unit-1 **(8 Hours)**

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self – incompatibility and male sterility- genetic consequences, cultivar options.

Unit-2 **(6 Hours)**

Domestication, Acclimatization, introduction; Centre of origin/diversity, component of Genetic variation; Heritability and genetic advance;

Unit-3 **(8 Hours)**

Genetic basis and breeding methods in self- pollinated crops-mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law,

Unit-4 **(6 Hours)**

Genetic basis and methods of breeding cross-pollinated crops, modes of selection; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties;

Unit-5 **(16 Hours)**

Breeding methods in asexually propagated crops, Clonal selection and hybridization; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses, Biotechnological tools-DNA markers and marker-assisted selection, Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Course Learning Outcomes (CLOs):

CLO-1: Learn breeding procedures in self and cross pollinated crops

CLO-2: Understand exploitation of heterosis utilizing male sterility and other method

CLO-3: Know about the various population improvement programmes

CLO-4: Study about the fundamentals of mutation, polyploidy and wide hybridization and their role in crop improvement

CLO-5: Orientation regarding modern molecular approaches like Marker Assisted Selection

CLO-6: Learning about IPR, Patenting, Plant Breeders and & Farmer's Rights

Text books:

Principles of Plant Breeding - B. D. Singh Essentials of Plant Breeding – Phundan Singh

Principles of Plant Breeding - R.W. Allard

Reference books:

Principles of Plant Breeding - R.W. Allard

Online links for study & reference materials:

http://ecoursesonline.iasri.res.in › course

Course Code : ATUG- 303 **Course Name : Agricultural Finance and Co-Operation**
Course Credit Hour : 2 hr **Total Contact Hour : 30** hr

Course Objective :

To make the students aware about the agricultural Finance, Banking and Cooperation.To acquaint the students with the basic concepts, principles and functions of management. To understand the process of finance banking and cooperation.

Course Description :

This subjects is very useful to students in agriculture how the loans provide by the banks to farmers. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India..

Course Contents :

Unit 1:

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits.

Unit 2:

Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India. Cost of credit.

Unit 3:

Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.

Unit 4:

Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED.

Course Learning Outcomes(CLOs) :

CLO-1 : Understand the scope and significance of Agricultural Finance
CLO2.Understand the credit need and its role in agriculture
CLO3. Learn about Working Capital Management Risk and Return and Venture Capital
CLO4. Learn about farmers' service cooperative societies in India
CLO5. Understand the concepts and process of Capital Budgeting and LongTerm Financing Capital Structure and Cost of Capital

Text books :

Muniraj, R., 1987, Farm Finance for Development, Oxford and IBH, New Delhi
Subba Reddy. S and P.Raghu Ram 2011, Agricultural Finance and Management, Oxford and

IBH, New Delhi.

Reference books :

Lee W.F., M.D. Boehlje A.G., Nelson and W.G. Murray, 1998, Agricultural Finance, Kalyani Publishers, New Delhi.

Mammoria, C.B., and R.D. Saxena 1973, Cooperation in India, Kitab Mahal, Allahabad.

Online links for study & reference materials :

http://ecoursesonline.iasri.res.in/Courses/Agricultural%20Finance

Course Code: ATUG-305 **Course Name:** Farm Machinery Power

Course Credit Hour: 3 Hr **Total Contact Hour:** 30 hours

Course Objective:

The overall objective of this course is to provide an environment for students to develop critical thinking on farms and machinery. Source of farm power, working of engines, Familiarization with Plant Protection equipment.

Course Description:

Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor. Power transmission system : clutch, gear box, differential and final drive of a tractor , Tractor types, Cost analysis of tractor power and attached implement

Course Contents:

Unit 1 **(4 Hours)**

Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines ,

Unit 2 **(4 Hours)**

Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor,

Unit 3 **(4 Hours)**

Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor , Tractor types, Cost analysis of tractor power and attached implement,

Unit 4 **(4 Hours)**

Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment,

Unit 5 **(4 Hours)**

Calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Course Learning Outcomes (COs).

On completion of the course the students will be

CO-1: Understanding the working, operation and uses of different farm machines CO-2: Understanding the various scientific principles for the efficient operation of farming activities

CO-3: Applying the different farming machine-operational methods

CO-4: Creating an appropriate method of farm machining that can give maximum crop productivity with minimum cost and human efforts.

Text Books

Farm Machinery Fundamentals,Marshall F. Finner, Richard J. Straub, American Publishing.

Reference Books

Principles of Farm Machinery, Roy Bainer, Read Books Design

Farm Machinery, Claude Culpin, Read Books.

Course Code : ATUG-306 **Course Name : Production technology for vegetables and spices**
Course Credit Hour : 2hr **Total Contact Hour : 40hr**
Course Objective :
To inform students about the use of vegetables and spices in human nutrition and economic growth of a nation. To educate students about production technology of vegetables and spices.
Course Description :
This course will inform students about importance of spices and various vegetables for proper growth and development, nutrition and economic growth of a nation. Time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management,
Course Contents :
Unit 1:
Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices
Unit 2:
Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas;
Unit 3:
Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic; Root crops such as Carrot, Raddish, Beetroot;
Unit 4:
Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables.

Course Learning Outcomes(CLOs) :
CLO-1 : To know importance of vegetables and spices crops.
CLO-2 : Types of vegetable gardening with special reference to kitchen gardening. CLO-3 : To understand the scientific cultivation methods of vegetables and spices.
CLO-4 : To know more about origin, area, climate, soil, improved varieties and cultivation practices such as time and methods of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield.
CLO-5 : Bulb crops such as Onion, Garlic; Root crops such as Carrot, Radish, Beetroot; Tuber crops such as Potato and Sweet potato; Leafy vegetables such as Amaranthus and Palak; Perennial vegetables such as drumstick and pointed gourd.
Text books :
P. Hazra, A. Chattopadhyay, K. Karmakar and S. Dutta (2010). Modern Technology in Vegetable Production. New India Publishing Agency,New Delhi, ISBN 9789380235325.
N. P. Singh (2007). Basic Concepts of Vegetable Science. International Book Distributing Co. New Delhi, Academic Press, New Delhi, ISBN: 9789385915215, 9789385915215.
Reference books :
G., Shanmugavelu, N. Kumar and K. V. Peter (2005). Production Technology of Spices and Plantation Crops. Agrobios(India), Jodhpur.
Online links for study & reference materials :
www.agrimoon.com www.tnau.in

Course Code: ATUG-307
Course Name: Environmental Studies & Disaster Management
Course Credit Hour: 3 **Total Contact Hour: 30 hr**
Course Objective:
Disciplinary knowledge: Enable students to develop a comprehensive understanding of various facets of life forms, ecological processes and how humans have impacted them during the Anthropocene era.
Course Description:
Through interdisciplinary academic courses, internships, experiential, and co-curricular activities our students become passionate stewards of the environment, scholars in sustainability and environmental management, and experts in environmental studies. With a focus on environmental justice, students develop critical-thinking skills, analyze real- world problems, and understand the power of narrative to create sustainable solutions for local and global communities.
Course Contents:
UNIT-1
Introduction to Environment: Definition, Components of Environment, Relationship between different components, Man Environment relationship, Impact of Technology on the environment, Environmental Degradation, Sustainable Development, Environmental Education.
Ecology & Ecosystems: Introduction: Ecology- Objectives and Classification, Concepts of an ecosystem- structure & function of ecosystem, Components of ecosystem- Producers, Consumers, Decomposers,Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features,
Unit-2:
structure and function of the following ecosystem:Forest ecosystem Grassland ecosystem Desert ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) Bio-Geo- Chemical Cycles- Hydrological Cycle, Carbon cycle, Oxygen Cycle, Nitrogen Cycle, Sulfur CycleEnvironmental Pollution: Air Pollution: Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like SPM, SO_2, NOX – Natural & Anthropogenic Sources, Effects of common air pollutants, Air Pollution EpisodesNoise Pollution: Introduction, Sound and Noise measurements, Sources of Noise Pollution, Ambient noise levels, Effects of noise pollution, Noise pollution control measures.
Unit-3:
Water Pollution: Introduction – Water Quality Standards, Sources of Water Pollution, Classification of water pollutants, Effects of water pollutants, Eutrophication, Water Pollution Episodes
Current Environmental Global Issues: Global Warming and Green Houses Effect, Acid Rain, Depletion of Ozone Layer. Energy Resources: Renewable &Nonrenewable Resources: Renewable Resources, Nonrenewable Resources, Destruction versus Conservation. Energy Resources: Energy Resources - Indian Scenario , Conventional Energy Sources & its problems, non-conventional energy sources- Advantages and its Limitations.
UNIT-4
Types of Disaster Introduction, Types of Natural Disasters, Accidental Disasters, Impact of Disasters on Trade and International Trade. Natural Disasters: Introduction, Earthquakes, Hurricanes, Tornadoes, Floods, Drought, Tsunami, Volcanoes, Cyclones and Storms, Forest Fires, Severe Heat Waves, Landslides and Avalanches, Epidemics and Insect Infestations Technological and Social Disasters: Introduction, Types of Technological Hazards, Hazardous Materials, Social Disasters, Political and Crowd Disasters,War and Terrorism.Disaster Management: Components of Disaster Management, Government’s Role in Disaster Management through Control of Information, Actors

in Disaster Management, Organizing Relief measures at National and Local Level, Psychological Issues, Carrying Out Rehabilitation Work, Government Response in Disaster

Course Learning Outcomes (CLOs):

CLO-1 Understand the natural environment and its relationships with human activities.

CLO-2 Characterize and analyze human impacts on the environment.

CLO-3 Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems

CLO-4 Capacity to integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels

CLO-5 Capacity to obtain, analyse, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios.

Text books:

Basics of Environmental Studies by Dr. N. S. Varandani, Books India Publications

Disaster Management by MukeshDhunna, Vayu Education of India, Delhi Publication

Reference books:

Environmental Studies by R. Rajagopalan, Oxford University Press Publication

Environmental Science by Richard T Wright & Bernard J Nebel, Prentice Hall India Publication

- Environmental Science by Daniel B Botkin& Edward A Keller, Wiley Publications

Course Code: ATUG-308 **Course Name: Statistical Methods**
Course Credit Hour: 2 Hr **Total Contact Hour: 20 hours**

Course Objective:

The course aims to provide the fundamental knowledge of statistics commonly used in Agricultural studies. It enables to analyze the data scientifically and carry out the experiments in scientific way

Course Description:

This course introduces the fundamental concept of Statistical methods and imparts the basic knowledge of statistics viz; graphical presentation; types of data; median ; mode; geometric mode ; standard deviation; Application of One Sample t-test. Application of Two Sample Fisher's t-test. Chi-Square test of Goodness of Fit.

Course Content

Unit 1 **(4 Hours)**

Introduction to Statistics and its Applications in Agriculture, Concept of primary & secondary sources of data, Classification- objectives & types of classification, Construction of frequency distribution, Tabulation- meaning advantages & types of tabulation.

Unit 2 **(4 Hours)**

Diagrammatic presentation- meaning , importance & rules for constructing diagrams, types of diagrams- bar, square, pie diagrams, cartograms, Graphical presentation- histogram, frequency curve, ogive.

Unit 3 **(4 Hours)**

Measures of central tendency- meaning, objectives, characteristics of a good average, arithmetic mean, median, quartiles, mode & their applications.

Unit 4 **(4 Hours)**

Measures of dispersion- meaning, objectives, characteristics of a good measure of dispersion, types – range, quartile deviation, mean deviation, standard deviation, coefficient of variation & their applications.

Unit 5 **(4 Hours)**

Correlation analysis- meaning importance, types- positive, negative & linear correlation, methods- scatter diagram, Karl Pearson's coefficient of correlation (for ungrouped data), linear regression analysis- meaning utility, regression lines & regression coefficients (for ungrouped data).

Course Learning Outcomes (CLOs):

On completion of the course the students will be

CO-1: Understanding the basic concepts, uses & applications of statistics in agriculture.

CO-2: Applying & analyzing the concepts of diagrammatic & graphical representation of data. CO-3: Understanding, applying &analyzi

Text Books:

Hand Book of Agricultural Statistics, Shri Ram Singh Chandel,Achal Prakashan Ma

Reference Books: Agricultural Statistics. R. Singh, A.K.Sharma and S.P. Singh. Aman Publication.
Agricultural Mathematics and Statistics. R. Singh. Rama Publication
An Introduction to Statistical Methods. C. B. Gupta. Vikas Publication

Course Code: ATUG-309 **Course Name:** Livestock & Poultry Management
Course Credit Hour: 4Hr **Total Contact Hour:** 40 hr

Course Objective:

The course aims to provide the fundamental knowledge of livestock & Poultry management. It enables to know the students regarding the importance of Livestock & Poultry and also it is one of the alternative for entrepreneurship.

Course Description:

This course introduces the fundamental concepts of livestock & Poultry management like exotic and indigenous breeds of cattle; sheep; goat & birds. Selection of desired breeds to raise them in particular area and practical use of sustainable agriculture.

Course Content

Unit: 1. **(8 Hours)**

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry

Unit 2 **(8 Hours)**

Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers

Unit 3. **(8 Hours)**

Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry

Unit 4 **(8 Hours)**

Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.

Unit 5 **(8 Hours)**

Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Course Learning Outcomes (CLOs):

CLO-1: Develop vocabulary building and basic grammar concepts. CLO-2: Inculcate speaking skills and listening skills.

CLO-3: Develop the writing skills.

CLO-4: Understand technical writing skills.

CLO-5: Demonstrate all skills in presentation and interviews

1. Handbook of Agriculture: Indian Council of Agricultural Research, New Delhi.6th edition.

Reference books:

1. Fundamentals of Agriculture-Arun Katyayan- Kushal Publication
2. Agriculture and Live-stock in India, Indian Council of Agricultural Research.
3. Mineral Nutrition of Livestock, CABI By N. F. Suttle Manager of Publications [Government of India], 1939

B.Sc. (Hons.) Agriculture
IV SEMESTER

S.NO	Course Code	Subject	Sessional Exam			Evaluation Scheme				Credit
						External Exam	PRACTICAL		Subject Total	
			CA	TA	Total		INTERNAL	EXTERNAL		
1	ATUG-401 **(T&P)**	Crop Production Technology –II (Rabi Crops)	20	20	40	60	25	25	150	2(1+1)
2	ATUG-402 **(T&P)**	Production technology for ornamental palnts	20	20	40	60	25	25	150	2(1+1)
3	ATUG-403 (T&P)	Renewable Energy and Green Technology	20	20	40	60	25	25	150	2(1+1)
4	ATUG-404 (T)	Problematic Soils and their Management	20	20	40	60			100	2(2+0)
5	ATUG-405 (T&P)	Production technology for Fruit and plantation crop	20	20	40	60	25	25	150	2(1+1)
6	ATUG-406 (T&P)	Principles of seed technology	20	20	40	60	25	25	150	2(1+1)
7	ATUG-407 (T)	Farming system and sustainable agriculture	20	20	40	60	-	-	100	1(1+0)
8	ATUG-408 (T&P)	Agriculture marketing trade and prices	20	20	40	60	25	25	150	3(2+1)
9	ATUG-409 (T&P)	Introductory Agro-meteorology & climate change	20	20	40	60	25	25	150	2(1+1)
10	ATUG-410 A	Elective Course BIOPESTICIDES & BIOFERTILIZERS	20	20	40	60	25	25	150	3(2+1)
	ATUG-410 B	Protected Cultivation								
	ATUG-410 C	Micro Propagation Technologies **Student has to Select any one Elective course among three**								
	(T+P) : THEORY + PRACTICAL & (T): THEORY ONLY									

Course Code : ATUG- 401 **Course Name :** Crop production tech-II(rabi crop)
Course Credit Hour : 3hr **Total Contact Hour : 60** hr

Course Objective :

- To know the Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi crops
- Identify weeds in rabi season crops
- To understand the yield attributing characters of kharif crops an d Estimate yield of Rabi crops.

Course Description :

- To know the crops with relation to growing environment and develop competency in field crop production by knowing scientific technology

Course Contents :

Unit-1 Importance, origin, distribution, climate, varieties improved, agronomic practices managing and irrigation, plant protection, harvesting and processing of the following crops under various agro climatic conditions of U.P. Cereal crops- Wheat, Barley
Unit-2 Oilseed Crop- Rapeseed and mustrad Linseed, Sunflower
Unit-3 Pulse Crops- Chickpea,Field pea, Lentil.
Unit-4 Medicinal and aromatic crops- Lemon grass, Mentha, Citronella
Unit-5 Sugar Crop-Sugarcane
Unit-6 Forage Crops-Berseem Lucerne, Oat

Course Learning Outcomes(CLOs) :

CLO-1 : Understand the cropping system.
CLO-2: Understand the concept of agro-forestry.
CLO-3: Understand the concept of integrated farming.
CLO-4: Identify growing media.
CLO-5: Identify various type of fertilizers.
CLO-6: Identify various type of pesticides

Text books :

Rajendra Prasad. Textbook of Field Crops Production
Singh, Chhidda; Singh P. and Singh, R. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.

Reference books :

Field crops production-Food grain crops Volume I Dr. Rajendra Prasad
Field crops production-Commercial crops Volume II Dr. Rajendra Prasad

Online links for study & reference materials :

Course Code: ATUG-402 **Course Name:** Production technology for ornamental crops, MAP and lanscaping

Course Credit Hour: 1 Hr **Total Contact Hour:** 10 hours

Course Objective:

The objective of this course is to make students to understand about importance of ornamental, medicinal and aromatic plants. Students will learn about the production technology, packaging and processing of these plants.

Course Description:

This course will teach students the practical hands on training to grow different plant species that have medicinal, ornamental, aromatic, value. They will learn about the scientific cultivation methods that can be used for the commercial production of these plants.

Course Contents:

Unit-1 **(3 hours)**

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers.

Unit-2 **(3**hours)

Production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions.

Unit-3 **(4 hours)**

Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

Course Learning Outcomes (CLOs):

On completion of the course the students will be

CO-1: To understand the importance and scope of Ornamental Crops, MAPs and Landscaping.
CO-2: To learn about production technology of cut flower, loose flower, medicinal and aromatic plants.
CO-3: To learn the uses of tree, shrub, climbers, potted plants in landscaping, processing and value addition in ornamental plants and MAPs produce.

Text Books:

P. Muthukumar and R. Selvakumar. Glaustas Horticulture. New Vishal Publication.

Reference Books:

S. N. Gupta (2010). Instant Horticulture. Jain Brothers. ISBN 978-8183601153.

Course Code: ATUG 403 **Course Name:** Renewable Energy & Green Technology

Course Credit Hour: 3hr **Total Contact Hour:** 32hr

Course Objectives:

- To impart the knowledge about green technology, renewable energy sources, and their utilization in Agriculture

Course Description:

- This course provides a stair-step introduction of energy sources, biogas plants and Gasifiers, biogas, bio alcohol, biodiesel and bio oil production and their utilization as bio energy resource, Introduction of solar energy, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application.

Course Contents:

Unit-I **(12 Hours)**

Classification of energy sources, Familiarization with biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and Gasifiers, biogas, bio alcohol, biodiesel and bio oil production and their utilization as bio energy resource

Unit-II **(12 Hours)**

Introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application

Unit-III **(8 Hours)**

Introduction of wind energy and their application, Availability of bio mass and their application in different places

Course Learning Outcomes (CLOs):

CLO-1: Understand the basic concepts of the renewable energy resources and familiarization of biomass its application practically.

CLO-2: Acquaint with the biogas, biodiesel and bio-oil production

CLO-3: Understanding of solar energy gadgets and their utilization

Text books:

Green Technology: An A-to-Z Guide (The SAGE Reference Series on Green Society: Toward a Sustainable Future-Series Editor: Paul Robbins Book 10) 1st Edition, Kindle Edition: Dustin R. Mulvaney

Renewable Energy: Power for a Sustainable Future Book by Godfrey Boyle 3rd Edition.

Reference books:

Renewable Energy: Power for a Sustainable Future Book by Godfrey Boyle 3rd Edition.

Online links for study & reference materials:

https://learnengineering.in/renewable-energy-books/

Course Code : ATUG-404 **Course Name :** Problematic soils and their management
Course Credit Hour : 2hr **Total Contact Hour :** 40hr

Course Objective :

- To introduce students to problematic soils, identify processes resulting in deterioration of soil physical and chemical properties.
- To identify the problem of soil and different reclamation methods require to improve the soil health.

Course Description :

The aim of this course is to introduce the students to the factors that are affecting soil quality and its health. Students will be introduced various reasons that are causing deterioration of soil health and methods to manage damaged soil. Students will understand the quality standards for use of irrigation water in agricultural fields. Role of remote sensing and GIS in diagnosis of soil problem will be explained. This course will help to apply scientific knowledge to solve various soil problems.

Course Contents :

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils. Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils.Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro- ecosystems.

Course Learning Outcomes(CLOs) :

CLO-1 : Students will learn about the identification of problem soil and associated problems.
CLO-2 : To learn different methods to improve soil fertility, that necessary to improve the yield.
CLO-3 : Students could explain the role of multipurpose trees in bioremediation.

Text books :

R. R. Agarwal, J. S. P. Yadav and R. N. Gupta (1982). Saline Alkali soils of India, ICAR, New Delhi.

D. K. Das (2019). Problematic soils and their management. Kalyani Publishers, ISBN : 9789353592769.

Reference books :

L. L. Somani (2019). Textbook of Problematic Soils and their Management, ATPA, ISBN: 9788183214995

Course Code : ATUG-405 **Course Name :**Production Technology for Fruit and Plantation Crops

Course Credit Hour :2h **Total Contact Hour : 30** hr

Course Objective :

- To provide technical and scientific cultivation practices of different fruit and plantation crops.
- To provide field knowledge and acquaint the students with practical field
- To provide technical and scientific cultivation practices of different fruit and plantation crops.

Course Description :

- To teach about basic concepts and fundamental aspects of production technology of fruits and plantation crops
- To impart skills to design nursery lay out, orchard establishment, vegetative propagation techniques, care and maintenance of important fruits and plantation crops

Course Contents :

Unit- 1 Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks

Unit-2 Production technologies for the cultivation of major fruits-mango, banana, citrus,
grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond

Unit-3 Minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry, Unit- 4 plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Course Learning Outcomes(CLOs) :

CLO-1 :To know importance of different fruit crops and plantation crop

CLO-2 :To Understand the scientific cultivation methods of different fruit crops likemango,banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond

CLO-3 :ToUnderstand the scientific cultivation methods ofMinor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry

CLO-4 :To Understand the scientific cultivation methodsof plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Text books :

1. Amar Singh. Fruit Physiology and Production
2. R.S. Singh. Diseases of Fruit Crops
3. K.L. Chadha. Handbook of Horticulture

Reference books :

1. Chattopadhya, P. K. Year.Text Book on Pomology (Fundamentals of Fruit Growing). Kalyani Publishers, Ludhiana.

2. Bijendra Singh. 2012. Horticulture at a Glance. Kalyani Publishers, Ludhiana

3. Parthasarathy, V. A., P.K.Chattopadhyay and Bose, T.K. 2006. Plantation Crops. Vol I and II. Parthasankarbasu Naya Udyog, Kolkata.

Course Code: ATUG 406 **Course Name: Principles of seed Technology**
Course Credit Hour: 4hr **Total Contact Hour:** 40hr

Course Objectives:

- To strengthen undergraduate student in the field of seed science & technology by learning Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables.
- To initiate basic research related to genetic purity, seed health and seed storage, Deterioration Seed Act and Seed Act enforcement, Seed certification and Private and public sectors and their production and marketing strategies.

Course Description:

- This course is designed to provide upper level undergraduate and beginning graduate students with a basic knowledge of seeds and their role in agriculture. Principles followed during seed production, conditioning, testing, and marketing. The seed laws, regulations, and organizations relating to seed distribution and uses

Course Contents:

Unit-I **(10 Hours)**

Seed and seed technology: introduction, definition and importance, Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables.

Unit-II **(12 Hours)**

Seed certification, phases of certification, procedure for seed certification, field inspection, Seed Act and Seed Act enforcement, Duty and powers of seed inspector, offences and penalties, Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test, Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production

Unit-III **(10 Hours)**

Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing, Seed storage; general principles, stages and factors affecting seed longevity during storage, Measures for pest and disease control during storage.

Unit-IV **(8 Hours)**

Seed marketing: structure and organization, sales generation activities, promotional media, Factors affecting seed marketing, Role of WTO and OECD in seed marketing, Private and public sectors and their production and marketing strategies.

Course Learning Outcomes (CLOs):

CLO-1: Develop an understanding of seed development, germination, vigour, deterioration and the relationship between laboratory tests and field performance.

CLO-2: Acquaint the students with the principles of seed production for agronomic and horticultural crops within and outside of the region of adaptation and the techniques used in seed conditioning.

CLO-3: Understand seed increase systems, seed testing and the laws and regulations related to marketing high quality seed.

CLO-4: Know about the hybrid seed production and seed certification with production and marketing strategies.

Text books:

Seed technology-R.L. Agarwal

Principles of seed technology- G.M. Kulkarini

Reference books:

Principles of seed science & technology-L.O. Copeland & M. B. Kc Donald

Structure development & reproduction in Angiosperms- V. Singh, P. C. Pande & D. K. Jain

Course Code : ATUG-407 **Course Name :** Farming system and sustainable agriculture

Course Credit Hour : 1hr **Total Contact Hour :** 40hr

Course Objective :

To acquaint the students from agricultural as well as other disciplines with conventional and alternative agricultural production practices throughout the world and their effect on long-term sustainability and environmental quality.

To show how agricultural scientists are attempting to minimize agricultural pollution and sustain food production adequate for the world's population.

Course Description :

This course is designed as an introduction to the concepts, types and principles associated with farming systems and sustainable agriculture. Cropping systems, problems and impacts of sustainable agriculture will be discussed with the students. The economic, environmental and social aspects of sustainability in agroecosystems will be addressed. This course includes case studies and field trips to connect principles of sustainable agriculture to local farming systems. The students' interests and goals in sustainable agriculture will also be explored.

Course Contents :

Unit 1:

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance,

Unit 2:

Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system;

Unit 3: Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques,

Unit 4:

Resource cycling and flow of energy in different farming system, farming system and environment, Visit of IFS model in

different agro-climatic zones of nearby states University/ institutes and farmers field.

Course Learning Outcomes(CLOs) :

CLO-1 : The student will be able to explain the major aspects of agricultural practices and traditions through time.

CLO-2 : The student wil be able to explain in general the relationships among culture, economics, politics, science, and agricultural development.

CLO-3 : Students will gain an understanding of the current social, economic and technical challenges and opportunities in sustainable food production.

Text books :

R. K. Nanwal (2019). Farming Systems And Sustainable Agriculture, New India Publishing Agency- Nipa, ISBN: 9789389130089.

A. Zaman (2019). Integrated Farming Systems and Agricultural Sustainability, New India Publishing Agency- Nipa, ISBN: 9789387973725.

Reference books :

S. C. Panda (2016). Cropping System And Sustainable Agriculture, Agrobios, ISBN: 9788177545647, 9788177545647.

Online links for study & reference materials :

https://www.coabnau.in/uploads/1609844393_Agron.5.6.pdf

Course Code : ATUG-408 **Course Name :** Agriculture marketing trade and prices

Course Credit Hour : 3hr **Total Contact Hour :** hr

Course Objective :

- The objective of this course is to provide students with a theoretical and empirical basis for valuating agricultural marketing organization and actors for market performance and public policy decision, and to enable them develop and use the tools of economic theory to analyze issues related to the marketing of agricultural commodities..

Course Description :

- Maximize your business and improve your marketing with this course. Explore innovative and different approaches to improve sales and profit for any agricultural enterprise, on or off farm.

Course Contents :

- Unit-1 Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation,
- Unit-2 Classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions.
- Unit-3 Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark);
- Unit-4 Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India;
- Unit-5 -Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Course Learning Outcomes(CLOs) :

CLO-1 : To understand about agricultural marketing, market structure.

CLO-2 : To understand about Classification and characteristics of agricultural markets, producer's surplus, product life cycle.

CLO-3 : To gain knowledge about Design strategies for effective market performance.

CLO-4 : To Understand the Use of marketing concepts for analyzing market structure and performance in agriculture and formulate effective agricultural marketing policy.

CLO-5: To understand about the Risk in marketing and Agricultural prices and policy.

Text books :

ES. S. Acharya, Agricultural Marketing In India,Oxford and IBH Publishing, 2004

Reference books :

F. Bailey Norwood and Jayson L. Lusk, Agricultural Marketing and Price Analysis,20018
G.

Course Code: ATUG-409 **Course Name:** Introductory Agro-meteorology & climate change

Course Credit Hour: 2 hr **Total Contact Hour:** 30hr

Course Objective:

- To study about different climatic factors affecting crop growth and development
- Study about different weather aberrations
- Study about climate change, it's cause and impacts

Course Description :

- Write a brief summary indicating how this will be conducted specifying the key topics of the whole course.
- Write about 4 to 5 lines or till 7 lines, if some course description demands.

Course Contents:

UNIT-1 Earth atmosphere its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze.

UNIT-2 solar radiation Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature.

UNIT-3 Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture,

UNIT-4 Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat- wave and cold-wave

UNIT-5 Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

Course Learning Outcomes (CLOs):

CLO-1: To Introduce agro meteorology (definitions, aims, scope and importance)

CLO-2: To Understand roles of agro meteorology in agriculture and its relation to other areas of agriculture.

CLO-3: To acquaint with recent developments in agrometeorology with historical developments.

CLO-4: Studies the characteristics, behavior or phenomenon of the atmosphere CLO-5: Studies the changes of individual weather elements. (such as temperature)

Text books:

Introductory Agro-meteorology & climate change **by B.S Chouhan**

Reference books:

- Fundamentals of Agrometeorology Mahi, G.S. and Kingra, P.K. 2015 Publisher: Kalyani Publishers, New Delhi
- Agrometeorology Reddy, S. R. and Reddy, D.S. 2014 Publisher: Kalyani Publishers New Delhi
- Comprehensive Agrometeorology Mahi, G.S. and Kingra, P.K.
- Introduction to Agriculture and Agrometeorology Reddy, S. R. 2014 Publisher: Kalyani Publishers New Delhi

Online links for study & reference materials :

Web sites: http://www.agrimoon.com/ http://www.agriinfo.in/ eagri.org
http://www.agriglance.com/ http://agritech.tnau.ac.in/

Course Code : ATUG-410 A **Course Name : Biopesticides & Biofertilizer**

Course Credit Hour : 3hr **Total Contact Hour :** 40 hrs

Course Objective :

Understanding the basics of bio-pesticide and bio-fertilizers. Explaining the application of mass production technology of bio-pesticide

Course Description :

Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.

Course Contents :

Unit 1 **(4 Hours)**

History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses.

Unit 2 **(4 Hours)**

Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticide.

Unit 3 **(4 Hours)**

Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorhiza.

Unit 4 **(4 Hours)**

Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation,

Unit 5 **(4 Hours)**

Mass production of carrier based and liquid biofertiizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

Course Outcomes (COs).

CO – 1: Understanding the basics of bio-pesticide and bio-fertilizers
CO – 2: Explaining the application of mass production technology of bio-pesticide
CO – 3: Describing the quality control and marketing of bio-fertilizers

Text Books:

1. Integrated Pest Management. G.S.Dhaliwal and Ramesh Arora. Kalyani **3.** Elements of Entomology: Rajendra Singh. Rastogi Publications

Reference books:

1. **The complete technology book on Bio-fertilizer and organic farming**,NIIR Board of National Institute of Industrial Technology
2. 2 . Principles of Agronomy - S. R. Reddy. Kalyani Publisher.
3. 3.Principles of Agronomy - S. R. Reddy. Kalyani Publisher.

4 .Manures and Fertilizers - K. S. Yawalkar, J.P. Agrawal and S. BokdeAgri- Horticultural Pub. House

Course Code : ATUG-410 B **Course Name : Protected Cultivation**

Course Credit Hour : 3hr **Total Contact Hour :** 40 hrs

Course Objective :

The main objectives of protected cultivation are to protect the crops from harmful temperatures, wind, rain, hail and snow, and from pests, diseases and predators, creating a microclimate that allows for the improvement of their productivity and quality contributing to a better use of resources

Course Description :

Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.

Course Contents

Unit 1 **(4 Hours**

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material involved in greenhouse/ poly house.

Unit 2 **(4 Hours)**

Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers.

Unit 3 **(4 Hours)**

Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops.

Unit 4 **(4 Hours)**

Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc.

Unit 5 **(4 Hours)**

Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

Course Outcomes (COs).

On completion of the course the students will be

CO-1:	Understanding importance and scope of protected cultivation.
Understanding greenhouse technology and its application in cultivation of important horticultural crops Analyzing the propagation and production of quality planting material of horticultural crops.	

Text Books

1. Greenhouse Technology and Management, Nicolas Castilla, CABI,

Reference Books

1.Postharvest Management and Value Addition,Ashwai K.Goel, Rajinder Kumar, Satwinder S. Mann Daya Books,

2.Postharvest Technology of Fruits and Vegetables: General concepts and principles L. R. Verma, Dr. V. K. JoshiIndus Publishing Company.

3. Greenhouse Technology and Management, Nicolas Castilla, CABI

Course Code: ATUG-410 C **Course Name: Micro propagation Technologies**
Course Credit Hour: 3hr
Total Contact Hour: 30 hrs

Course Objective :
Understanding the basics of Micro propagation Technologies. Explaining the application of this techology

Course Description :
Stages of micropropagation, Axillary bud proliferation. Somaclonal variation, Cryopreservation

Course Outcomes (COs).
On completion of the course the students will be

CO–1 Understanding the concepts and principles of micropropagation
CO–2 Recognizing the different pathways of plant regeneration under in vitro conditions
CO–3 Applying various micro propagation methods to conserve germplasm and vitro, production of secondary metabolites.

Course Contents :

Unit 1: **(4 Hours)**
Introduction, History, Advantages and limitations; Types of cultures (seed, embryo, organ, callus, cell)
Unit 2: **(4 Hours)**
Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture)

Unit: 3 **(4 Hours)**
Organogenesis (callus and direct organ formation)
Unit:4 **(4 Hours)**
Somatic embryogenesis, cell suspension cultures
Unit:5 **(4 Hours)**
Production of secondary metabolites , Somaclonal variation, Cryopreservation

Text Books:

1. BasicHorticulture-Jitendra Singh. Kalyani Publisher

Reference Books:

1. Basics of Horticulture by K.V. Peter. New India Publishing Agency, New Delhi

2. Principles of Horticulture by C.R. Adams, M.P. Early. Routledge

3. Terminology of Horticulture by Neeraj Pratap Singh.International Book Distributing Co (IBDC Publishers)

B.Sc. (Hons.) Agriculture
V-SEMESTER

S.NO	Course Code	Subject name	Sessional Exam			Evaluation Scheme				Credit
						External Exam	PRACTICAL		Subject Total	
			CA	TA	Total		INTERNAL	EXTERNAL		
1	ATUG-501	Principles of Integrated Pest and Disease Management	20	20	40	60	25	25	150	3(2+1)
2	ATUG-502	Manures, Fertilizers and Soil Fertility Management	20	20	40	60	25	25	150	3(2+1)
3	ATUG-503	Pests of Crops and Stored Grain and their Management	20	20	40	60	25	25	150	3(2+1)
4	ATUG-504	Diseases of Field and Horticultural Crops and their Management -I	20	20	40	60	25	25	150	2(1+1)
5	ATUG-505	Crop Improvement-I *(Kharif Crops)*	20	20	40	60	25	25	150	2 (1+1)
	ATUG-508	Practical Crop Production – I (*Kharif* crops)	20	20	40	60	25	25	150	2(0+2)
9	ATUG-509	Intellectual Property Rights	20	20	40	60				1(1+0)
10	ATUG-510 A	Commercial plant breeding	20	20	40	60	25	25	150	3(2+1)
	ATUG-510 B	Weed Mnagement								
	ATUG-510 C	Hi-tech. Horticulture **Student has to Select any one Elective course among three**								
10	**Total**									**19**

Course Code : ATUG-501 **Course Name :** Principles of Integrated Pest and Disease Management
Course Credit Hour : 3hr **Total Contact Hour :** 60hr

Course Objective :

- At the end of the semester students will be able to understand:
- What is a pest and categories of Pest?
- IPM and tools of IPM.
- Cultural, Mechanical, Physical, Biological, Microbial and Legislative methods of Pest and Disease Management.
- Chemical Control of Pests

Course Description :

- This subject can help to students to know about pest and damage, how to control pest and what are the methods were useful to prevent insect pest &disease. students can learn different types of symptoms were take place in plant parts. they can know about what is IPM and their use.

Course Contents :

UNIT-1
Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis.
UNIT-2
Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control.
Unit-3
Ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases.
Unit- 4
Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM.
Unit-5
Case histories of important IPM programmes. Case histories of important IPM programmes.

Course Learning Outcomes(CLOs) :

CLO-1 : Understand the meaning, concept, categories of pest and diseases
CLO2. Understand Principles of pest management, Components of IPM
CLO3**.** Learn the IPM integration tactics
CLO4. Develop an understanding on Agro-ecosystem analysis
CLO5. Discuss the Successful IPM case

Text books :

Integrated Pest Management: Principles and Practice by Dharam P. Abrol, Uma Shankar CABI
ISBN-13: 9781786390318

Integrated Pest Management: Current Concepts and Ecological Perspective by Dharam P Abrol ISBN-13: 978-0123985293

Reference books :

Singh, R.S. 2002. Introduction to Principles of Plant Pathology. Oxford & IBH Publishing Co.Pvt. Ltd.,New Delhi

Course Code: ATUG-502

Course Name: Manures, fertilizers and soil fertility management

Course Credit Hour: 3 **Total Contact Hour: 40 hr**

Course Objective:

- **To know about different manures, fertilizers.**
- **To manage the soil quality**
- **To improve soil health**
- **The relationship between soil fertility and plant health**
- **Goals of a sustainable fertility/soil management program**

Course Description:

Manures, fertilizers and soil fertility management Review Course is designed to provide an overview of the fundamental manure and fertilizers. Genesis, Classification and importance of organic manure show the importance of organic farming. Instructors will use the Fundamentals Performance Objectives (POs) as a guide for discussing topics within each section, but will not go through each objective individually. However, students are encouraged to ask questions regarding specific POs if needed.

Course Contents:

UNIT-1 Classification and importance of organic manures, properties and methods of preparation of bulky manures. Green/leaf manuring. ii. Transformation reactions of organic manures in soil and importance of C:N ratio in rate of decomposition. iii. Integrated nutrient management

UNIT-2 Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano-fertilizers, Soil amendments, v. Fertilizer Storage, Fertilizer Control Order. History of soil fertility and plant nutrition, Criteria of essentiality. Role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Critical levels of different nutrients in soil. Forms of nutrients in soil

UNIT-3 Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients viii. Soil fertility evaluation, Soil testing, plant analysis, rapid plant tissue tests. Indicator plants. ix. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated condition.

Course Learning Outcomes (CLOs):

CLO-1: **The students get knowledge about different kind of manures, fertilizers**

CLO-2: **The students will learn how to maintain the soil health.**

CLO-3**The students acquire practical knowledge of nutrient analysis soil.**

Text books:

1. Fundamentals of Soil (1999) by V. N. Sahai
2. Introductory Soil Science (1999) by D. K. Das.

Reference books:

Reference Books

1. Manures and Fertilizes (1992), Seventh Edition by K. S. Yawalkar, J. P. Agarwal and S. Bokde

2. Soil Fertility, theory and practice (1976) by J. S. Kanwar
3. Soil Fertility and Fertilizers (1985) by S.L. Tisdale, W.L. Nelson and J. D. Beaton

Online links for study & reference materials:

- http://www.agriinfo.in/
- http://www.agrimoon.com/

Course Code: ATUG-503 **Course Name: Pests of Crops and Stored Grain and their Management**
Course Credit Hour: 4 Hr **Total Contact Hour:** 45 hours

Course Objective:

The overall objective of this course is to equip the students by the demage caused by different insects of Arthropod group. Major pest problems of stored grains their symptoms nature of demage and symptomology further management practices will also be learned by the students

Course Description:

The course focuses on the General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crop, vegetable crop, fruit crop and the factor affecting the losses

Course Contents:

Unit-1 **(10 hours)**

General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests

Unit-2 **(15 hours)**

scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crop, vegetable crop, fruit crop, plantation crops, ornamental crops, spices and condiments.

Unit-3 **(10 hours)**

Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

Unit-1 **(10 hours)**

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodentcontrol operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory,Department of Food., Delhi. Visit to nearest FCI godowns.

Course Learning Outcomes (CLOs):

On completion of the course the students will be

CO-1:	Understanding the classification of different arthropods pests and importance of beneficial insects..
CO-2:	Identifying the different insect pest of field and stored grains.
CO-3:	Applying various procedures and approaches for insect-pests management

Text Books:

1 Stored Grain Pests and Their Management, B.P. Khare. Kalyani Publisher.

Reference Books:

3. Pests of Stored grains and Their management. M.C. Bhargava, and K.C. Kumawat.
4. Agricultural Pests of South Asia and Their Management. G.S.Dhaliwal and Ramesh Arora. Kalyani Publisher
5. Integrated Pest Management. G.S.Dhaliwal and Ramesh Arora. Kalyani Publisher
6. Principles of Insect Morphology. R. E. Snodgrass. Cornell University Press

Course Code: ATUG-504 **Course Name: Diseases of Field & Horticultural Crops-I**

Course Credit Hour: 4 Hr **Total Contact Hour:** 40 hours

Course Objective:

The overall objective of this course is to provide an environment for students to develop critical thinking on identification of diseases of field crops by studying Symptomology; Epidemiology; survival structures and management of diseases of field and horticultural crops

Course Description:

The course focuses on the study of diseases of field crops & Horticultural crops with special reference to Symptomology; Epidemiology; survival structures and management of diseases of field and horticultural crops. Students are also able to learn the hindi name of the diseases so that they can interact with the farmers and give remedies for their problems of crops

Course Contents:

Unit-1 **(10 hours)**

Symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro;Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra :downy mildew and ergot; Groundnut: early and late leaf spots, wilt Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic;

Unit-2 **(10 hours)**

Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight;Tobacco: black shank, black root rot and mosaic.

Unit 3 **(10 hours)**

Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top;Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight;

Unit-4 **(10 hours)**

Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust Practical Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium; Note: Students should submit 50 pressed and wellmounted specimens

Course Learning Outcomes (CLOs):

On completion of the course the students will be

CO-1:	To understand the symptomology; etiology; of diseases of field crops.
CO-2:	To understand the symptomology; etiology; of diseases of Horticultural crops.
CO-3:	The students do understand the management of diseases of field & Horticultural crops

Text Books:

1. R. S. Singh (2010). Plant Disease oxford & IBH Publications.

Reference Books:

7. G.N. Agrios (2006). Plant Pathology, Academic Press.

Course Code: ATUG 505 **Course Name:** Crop Improvement II (Rabi Crop)
Course Credit Hour: 3hr **Total Contact Hour:** 30hr

Course Objectives:

➢ This subject aims to know about techniques, which is used to improve crop and study about hybrids and varieties for yield & how to improve it To know about the Major breeding objectives and procedures and improvement strategies of rabi crops.

Course Description:

➢ This course is designed to provide upper level undergraduate and students with a basic knowledge of crop improvement in agriculture.

Course Contents:

Unit-I **(6 Hours)**

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops;

Unit-II **(4 Hours)**

Plant genetic resources, its utilization and conservation,

Unit-III **(12 Hours)**

study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)

Unit-IV **(8 Hours)**

Hybrid seed production technology of Rabi crops. Ideotype concept and climate resilient crop varieties for future

Course Learning Outcomes (CLOs):

CLO-1: Develop an understanding of Centres of origin and crop diversity in crop.

CLO-2: Understand seed increase systems, seed production in major field crops of rabi season.

CLO-3: This subject is very helpful to know about different techniques like emasculation and hybridization techniques in different crops

CLO-4: Know about Ideotype breeding for future utilization in agriculture

.

Text books:

Crop Breeding and Biotechnology : By HariHar Ram: Kalyani Publication New Delhi

Reference books:

Breeding of Asian Field crops: By D. A. Sleper J.M. Poehlman: Blackwell Publishers

Course Code : ATUG- 508 **Course Name:**Practical Crop Production-I (Kharif Crops)

Course Credit Hour : 2hr **Total Contact Hour : 32** hr

Course Objective :

- To know the Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops
- Identify weeds in Kharif season crops
- To understand the yield attributing characters of kharif crops an d Estimate yield of crops.

Course Description :

- To know the crops with relation to growing environment and develop competency in field crop production by knowing scientific technology

Course Contents :

Practical Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

Course Learning Outcomes(CLOs) :

CLO-1 : Understand the cropping system.

CLO-2: Understand the concept of agro-forestry.

CLO-3: Understand the concept of integrated farming.

CLO-4: Identify growing media.

CLO-5: Identify various type of fertilizers.

CLO-6: Identify various type of pesticides

Text books :
Rajendra Prasad. Textbook of Field Crops Production
Singh, Chhidda; Singh P. and Singh, R. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.

Reference books :
Field crops production-Food grain crops Volume I Dr. Rajendra Prasad
Field crops production-Commercial crops Volume II Dr. Rajendra Prasad

Online links for study & reference materials :

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: ATUG- 509
Course Name : Intellectual Property Rights
Course Credit Hour: 1hours
Total Contact Hour : 16 h

Course Objective :

- This course is aimed at familiarizing researchers with the nuances of Intellectual
- Property Rights (IPR) so as to help them integrate the IPR process in their research activities.
- IPR internalisation process to help the researchers to set targeted objectives in their research project and also to design and implement their research to clearly differentiate their work vis-a-vis the existing state of knowledge/ prior art.
- To give the Students "hands- on –training" in literature, including patent search
- and documentation of research activities that would aid an IPR expert to draft, apply
- and prosecute IPR applications.
- Research, development and commercialization.
- Facilitate the students to explore career options in IPR.

Course Description :

- This course deals with overall provides a thorough grounding in the field of intellectual property law, including areas such as copyrights, trademarks, patents, trade secrets, the programme also covers emerging issues such as the ownership and licensing of new media content, internet streaming, technology and software, and pharmaceutical patenting and commercialization.

Course Contents :

Theory Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc. Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, 108 109 Report of the ICAR Fifth Deans' Committee Report of the ICAR Fifth Deans' Committee Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database. Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders. Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

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Course Learning Outcomes(CLOs) :

CLO-1 :. This course will introduce the concept of intellectual property and explain how it creates value..

CLO-2: You will learn about the major forms of intellectual property protection - copyright, trademarks, and patents, as well as alternative forms of intellectual property protection .

CLO-3: You will examines the effect of intellectual property law on the modern economy, and the policy reasons behind providing intellectual property protection. .

CLO-4: You will examines alternative forms of intellectual property protection, and explores the benefits and drawbacks of those alternatives.

Text books :

1.Ganguli Prabuddha Gearing up for Patents…..The Indian Scenario", Universities Press (1998)

2. Ganguli Prabuddha "Intellectual Property Rights--Unleashing the Knowledge Economy", Tata McGrawHill (2001)

3. Ganguli Prabuddha "Geographical Indications--its evolving contours" accessible in http://iips.nmims.edu/files/2012/05/main_book.pdf (2009)

Reference books :

Fundamentals of patent law: interpretation and scope of protection. By Matthew Fisher. Hart, 2007. (KD1369 .F57x 2007, Library 4 West)

· A Guide for the preparation of patent drawings. USPTO, 2002. (C21.14/2:D79/2, Library 3 East)

· A guide to filing a design patent application. USPTO, 2009. (C 21.14/2:D 46/2009, Library 3 East)

· A guide to filing a utility patent application. USPTO, 2008. (C 21.14/2:UT 4/2008, Library 3 East)

· A Guide to the international registration of marks under the Madrid Agreement and the Madrid Protocol. WIPO, 2004. (K1557 .G85x 2004, Reference, Library 2 East)

Online links for study & reference materials :

https://www.rvskvv.net/images/INTELLECTUAL-PROPERTY-RIGHTS_20.04.2020.pdf

Course Code: ATUG 510 A **Course Name:** Commercial Plant Breeding

Course Credit Hour: 4hr **Total Contact Hour:** 40hr

Course Objectives:

- This subject aims to know about the advances in hybrid seed production of major field crops IPR issue in commercial plant breeding, DUS testing Genetic and Agronomic principles of quality seed production and its characteristics.

Course Description:

- This course examines the Classifications of crops, Hybrid varieties & features, Development of hybrid varieties, Principles of quality seed production of Field and vegetables crops, DUS testing, Variety testing, release and notification major steps in India.

Course Contents:

Unit-I **(10 Hours)**

Types of crops and modes of plant reproduction: Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production, Genetic purity test of commercial hybrids.

Unit-II **(12 Hours)**

Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc, Quality seed production of vegetable crops under open and protected environment.

Unit-III **(8 Hours)**

Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools.

Unit-IV **(10 Hours)**

IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops

Course Learning Outcomes (CLOs):

CLO-1: Learn classification of crops

CLO-2: Understand exploitation of male sterility utilization in hybrid seed production

CLO-3: Know about advances in hybrid seed production of field and vegetable crops

CLO-4: Study about the fundamentals of IPR, DUS testing Patenting, Plant Breeders and & Farmer's Rights

Text books:

Hybrid Seed Production in Field Crops: Principles and Practices by N. C. Singhal, 2003, Kalyani publication, Delhi Principles of Seed Technology by P.K. Agrawal, 2002, Oxford
Seed Production of Vegetables. By Prabhakar Singh and B. S. Asati

Reference books:

Principles of Plant Breeding - R.W. Allard

Course Code: ATUG-510 B **Course Name: Weed Management**

Course Credit Hour: 2hr **Total Contact Hour:** 20 hrs

Course Objective :

Identification of weeds and to know the hindi names of weeds. Management of weeds in major field crops

Course Description :

Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Integration of herbicides with non chemical methods of weed management

The Course Outcomes (Cos).

On completion of the course the students will be

CO – 1	Understanding the principles of weed management
CO – 2	Applying different tools and techniques for weed management.

Course Contents :

Unit 1 **(4 Hours)**

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds.

Unit 2 **(4 Hours)**

Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity.

Unit 3 **(4 Hours)**

Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture.

Unit 4 **(4 Hours)**

Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application.

Unit 5 **(4 Hours)**

Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management.

Text books:

1. Handbook of Agriculture: Indian Council of Agricultural Research, New Delhi

Reference books:

1.Principles of Agronomy - S. R. Reddy. Kalyani Publisher

2.Manures and Fertilizers -K. S.Yawalkar, J.P. Agrawal and S. Bokde Agri-Horticultural Pub. House
3.Fundamentals of Agronomy Gopal Chandra De. Oxford and IBH Publishing Co. PVT. LTD.

Course Code: ATUG-510 C **Course Name: Hi-tech. Horticulture**

Course Credit Hour: 2hr **Total Contact Hour:** 20 hrs

Course Objective :

Importance of Hi-tech. Horticulture in Modern Agriculture and its application in new world of Agriculture.

Course Description :

Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation. High density orcharding, Components of precision farming: Remote sensing, Geographical Information System (GIS),

Course Outcomes (COs).

On completion of the course the students will be

CO – 1 Understanding the importance of Hi-tech Horticulture and protected cultivation.

CO – 2 Describing the Differential Geo-positioning System (DGPS). .

– 3 Applying the high density orcharding, precision farming and micro propagation in horticultural crops

Course Content

Unit 1 **(4 Hours)**

Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods,

Unit 2 **(4 Hours)**

Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management,

Unit 3 **(4 Hours)**

High density orcharding, Components of precision farming: Remote sensing, Geographical Information System (GIS),

Unit 4 **(4 Hours)**

Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA),

Unit 5 **(4 Hours)**

Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

Text Books:

1. BasicHorticulture-Jitendra Singh. Kalyani Publisher

Reference Books:

1. Basics of Horticulture by K.V. Peter. New India Publishing Agency, New Delhi
2. Principles of Horticulture by C.R. Adams, M.P. Early. Routledge
3. Terminology of Horticulture by Neeraj Pratap Singh.International Book Distributing Co (IBDC Publishers)

B.Sc. (Hons.) Agriculture
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<table>
<tr><th rowspan="3">S.NO</th><th rowspan="3">Course Code</th><th rowspan="3">Subject</th><th colspan="3" rowspan="2">Sessional Exam</th><th colspan="4">Evaluation Scheme</th><th rowspan="3">Credit</th></tr>
<tr><th rowspan="2">External Exam</th><th colspan="2">PRACTICAL</th><th rowspan="2">Subject Total</th></tr>
<tr><th>CA</th><th>TA</th><th>Total</th><th>INTERNAL</th><th>EXTERNAL</th></tr>
<tr><td>1</td><td>ATUG-601 (T+P)</td><td>Rainfed Agriculture & Watershed Management</td><td>20</td><td>20</td><td>40</td><td>60</td><td>25</td><td>25</td><td>150</td><td>2 (1+1)</td></tr>
<tr><td>2</td><td>ATUG-602 (T+P)</td><td>Protected Cultivation and Secondary Agriculture</td><td>20</td><td>20</td><td>40</td><td>60</td><td>25</td><td>25</td><td>150</td><td>2 (1+1)</td></tr>
<tr><td>3</td><td>ATUG-603 (T+P)</td><td>Diseases of Field and Horticultural Crops and their Management-II</td><td>20</td><td>20</td><td>40</td><td>60</td><td>25</td><td>25</td><td>150</td><td>3 (2+1)</td></tr>
<tr><td>4</td><td>ATUG-604 (T+P)</td><td>Post-harvest Management and Value Addition of Fruits and Vegetables</td><td>20</td><td>20</td><td>40</td><td>60</td><td>25</td><td>25</td><td>150</td><td>2 (1+1)</td></tr>
<tr><td>5</td><td>ATUG-605 (T+P)</td><td>Management of Beneficial Insects</td><td>20</td><td>20</td><td>40</td><td>60</td><td>25</td><td>25</td><td>150</td><td>2 (1+1)</td></tr>
<tr><td>6</td><td>ATUG-606 (T+P)</td><td>Crop Improvement-II (Rabi crops)</td><td>20</td><td>20</td><td>40</td><td>60</td><td>25</td><td>25</td><td>150</td><td>2 (1+1)</td></tr>
<tr><td>7</td><td>ATUG-607 (P)</td><td>Practical Crop Production –II (Rabi crops)</td><td></td><td></td><td></td><td></td><td>25</td><td>25</td><td>150</td><td>2 (0+2)</td></tr>
<tr><td>8</td><td>ATUG-608 (T+P)</td><td>Principles of Organic Farming</td><td>20</td><td>20</td><td>40</td><td>60</td><td>25</td><td>25</td><td>150</td><td>2 (1+1)</td></tr>
<tr><td rowspan="3">9</td><td>ATUG-609 A</td><td>Agro-Chemicals</td><td rowspan="3">20</td><td rowspan="3">20</td><td rowspan="3">40</td><td rowspan="3">60</td><td rowspan="3">25</td><td rowspan="3">25</td><td rowspan="3">150</td><td rowspan="3">3(2+1)</td></tr>
<tr><td>ATUG-609 B</td><td>LandScaping</td></tr>
<tr><td>ATUG-609 C</td><td>Agricultural Journalism
Student has to Select any one Elective course among three</td></tr>
<tr><td></td><td colspan="9">(T+P) : THEORY + PRACTICAL & (T): THEORY ONLY</td><td>20 (10+10)</td></tr>
</table>

Course Code: ATUG-601

Course Name: Rainfed Agriculture and Watershed Management

Course Credit Hour: 2 Total Contact Hour: 20 hr

Course Objective:

- Students learn basic knowledge of rain fed agriculture and water shed management.
- Study the crop adaptation and mitigation strategies, crop planning and crop management techniques.
- Main objective is to increase / stabilize production of crops, forage, fruits, fuel and timber in rainfed areas by introduction of improved soil and moisture conservation measures, better crop and range land management practices.

Course Description: History of rainfed agriculture & watershed in India Review Course is designed to provide an over. basic knowledge of rain fed agriculture and water shed management.Instructors will use the Fundamentals Performance Objectives (POs) as a guide for discussing topics within each section, but will not go through each objective individually. However, students are encouraged to ask questions regarding specific POs if needed.

Course Contents:

UNIT-1 Introduction, types, History of Rainfed Agriculture in India. Problems and prospects of Rainfed Agriculture in India. Soil and climatic conditions prevalent in rainfed areas. Soil erosion; water and wind, Soil and water conservation techniques. Types, effect of water deficit on physiomorphological characteristics of the plants

UNIT-2 Crop adaptation and mitigation to drought. Importance, its techniques, efficient utilization of water through soil and crop management practices. Management of crops in rainfed areas. Contingent crop planning for aberrant weather conditions. History of watershed in India, Concept, objective, principles and components and Factors affecting Watershed Management

Practical syllabus:

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different dry land areas in the country and demarcation of dry land area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices viz; mulching, plant density, depth of sowing, thinning and leaf removal for mitigating moisture stress. Characterisation and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

Course Learning Outcomes (CLOs):

CLO-1: Student can able to understand about rainfed agriculture and its introduction, problem and prospects in India.

CLO-2: Rain fed agriculture is used to describe farming practices that rely on rainfall for water.

CLO-3: Student can able to understand objective, principles and component of watershed management .

CLO-4: Conservation of soil by adopting latest soil conservation techniques will help in obtaining higher production of Rainfed crops.

Text books:

1. Handbook of Agriculture, ICAR, New Delhi
2. Suresh, 2016, Soil and Water Conservation Engineering, New Delhi

Reference books:

1. Principles of Agronomy by SR Reddy
2. Rainfed Agriculture and watershed Management by Rayees Ahmad Shah, 2017

Online links for study & reference materials:

- http://www.agriinfo.in/
- http://agriinfo.in/agronomy/42/

Course Code: ATUG 602 **Course Name:** Protected Cultivation and secondary Agriculture
Course Credit Hour: 3hr **Total Contact Hour:** 30hr

Course Objectives:

- This subject imparts knowledge to the students about green house technology Planning and design of greenhouses irrigation system Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation, Drying and dehydration and Material handling equipments.

Course Description:

- This course is designed to provide basic knowledge of engineering of green house technology designing and handling of various equipments used in agricultural sciences

Course Contents:

Unit-I **(10 Hours)**

Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes, Materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses,

Unit-II **(8 Hours)**

Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation

Unit-III **(8 Hours)**

Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, re-circulatory dryer and solar dryer)

Unit-IV **(4 Hours)**

Material handling equipment; conveyer and elevators, their principle, working and selection

Course Learning Outcomes (CLOs):

CLO-1: Develop an understanding about the green house technology.

CLO-2: Acquaint the students about important engineering properties of agricultural crops

CLO-3: Understand drying and dehydration techniques in different crops

CLO-4: Know about Material handling equipment and their working principles

.

Text books:

Green House Technology & Management by K. Radha Manohar (2000) C. Igathinathane B.S. Publications

Reference books:

Emerging Trends in PHT and Utilization of Plant Food by N Khetarpaul et al(2003) Agrotech Publishing Academy, Udaipur

Green House management by L R Taft (1997) Biotech Books, Delhi

Course Code: **ATUG-603** **Course Name: Diseases of Field & Horticultural Crops-II**

Course Credit Hour: 3 Hr **Total Contact Hour:** 40 hours

Course Objective:

The overall objective of this course is to provide an environment for students to develop critical thinking on identification of diseases of field crops by studying Symptomology; Epidemiology; survival structures and management of diseases of field and horticultural crops

Course Description:

The course focuses on the study of diseases of field crops & Horticultural crops with special reference to Symptomology; Epidemiology; survival structures and management of diseases of field and horticultural crops. Students are also able to learn the hindi name of the diseases so that they can interact with the farmers and give remedies for their problems of crops

Course Contents:

Unit-1 **(10 hours)**

Symptoms, etiology, disease cycle and management of following diseases: Field Crops: Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and Pokkah Boeng;

Unit-2 **(10 hours)**

Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and Ascochyta blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust

Unit 3 **(10 hours)**

Horticultural Crops: Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus:

canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl.

Unit-4 **(10 hours)**

Horticultural Crops: Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust Practical Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium; Note: Students should submit 50 pressed and wellmounted specimens. Strawberry: leaf spot Potato: early and late blight, black scurf, leaf roll, and mosaic;

Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

Course Learning Outcomes (CLOs):

On completion of the course the students will be

CO-1: To understand the symptomology; etiology; of diseases of field crops.
CO-2: To understand the symptomology; etiology; of diseases of Horticultural crops.
CO-3: The students do understand the management of diseases of field & Horticultural crops

<u>Text Books:</u>

1. R. S. Singh (2010). Plant Disease oxford & IBH Publications.

<u>Reference Books:</u>

8. G.N. Agrios (2006). Plant Pathology, Academic Press.

Course Code : ATUG- 604 **Course Name :** Post-harvest Management and Value Addition of Fruits and Vegetables

Course Credit Hour : 2hours **Total Contact Hour :** 32 h

Course Objective :

- The students are expected to gain knowledge on various management technologies on pre- harvest and post harvest of fruits and vegetables. Students are also expected to gain knowledge on conventional and modern packaging methods.

Course Description :

- This course deals with overall post harvest management of fruits and vegetables from farm to fork.

Course Contents :

Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and non-fermented beverages. Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning — Concepts and Standards, packaging of products.

Course Learning Outcomes(CLOs) :

CLO-1 : Students will acquire knowledge on post harvest management tools and novel paclkaging techniques.
CLO-2: Students learn the pre and post harvest factors affecting the vagetables and fruits.
CLO-3: To Study the value addition and methods of preservation.

CLO-4: To gain the knowledge of Drying, Dehydration, canning, of fruits and vegetables
CLO-5: Students learn the Concept and methods of canning process.

Text books :
Post-Harvest Management and Processing of Fruits and Vegetables by N S Rathore (Author), G K Mathur (Author), S S Chasta (Author)
Fruit And Vegetable Preservation Principles And Practices Revised And Enlarged 3Ed (Pb 2019) Paperback – 1 January 2019
by Srivastava (Author)

Reference books :
Postharvest Management and Value Addition
by Ashwani K. Goel (Author), Rajinder Kumar (Author), Satwinder S. Mann (Author)

Online links for study & reference materials :
https://agrimoon.com/post-harvest-management-value-addition-of-fruits-vegetable-pdf
http://ecoursesonline.iasri.res.in/course/view.php?id=164

Course Code: ATUG-605 **Course Name:** Management of Beneficial Insects **Course Credit Hour:** 4Hr **Total Contact Hour:** 40 hr

Course Objective:

- The course entitled "Pest of Horticultural crops and their Management and beneficial insects" has been designed with a primary objective of imparting adequate knowledge to students, both in theory and practice, to diagnose a variety of horticultural crop problems related to insect and non insect pests, to comprehend their life histories and damages and to be able to recommend management strategies .

Course Description:

- Detailed information has been provided on all major pests of crops as regards their taxonomic position, distribution, host range, life history, nature and symptoms of damage, seasonal abundance and their management. However, for minor pests their taxonomic position, nature and symptoms of damage and management have been covered with additional information wherever necessary. Major and minor pests have been differentiated by their text format.

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Course Contents:

UNIT I: Importance of beneficial Insects, Beekeeping, pollinating plant and their cycle, bee biology, species of honey bees, commercial methods of rearing, equipment used, seasonal management, bee enemies and diseases. Bee pasturage, bee foraging and communication. Division and uniting of honey bee boxes. Toxicity of pesticides to honey bees.
UNIT II: Types of silkworm, voltinism and biology of silkworm. Mulberry/castor cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing and mounting larvae and harvesting of cocoons. Pest and diseases of silkworm and management. Rearing appliances of mulberry silkworm and methods of disinfection.
UNIT III: Species of lac insect, morphology, biology, and host plant, lac production – seed lac, button lac, shellac, lac- products. Enemies of lac insects.

UNIT IV: Identification of major parasitoids and predators commonly being used in biological control. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance

Course Learning Outcomes (CLOs):
CLO-1: identify the key pest insects of the major horticultural crops and small fruit crops;
CLO-2: understand the pest complexes of the agro-ecosystems; have a broad idea of chemical ecology and tritrophic interaction amongst host plants,.
CLO-3: pests and their natural enemies; plan a monitoring program for pest insects
CLO-4: link sustainable agriculture with pest control
CLO-5: how to improve economic values of plants while defending and improving the environment

Text books:

1. Beneficial insects - David V. Alford
2. Insect ecology and integrated pest management including beneficial insects. TANU ICAR

Reference books:

1. Ecological based Paste management
2. Encyclopedia of Paste management - David Pimentel,

Total Internal Assessment - 40%

Course Code: ATUG 606 **Course Name:** Crop Improvement II (Rabi Crop)
Course Credit Hour: 3hr **Total Contact Hour:** 30hr

Course Objectives:

- This subject aims to know about techniques, which is used to improve crop and study about hybrids and varieties for yield & how to improve it.
- To know about the Major breeding objectives, procedures and improvement strategies in kharif crops.

Course Description:

- This course is designed to provide upper level undergraduate and students with a basic knowledge of plant breeding application their role in crop improvement in agriculture.

Course Contents:

Unit-I **(6 Hours)**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals ‑wheat and barley

Unit-II **(10 Hours)**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties,, pulses-chickpea, lentil, peas, oilseeds-rapeseed, mustard and sunflower;

Unit-III **(8 Hours)**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, sugar crops-sugarcane; medicinal and aromatic crops-mentha, lemon grass and citronella,

Unit-IV **(6 Hours)**

Origin, geographical distribution, economic importance, soil and climatic requirements,

varieties,Forage crops-berseem, lucerne and oat

Course Learning Outcomes (CLOs):

CLO-1: Develop an understanding of Centres of origin and crop diversity in crop.

CLO-2: Acquaint the students about seed increase systems, seed production in major field crops.

CLO-3: This subject is very helpful to know about different techniques like emasculation and hybridization techniques in different kharif crops.

CLO-4: Know about Ideotype breeding

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Text books:

Allard, R.W. 1960. *Principles of Plant Breeding*. John W iley and Sons, New York.

Chopra, V.L. and Paroda, R.S. 1986. *Approaches for Incorporating Drought Salinity Resistance in Crop Plants*. Oxford and IBH, Publishing Co., New Delhi.

Reference books:

Kumar, N. 2006. *Breeding of Horticultural Crops – Principles and Practices.* New India Publishing Agency, New Delhi.

Phundan Singh, 1996. *Essentials of Plant Breeding* . Kalyani Publishers, New Delhi.

Poehlman, J.M. and Borthakur, D. 1995. *Breeding Asian Field Crops*. Oxford and IBH Publishing Co., New Delhi.

Course Code:ATUG-607 **Course Name: Practical crop production-II (Rabi crops)**

Course Credit Hour 2Hr

Total Contact Hour: 20 hours

Course Objective:

To get the practical experience of growing and managing Rabi crops in the field.

Course Description:

Students will learn about the preparation of field, seed treatment, nursery raising, sowing and other practices till storage and marketing of the produce. Students will understand the yield attributing characters of rabi crops and estimate yield.

Course Contents:

Unit-1 **(10 hours)**

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce

Unit-2

The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

Course Learning Outcomes (CLOs):

On completion of the course the students will

be CO- 1: Students will able to recognize the Rabi crops
CO-2: Students will be able to understand the cultural practices and yield of Rabi crops.

Text Books:

Lokesh Kumar Jain (2021). A Manual on Crop Production Technology (Kharif and Rabi). Bhavya Books. ISBN-13 : 978-9383992584.

S.P.S. Tomar, S.N. Khajanji and G.S. Tomar (2011). Science Of Crop Production PART-2 (Rabi Crops). Kushal Publications

Course Code : ATUG- 608 **Course Name : Principles of organic farming**

Course Credit Hour : 2hours **Total Contact Hour :** 32 h

Course Objective :

- Develop an understanding of the historical, biological and ecological basis for Organic farming including crop and livestock management.
- Understand the National Organic Program rules.
- Learn the basic principles of organic matter management to feed the soil food web through the use of cover crops, compost and other organic and mineral amendments.
- Learn the basic principles of managing biodiversity, crop rotations, non-crop competitors(weeds) and plant health for productive cropping systems with minimal off-farm resources.
- Understand the foundation of organic animal husbandry and the integration of crops and animals on the organic farm.
- Develop critical and creative thinking with a systems approach to agriculture using case studies as working examples of farming systems.
- Understand the social, economic, political and environmental context for current and future organic agriculture production and sales.
- Demonstrate ability to knowledgeable discuss principles and practices of organic agriculture.

Course Description :

- Principles and practices of organic farming; farms as ecological systems; the certification process and agencies; organic matter management to support the soil food web and nutrient availability; managing biodiversity, crop rotations, plant competition, ground cover, and plant health; integrating crops and animals; organic animal husbandry practices, crop systems studies, farmer and researcher panel discussions.

Course Contents :

Organic farming, principles and its scope in India; Initiatives taken by Government (central/ state), NGOs and other organizations for promotion of organic agriculture; Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Course Learning Outcomes(CLOs) :

On completion of this module, students should be able to:
CLO-1 : Summarise the aims and objectives of organic farming and identify the regulations governing organic farming in the India
CLO-2: Identify and explain the key principles and practices involved in maintaining soil fertility and plant productivity and health in organic farming systems.
CLO-3: Explain the role of livestock and forage production in organic farming systems and identify the key principles and practices underpinning the management, productivity, health and welfare of organic livestock .
CLO-4: Learn the role of the market and other factors influencing the physical and financial performance of organic farming and their implications for the adoption of organic farming and the conversion process
CLO-5: Understand the contribution of organic farming to food quality, environmental and social policy objectives and outline the policy measures which have a direct influence on the extent and adoption of organic farming in the European Union.

Text books :

Textbook on Principles of Organic Farming by L.L. Somani (Author)
Principles of Organic Farming S.R. Reddy

Reference books :
Principles Of Organic Farming (With Theory And Practicals)by Somasundaram, E
Principles Of Organic Farming by P L Maliwal

Online links for study & reference materials :
https://www.coabnau.in/uploads/1587019407_Principlesoforganicfarming.p

Course Code: ATUG-609 A **Course Name: AgroChemicals**
Course Credit Hour: 2hr **Total Contact Hour:** 20 hrs

Course Objectives:
Importance of Agrochemicals in Agriculture & its classification.
Course Description :
An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture. Herbicides-Major classes
Course Outcomes (COs).
On completion of the course the students will be
CO – 1 Understanding the basics of different agrochemicals
CO – 2 Application of various methods and techniques of different agrochemicals
Analyzing various methodologies and techniques used for the development of ecological agriculture
Unit 1 **(4 Hours)**
An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture. Herbicides-Major classes, properties and important herbicides. Fate of herbicides.Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride.

Unit 2 **(4 Hours)**

Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation and use of Zineb and maneb.Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use. Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids,

Unit 3 **(4 Hours)**

Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses.

Unit 4 **(4 Hours)**

Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassiumchloride, potassium sulphate and potassium nitrate.

Unit 5 **(4 Hours)**

Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing.Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

<u>Text Books:</u>

1. Roy, N.K. 2002. Chemistry of Pesticides. CBS Publishers, New Delhi

<u>Reference Books:</u>

1. Integrated Pest Management. G.S.Dhaliwal and Ramesh Arora. Kalyani Publisher
2. Organic Farming for Sustainable Agriculture- S.C. Panda. Kalyani publishers.

Course Code: ATUG-609 B **Course Name: Landscaping**

Course Credit Hour: 2hr **Total Contact Hour:** 20 hrs

Course Objectives:

Importance of Landscaping & its classification.

Course Description:

Importance and scope of landscaping. Principles of landscaping, Styles and types, traces, terrace garden, vertical gardening, garden components. Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous Annuals: selection, propagation, planting scheme, Other garden plants

Course Contents:

Unit1:

Importance and scope of landscaping. Principles of landscaping, Styles and types, traces, terrace garden, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes.

Unit 2 **(4 Hours)**

Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials:

selection, propagation, planting schemes, architecture. Climber and creepers: importance, selection, propagation, planting,

Unit 3 **(4 Hours)**

Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management.

Unit 4 **(4 Hours)**

Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships,

Unit 5 **(4 Hours)**

Landscaping of river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

Course Outcomes (COs)

CO-1: Understanding the Basic Concepts and Principles of Landscaping

CO-2: Understanding and analyzing the beneficial trees, climbers and creepers used in different landscapes.

Co-3: Analyzing the propagation, planting and canopy management in horticulture crops

Text Books:

1. BasicHorticulture-Jitendra Singh. Kalyani Publisher

Reference Books:

1. Basics of Horticulture by K.V. Peter. New India Publishing Agency, New Delhi
2. Principles of Horticulture by C.R. Adams, M.P. Early. Routledge
3. Terminology of Horticulture by Neeraj Pratap Singh.International Book Distributing Co (IBDC Publishers

Course Code: ATUG-609 C **Course Name: Agricultural Journalism**

Course Credit Hour: 2hr **Total Contact Hour:** 20 hrs

Course Objectives:

Importance; Definition; Application of Agricultural Journalism.

Course Description:

Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist. Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers

Course Content

Unit 1 **(4 Hours)**

Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism.

Unit 2 **(4 Hours)**

Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines.

Unit 3 **(4 Hours)**

The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information:

Unit 4 **(4 Hours)**

Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources.

Unit 5 **(4 Hours)**

Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing.

The Course Outcomes (COs).

On completion of the course the students will be able

CO – 1	Understanding the agriculture journalism, newspaper and magazine as communication media.
CO – 2	Demonstrating the writing of agriculture stories using photographs and artwork.

Text Books

1.Mass Communication and Journalism in India, D.S.Mehta, Allied Publishers Private Limited

Reference Books:

1.Style in Journalism, P.V.L.Narasimha Rao, Readworth Publication

2.Agricultural Extension: Worldwide InnovationsR. SaravananNew India Publishing

3.Agricultural Extension Systems: Issues and ApproachesB.S. Hansra (ed.)Concept Publishing Company.

B.Sc. (Hons.) Agriculture
VII- Semester

S.NO	Course Code	Subject name	Sessional Exam			Evaluation Scheme				Credit
						External Exam	PRACTICAL		Subject Total	
			CA	TA	Total		INTERNAL	EXTERNAL		
1	ATUG-701	Rural Agricultural Work Experience (RAWE)					150	150	300	**0+14**
2	ATUG-702	Agro-industrial Attachment (AIA)					75	75	150	**0+6**

Sr. No.	**Activities**	**No. of weeks**	**Credit Hours**
1	General orientation & On campus training by different faculties	1	
2	Village attachment	8	14
3	Unit attachment in Univ./ College. KVK/ Research Station Attachment	5	
4	Plant clinic	2	02
5	Agro-Industrial Attachment	3	04
6	Project Report Preparation, Presentation and Evaluation	1	
	Total weeks for RAWE & AIA	20	20
	Total Marks = 450		

- **Agro- Industrial Attachment:** The students would be attached with the agro-industries for a period of 3 weeks to get an experience of the industrial environment and working**.**

RAWE Component-I

Village Attachment Training Programme

Sr. No.	**Activity**	**Duration**
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions (Soil sampling and testing)	1 week
5	Fruit and Vegetable production interventions	1 week
6	Food Processing and Storage interventions	
7	Animal Production Interventions	1 week
8	Extension and Transfer of Technology activities	1 week

RAWE Component –II

Agro Industrial Attachment

- Students shall be placed in Agro-and Cottage industries and Commodities Boards for 03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post-harvest-processing-value addition, Agri-finance institutions, etc.

Activities and Tasks during Agro-Industrial Attachment Programme

- Acquaintance with industry and staff
- Study of structure, functioning, objective and mandates of the industry
- Study of various processing units and hands-on trainings under supervision of industry staff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of students

B.Sc. (Hons.) Agriculture VIII SEMESTER

S.NO	Course Code	Subject name	Sessional Exam			Evaluation Scheme				Credit
						External Exam	PRACTICAL		Subject Total	
			CA	TA	Total		INTERNAL	EXTERNAL		
1	ATUG-801 A	Production Technology for Bioagents and Biofertilizer								10
	ATUG-801 B	Seed Production and Technology					150	150	300	
	ATUG-801 C	Mushroom Cultivation Technology								
	ATUG-801 D	Soil, Plant, Water and Seed Testing								
	ATUG-801 E	Commercial Beekeeping								
	ATUG-801 F	Poultry Production Technology								
		A student has to choose 1 course from the above								
2	ATUG-802 A	Commercial Horticulture								10
	ATUG-802 B	Floriculture and Landscaping								
	ATUG-802 C	Food Processing					150	150	300	
	ATUG-802 D	Agriculture Waste Management								
	ATUG-802 E	Organic Production Technology								
	ATUG-802 F	Commercial Sericulture								
		A student has to choose 1 course from the above								

Modules for Skill Development and Entrepreneurship: A student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in the **VIII semester.**

Course Code : **801** **Course Name : Mushroom technology**
Course Credit Hour : 3hr **Total Contact Hour : 40** hr

Course Objective :

- Enable the students to identify edible and poisonous mushrooms
- Provide hands on training for the preparation of bed for mushroom cultivation and spawn production
- Give the students exposure to the experiences of experts and functioning mushroom farms
- Help the students to learn a means of self employment and income generation

Course Description :

- The course introduces methods of growing edible mushrooms, including culture maintenance, basic mushroom substrate preparation, composting, spawn generation techniques, inoculation methods, harvesting, and pests and pest management of mushrooms. Students will understand the principles of mushroom cultivation, acquire the practical knowledge to grow several species of fungi, and will have the confidence to approach the mushroom industry for potential employment opportunities. The history of mushroom production and recent trends in the diversification of edible mushrooms will be discussed. Every step in small-scale and industrial commercialization of edible mushrooms, from spawn production to mushroom harvest, will be covered. Lessons and reading material include an overview of the importance of fungi in nutrient recycling and symbiotic associations with plants. Construction of growth chambers and greenhouses will be presented for the small grower with little capital. Small business opportunities and marketing mushrooms will also be included. Students will learn the unique vocabulary used in the industry and will be able to communicate with growers upon successful completion of the course. Three independent papers on various aspects of growing mushrooms will be required in the course. The objectives of the course are to introduce students to basic mycology as it relates to growing mushrooms, give students practical knowledge to begin growing mushrooms at home or with industry, and provide a foundation for starting a small business in mushroom cultivation.

Course Contents :

Module 1: Introduction to mushrooms (2 hours) Mushrooms -Taxonomical rank -History and Scope of mushroom cultivation - Edible and Poisonous Mushrooms-Vegetative characters

Module 2: Common edible mushrooms (2 Hours) Button mushroom (Agaricus bisporus), Milky mushroom (Calocybe indica), Oyster mushroom (Pleurotus sajorcaju) and paddy straw mushroom (Volvariella volvcea).

Module 3: Principles of mushroom cultivation (8 Hours) Structure and construction of mushroom house. Sterilization of substrates. Spawn production - culture media preparation- production of pure culture, mother spawn, and multiplication of spawn. Composting technology, mushroom bed preparation. Spawning, spawn running, harvesting. Cultivation of oyster and paddy straw mushroom.Problems in cultivation - diseases, pests and nematodes, weed moulds and their management strategies.

Module 4:Health benefits of mushrooms(2 Hours) Nutritional and medicinal values of mushrooms. Therapeutic aspects- antitumor effect

Module 5:Post harvest technology: (4 Hours) Preservation of mushrooms - freezing, dry freezing, drying, canning, quality assurance and entrepreneurship.Value added products of mushrooms.

Module 6: Training/ Workshop/ Field visit(12 Hours) Sterilization and sanitation of mushroom house, instruments and substrates Preparation of mother culture, media preparation, inoculation, incubationand spawn production Cultivation of oyster mushroom using paddy straw/agricultural wastes

Course Learning Outcomes(CLOs) :

CLO-1 : By successfully completing the course, students will be able to: .

CLO-2: Identify edible types of mushroom .

CLO-3: Gain the knowledge of cultivation of different types of edible mushrooms and spawn production. CLO-4: Manage the diseases and pests of mushrooms.
CLO-5: Learn a means of self-employment and income generation.

Text books :
Mushroom Cultivation Technology by Joy Sarkar Krishnendu Acharya, Anirban Roy
Mushroom Cultivation and its Diseases by Dr. Ravinder Singh Rana

Reference books :
MUSHROOM CULTURE TECHNOLOGY (Dr. Parimal Mandal, Sri Zerald Tiru, Dr. Sanjoy Sadhukhan, Dr. Arka Pratim Chakraborty, Dr. Ayon Pal, Mrs. Monalisha Pal Sarkar,)

Online links for study & reference materials :
https://agrimoon.com/wp-content/uploads/Mashroom-culture.pdf
https://nios.ac.in/media/documents/vocational/mushroom_production_(revised)(618)/Lesson-01.pdf

Course Code: 802 **Course Name: Seed Production Technology**
Course Credit Hour: 5hr **Total Contact Hour:** 60hr

Course Objectives:
- To impart knowledge to the students on the Agronomical management, Genetic management, seed testing, packing and seed marketing

Course Description:
- This course provides a stair-step introduction of genetical, agronomical, processing, handling, packaging, storage and marketing of seed.

Course Contents:

Definition of seed, planting value of seed, seed production system in India, Classes of seed, Seed legislation, Seed certification, 4Inw to become a seedproducer, Agronomical principles of seed production, Genetical principles of seed production, Principles of hybrid seed production of field crops, Seed healthmanagement, harvesting, threshing and drying of seed, Seed Processing, Value addition, Seed priming, Seed packaging and transportation, Seed demand planning cost of seed production, coat benefit ratio, Seed multiplication ratio, seed marketing etc., Seed storage, Maintenance breeding and roguing practices.

Course Learning Outcomes (CLOs):
CLO-1: Understand the basic concepts of the classification of field crops
CLO-2: Apply the agronomical and genetical principles of seed production
CLO-3: Acquaint with the seed handling and marketing
CLO-4: Learning about hybrid seed production in modules

Text books:
Khare D.and M S Bhale (2000) Seed Technology. Scientifir FubliMra (India)
Thomson I.R. An Introduction to Seed Technolngy Leonard Hill

Reference books:

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF BIOTECHNOLOGY & MICROBIOLOGY

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

UNDERGRADUATE PROGRAMME (BIOTECHNOLOGY)

Choice Based Credit System (CBCS)

(w.e.f. academic session 2019-20)

UNDERGRADUATE PROGRAMME (BIOTECHNOLOGY)

Curriculum Drafting Committee

1.	Dr. Lomas Tomar, Director, School of Sciences, NIU	Chairperson
2.	Dr. Varun Kumar Sharma, Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member Secretary
3.	Dr. Namrata Dudha Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
4.	Dr. Kashish Gupta Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
5.	Dr. Garima Sharma Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
6.	Dr. Navroop Kaur Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So, it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point

Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
   - **2.1 Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
   - **2.2 Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
   - **2.3 Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

     P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
   - **3.1** AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
   - **3.2** AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of courses

	Theory+ Practical	Theory + Tutorial
I. Core Course		
(14 Papers)	14X4= 56	14X5=70
Core Course Practical / Tutorial*		
(14 Papers)	14X2=28	14X1=14
II. Elective Course		
(8 Papers)		
A.1. Discipline Specific Elective	4X4=16	4X5=20
(4 Papers)		
A.2. Discipline Specific Elective		
Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		
B.1. Generic Elective/		
Interdisciplinary	4X4=16	4X5=20
(4 Papers)		
B.2. Generic Elective		
Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		

- **Optional Dissertation or project work in place of one Discipline Specific** Elective **paper (6 credits) in 6th Semester**

III. Ability Enhancement Courses

1. **Ability Enhancement Compulsory**		
(2 Papers of 2 credit each)	2 X 2=4	2 X 2=4
Environmental Science		
English/MIL Communication		
2. **Ability Enhancement Elective** (Skill Based)		
(Minimum 2)	2 X 2=4	2 X 2=4
(2 Papers of 2 credit each)		
Total credit	**140**	**140**

* Wherever there is a practical there will be no tutorial and vice-versa

B.Sc.. (Hons) Biotechnology

Core Papers (C): (Credit: 06 each) (1 period/week for tutorials or 4 periods/week for practical)

1. STUGBT/C01: Bio instrumentation (4 + 4)
2. STUGBT/C02: Elementary Cell Biology (4 + 4)
3. STUGBT/C03: Fundamentals of Biochemistry (4 + 4)
4. STUGBT/C04: Basics of Immunology (4 + 4)
5. STUGBT/C05: Microbial Genetics (4 + 4)
6. STUGBT/C06: Cell & Tissue Culture Technology (4 + 4)
7. STUGBT/C07: Environmental Biotechnology (4 + 4)
8. STUGBT/C08: Microbiology (4 + 4)
9. STUGBT/C09: Food technology & Bioprocess technology (4 + 4)
10. STUGBT/C10: Recombinant DNA Technology (4 + 4)
11. STUGBT/C11: Principle of Genomics and Proteomics (4 + 4)
12. STUGBT/C12: Elementary Molecular Biology (4 + 4)
13. STUGBT/C13: Nanotechnology (4 + 4)
14. STUGBT/C14: Entrepreneurship (4 + 4)

Discipline Specific Elective Papers: (Credit: 06 each) - DSE 1-4

(4 papers to be selected: 02 each for Odd semester and Even semester as listed below)

1. STUGBT/DSE01: Plant Biotechnology (4) + Lab (4)
2. STUGBT/DSE02: Animal Biotechnology (4) + Lab (4)
3. STUGBT/DSE03: Microbial Biotechnology (4) + Lab (4)
4. STUGBT/DSE04: Industrial Microbiology (5) + Tutorial (1)
5. STUGBT/DSE05: Parasitology (4) + Lab (4)
6. STUGBT/DSE06: Clinical Research (4) + Lab (4)
7. STUGBT/DSE07: Host Pathogen interaction (4) + Lab (4)
8. STUGBT/DSE08: Biological physics (4) + Lab (4)
9. STUGBT/DSE09: Bio-pesticide & Bio-fertilizer (5) + Tutorial (1)
10. STUGBT/DSE12: Dissertation

Skill Enhancement Courses (02 to 04 papers) (Credit: 02 each)- SEC1 to SEC4

1. STUGBT/SEC01: Molecular Diagnostics
2. STUGBT/SEC02: Enzymology
3. STUGBT/SEC03: Industrial Fermentations
4. STUGBT/SEC04: Basic Instrumentation Skills
5. STUGBT/SEC05: Fermentation technology
6. STUGBT/SEC06: Drug Designing
7. STUGBT/SEC07: Basics of Forensic Science
8. STUGBT/SEC08: Food technology
9. STUGBT/SEC09: Bioprocess technology
10.

Generic Elective Papers (GE): (Credit: 06 each)

1. STUGBT/GE01: Fund. of Computer Applications (4) + Lab (4)
2. STUGBT/GE02: Operating system (4) + Lab (4)
3. STUGBT/GE03: Chemistry-1 (4) + Lab (4)
4. STUGBT/GE04: Bioinformatics (4) + Lab (4)
5. STUGBT/GE05: Recombinant DNA Technology (4) + Lab (4)
6. STUGBT/GE06: Bioethics, Biosafety and IPR (4) + Lab (4)
7. STUGBT/GE07: Plant Pathology (4) + Lab (4)

Assessment method:

Assessment method	**Theory**					**Practical**	
	Internal assessment	Mid-term examination	End-term examination	Maximum Mark		Practical examination	Maximum Mark
Mark	20	20	60	100		50 Mark	50 Mark
%	20%	20%	60%	100%		100%	100%

PEOs, POs & PSOs of B.Sc.. Biotechnology Programme

Programme Educational Objectives (PEOs):

PEO1: To develop in our student competencies to pursue higher education and research in reputed institutes and industry at local and global level.

PEO2: To update, strengthen and deepen students 'knowledge using a flexible, research-intensive program in concord to academia and industry requirements.

PEO3: To develop a working knowledge of biotechnology product and processes

PEO4: To enable critical thinking and full-fledged grasp of essential aspects of bioethics inculcating a value system among students.

Programme Outcomes / Programme Specific Outcomes are attributes i.e. what students are expected to know or will be able to do when they graduate from a programme.

Programme Outcomes (POs): The POs of BSc Biotechnology are as follows:

PO1: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO2: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO3: Understand the impact of the professional biotechnological solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO4: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science practice.

PO5: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change

Programme Specific Outcomes (PSOs):

PSO1: Students will be equipped to understand three fundamental aspects in biological phenomenon: a) what to seek; b) how to seek c) why to seek?

PSO2: Undergraduate students will be able to demonstrate and apply the principles of bioprocess engineering in the design, analysis, optimization and simulation of bioprocess operations.

PSO3: Empower the students to acquire technological knowhow by connecting disciplinary and interdisciplinary aspects of biotechnology

PSO4: Detailed experience would enable them to begin a career in industry that engages in genetic engineering as well as in research laboratories conducting fundamental research

PSO5: Recognize the importance of Bioethics, IPR, entrepreneurship, Communication and management skills so as to usher next generation of Indian industrialists

PSO6: To impart in-depth practical oriented knowledge to students in various thrust areas of biotechnology, so as to meet the demands of industry and academia.

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for B.Sc.. (Biotechnology)

B.Sc.. Biotechnology 1st Year
SEMESTER-I

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGBT1/ C01	Bio instrumentation	4	0	0	20	20	40	60	100	4	C1
2	STUGBT1/ C02	Elementary Cell Biology	4	0	0	20	20	40	60	100	4	C2
3	STUGBT1/ GE1	Fundamentals of Computer Applications	4	0	0	20	20	40	60	100	4	GE1
4	STUGBT1/ AECC1	Environmental Sciences	2	0	0	20	20	40	60	100	2	AECC 1
Practical												
1	SPUGBT1/ C01	Bio instrumentation Practical	0	0	2			25	25	50	2	C1
2	SPUGBT1/ C02	Elementary Cell Biology Practical	0	0	2			25	25	50	2	C2
3	SPUGBT1/ GE1	Fundamentals of Computer Applications Practical	0	0	2			25	25	50	2	GE1
Total										**550**	**20**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc.. Biotechnology 1st Year
SEMESTER-II

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGBT2/ C03	Fundamentals of Biochemistry	4	0	0	20	20	40	60	100	4	C3
2	STUGBT2/ C04	Basics of Immunology	4	0	0	20	20	40	60	100	4	C4
5	STUGBT2/ GE02	Bioinformatics	4	0	0	20	20	40	60	100	4	GE2
6	STUGBT2/ AECC2	Technical Communication	2	0	0	20	20	40	60	100	2	AECC 2
Practical												
1	SPUGBT2/ C03	Fundamentals of Biochemistry Practical	0	0	2			25	25	50	2	C3
2	SPUGBT2/ C04	Basics of Immunology Practical	0	0	2			25	25	50	2	C4
3	SPUGCS2/ GE02	Bioinformatics Practical	0	0	2			25	25	50	2	AECC 2
Total										**550**	**20**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

NOIDA INTERNATIONAL UNIVERSITY

B.Sc.. Biotechnology 2nd Year
SEMESTER-III

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total	External Exam			
1	STUGBT3/ C05	Genetics	4	0	0	20	20	40	60	100	4	C5
2	STUGBT3/ C06	Cell & Tissue Culture Technology	4	0	0	20	20	40	60	100	4	C6
3	STUGBT3/ C07	Environmental Biotechnology	4	0	0	20	20	40	60	100	4	C7
4	STUGBT3/ SEEC1	Fermentation Technology	2	0	0	20	20	40	60	100	2	SEC1
5	STUGBT3/ GE3	Bioethics, Biosafety and IPR	4	0	0	20	20	40	60	100	4	GE3
Practical												
1	SPUGBT3/ C05	Genetics Practical	0	0	2			25	25	50	2	C5
2	SPUGBT3/ C06	Cell & Tissue Culture Technology Practical	0	0	2			25	25	50	2	C6
3	SPUGBT3/ C07	Environmental Biotechnology Practical	0	0	2			25	25	50	2	C7
4	SPUGBT3/ GE3	Bioethics, Biosafety and IPR Seminar	0	2	0			25	25	50	2	GE3
Total										**700**	**26**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc.. Biotechnology 2nd Year
SEMESTER-IV

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total	External Exam			
1	STUGBT4/ C08	Microbiology	4	0	0	20	20	40	60	100	4	C8
2	STUGBT4/ C09	Food Technology & Bioprocess technology	4	0	0	20	20	40	60	100	4	C9
3	STUGBT4/ C10	Basics of Genetic Engineering	4	0	0	20	20	40	60	100	4	C10
4	STUGBT4/ SEEC2	Basics of forensic science	2	0	0	20	20	40	60	100	2	SEC2
5	STUGBT4/ GE4	Plant Pathology	4	0	0	20	20	40	60	100	4	GE4
Practical												
1	SPUGBT4/ C08	Microbiology Practical	0	0	2			25	25	50	2	C8
2	SPUGBT4/ C09	Food technology & Bioprocess technology Practical	0	0	2			25	25	50	2	C9
3	SPUGBT4/ C10	Basics of Genetic Engineering Practical	0	0	2			25	25	50	2	C10
4	SPUGBT4/ GE4	Plant Pathology Practical	0	0	2			25	25	50	2	GE4
Total										**700**	**26**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Biotechnology 3rd Year
SEMESTER-V

S. No	Course Code	Subject	Period			Evaluation Scheme			External Exam	Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total				
1	STUGBT5/ C11	Principle of Genomics And Proteomics	4	0	0	20	20	40	60	100	4	C11
2	STUGBT5/ C12	Elementary Molecular Biology	4	0	0	20	20	40	60	100	4	C12
3	STUGBT5/ DSC1	Plant Biotechnology	4	0	0	20	20	40	60	100	4	DSC1
4	STUGBT5/ DSC2	Animal Biotechnology	4	0	0	20	20	40	60	100	4	DSC2
Practical												
1	SPUGBT5/ C11	Principle of Genomics and Proteomics Seminar	0	2	0			25	25	50	2	C11
2	SPUGBT5/ C12	Elementary Molecular Biology Practical	0	0	2			25	25	50	2	C12
3	SPUGBT5/ DSC1	Plant Biotechnology Practical	0	0	2			25	25	50	2	DSC1
4	SPUGBT5/ DSC2	Animal Biotechnology Practical	0	0	2			25	25	50	2	DSC2
Total										**600**	**24**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Biotechnology 3rd Year
SEMESTER-VI

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGBT6 /C11	Nanotechnology	4	0	0	20	20	40	60	100	4	C13
2	STUGBT6 /C12	Entrepreneurship	4	0	0	20	20	40	60	100	4	C14
3	STUGBT6 /DSC3	Parasitology/ Transcriptomics and Metabolomics	4	0	0	20	20	40	60	100	4	DSC3
4	STUGBT6 /DSC4	Clinical Research	4	0	0	20	20	40	60	100	4	DSC4
Practical												
1	SPUGBT6 /C11	Nanotechnology Practical	0	0	2			25	25	50	2	C13
2	SPUGBT6 /C12	Entrepreneurship Seminar	0	2	0			25	25	50	2	C14
3	SPUGBT6 /DSC3	Parasitology/ Transcriptomics and Metabolomics Seminar	0	2	0			25	25	50	2	DSC3
4	SPUGBT6 /DSC4	Clinical Research Seminar	0	2	0			25	25	50	2	DSC4
Total										**600**	**24**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

OVERALL CREDIT SCHEME

S. No.	SEMESTER	Theory Total	Practical Total	Subject Total	Total Credit
1	I	400	150	550	20
2	II	400	150	550	20
3	III	500	200	700	26
4	IV	500	200	700	26
5	V	400	200	600	24
6	VI	400	200	600	24
			Grand Total	**3700**	**140**

B.Sc.. (H) Biotechnology 1st Year
SEMESTER-I

BIO INSTRUMENTATION (STUGBT1/C01)

L	T	P
4	0	2

Course Name: Bio Instrumentation **Course Code:** STUGBT1/C01
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The students learn the physical principles of structure-function relationships in biological macromolecules such as proteins and nucleic acids, as well as the various approaches, techniques and instrumentation associated with structural biology.

Course Description:

This course presents the principles and applications of Biotechnology explaining the biomolecules and applications of biophysical methods. Students will be able to justify the need for buffers, describe how buffers are prepared, and calculate the amount of buffering agent needed when making a particular bufferOn successful completion of the course the students will be aware of Microscopic techniques, Electro physiological methods, Biomolecules structure determination using X-Ray diffraction.

Course Contents:

Unit I: General Biophysical methods: Measurement of pH, pOH, Buffer action, Isoelectric focusing.

Unit II: Separation & Identification of Materials: Concept of Chromatography (Partition Chromatography, Paper Chromatography, Adsorption Chromatography, TLC, GLC, Ion Exchange Chromatography, Gel Chromatography, HPLC, Affinity Chromatography); Electrophoresis (Gel Electrophoresis, Paper Electrophoresis).

Unit III: Centrifugation: Basic Principle of Centrifugation, Instrumentation of Ultracentrifuge (Preparative, Analytical), Factors affecting Sedimentation velocity, Standard Sedimentation Coefficient, Centrifugation of associating systems, Rate-Zonal centrifugation, sedimentation equilibrium Centrifugation.

Unit IV: Microscopy: Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, TEM, SEM.

Unit V: X-Ray Crystallography: X-ray diffraction, Bragg equation, Reciprocal lattice, Miller indices & Unit cell, Concept of different crystal structure, determination of crystal structure (concept of rotating crystal method, powder method). **Spectroscopy:** Basic concepts, principle, working, care &

maintenance and applications of Raman Spectroscopy, NMR Spectroscopy and Absorption Spectroscopy.

Course Learning Outcomes (CLOs):

CLO-1: Enable the student to get sufficient knowledge in principles and applications of bio instruments.

CLO-2. To enable the students to learn the immuno techniques and radio labelling techniques.

CLO-3. To differentiate and analyze the biomedical signal sources.

CLO4. Describe the Basic concept of microscopic techniques such as Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, TEM, SEM.

CLO5. Explain the basic principle and application of X-Ray Crystallography and spectroscopy.

Text Books:

- Cromwell, L. and Weibell, F.J. and Pfeiffer, E.A., Biomedical Instrumentation and Measurement, Dorling Kingsley (2006) 2nd ed.
- Carr, J.J. and Brown, J.M., Introduction to Biomedical Equipment Technology, Prentice Hall (2000) 4th ed.
- Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.

Reference Books:

- Geddes, L.A., and Baker, L.E., Principles of Applied Biomedical Instrumentation, Wiley InterScience (1989) 3rd ed.
- Khandpur, R.S., Handbook of Biomedical Instrumentation, McGraw Hill (2003) 2nd ed.
- Webster, J.G., Medical Instrumentation Application and Design, John Wiley (2007) 3rd ed.
- Biophysical Techniques By Iain Campbell • 2012, 9780199642144, 0199642141, QUP Oxford.

Online links for study & reference materials:
https://microbenotes.com/category/instrumentation/
https://lecturenotes.in/download/material/18824-note-of-bioinstrumentation-by-nithya-biotech.
http://biomedikal.in/2009/12/lecture-notes-on-biomedical-instrumentation/

B.Sc.. (H) Biotechnology 1st Year
SEMESTER-I

ELEMENTARY CELL BIOLOGY (STUGBT1/C02)

L	T	P
4	0	2

Course Name: Elementary Cell Biology
Course Code: STUGBT1/C02
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

To provide students the knowledge about cellular content, organization, structures and functions. To impart basic understanding of development biology and interaction of cell with environment.

Course Description:
It is an introductory cell biology course. Topics include the structure of the cell and cell components, both eukaryotic and prokaryotic. The processes of DNA replication and gene expression including protein processing and routing. Photosynthesis, respiration, and chemotrophy as means of energy production. The cell cycle and its regulation. These topics will be covered in one semester having four-hour lectures and one two-hour laboratory work per week.

Course Contents:

Unit I: Basics of Cell Biology (Structure & Function): Discovery of cell and Cell Theory; Comparison between plant and animal cells; Cell wall; Plasma membrane; Modification of plasma membrane and intracellular junctions; Cytoskeleton; Protoplasm; Mitochondria; Chloroplast; ER; Golgi complex; Lysosome, endosome and microbodies; Ribosome; Centriole; Nucleus; Chemical components of a cell; Catalysis and use of energy by cells.

Unit II: Biogenesis of Cellular organelles: Biosynthesis of mitochondria, chloroplast, ER, Golgi complex; Biosynthetic process in ER and Golgi apparatus; Protein synthesis and folding in the cytoplasm; Degradation of cellular components.

Unit III: Chromosomes: Chemical composition, structural organization of chromatids, centromeres, telomeres, chromatin, nucleosome organization, eu- and heterochromatin, special chromosomes (e.g. polytene and lampbrush chromosomes), banding patterns in human chromosomes.

Unit IV: Membrane Structure & Transport: Models of membrane structure, Membrane lipids, proteins and carbohydrates; Solute transport by Simple diffusion, Facilitated diffusion and Active transport; Cell adhesion

Unit V: Cell Cycle: An overview of cell cycle; Mitosis and meiosis; Components of cell cycle control system; Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer, Viral disease (AIDS) & Organ transplant.

Course Learning Outcomes (CLOs):
After completion of the course, students will have a basic understanding of cell biology and will be able to demonstrate/explain:

CLO 1: To differentiate between animal as well as plant cells, to recognize and identify the function(s) of the following: centrioles, chromatin, Golgi apparatus, lysosome, microfilaments, microtubules, mitochondrion, nucleus, peroxisome, plasma membrane, rough and smooth endoplasmic reticulum, and ribosomes. An understanding of the ability of enzymes to facilitate chemical reactions. Explain how catalysts, including enzymes, affect and are affected by the chemical reactions in which they participate.

CLO 2: Protein sorting and transport of protein. Understanding of the biochemical processes of photosynthesis, glycolysis, citric acid cycle, and oxidative phosphorylation. Define cellular respiration and identify the cellular locations of the various stages of cellular respiration. Distinguish between the light reactions and the Calvin cycle of photosynthesis.

CLO 3: Chemical composition of nucleic acids (DNA/RNA). Structural Organization of DNA, chromatids, chromosome. Describe the various types of chromosomes on the basis of centromeric position. Chromosomal banding patterns and its application.

CLO 4: Cellular membrane structure and function. Various models of cellular membrane. Composition of cellular membranes. Transport across membrane by simple diffusion, facilitated diffusion and Active transport. Interaction between cells through cell adhesion molecules.

CLO 5: An understanding of how cells grow and divide. Describe the major events of each of the stages of the cell cycle (interphase, G1, G2, S, mitosis, prophase, prometaphase, metaphase, anaphase, telophase, mitotic phase, and cytokinesis). Cell Death and various process associated with cell death.

Text Books:

- Jeff Hardin, Gregory Bertoni, Lewis J. Kleinsmith, Wayne M. Becker. Becker's World of the Cell, 8th edition, Benajmin Cummings, 9780321689634, 0321689631, (2012).
- EDP De Robertis and EMF De Robertis. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, 9780781734936, 0781734932, (2006)

Reference Books:

- Gerald Karp, Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc, 9780470483374, 0470483377 (2010)
- G.M. Cooper, and R.E. Hausman. The Cell: A Molecular Approach. 5^{th} Edition. ASM Press 780878931064, 0878931066 (2009)

Online links for study and reference materials:

- http://www.open2study.com/cellbiology
- https://nptel.ac.in/courses/102103012/
- Cell Biology - Course (swayam2.ac.in)

B.Sc.. (H) Biotechnology 1st Year
SEMESTER-I

FUNDAMENTALS OF COMPUTER APPLICATION (STUGBT1/GE1)

L	T	P
4	0	2

Course Name: Fundamentals of Computer Application **Course Code:** STUGBT1/GE1
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of computer application. This course will introduce the students with fundamentals of hardware, software and programming.

Course Contents:

Unit-I: Fundamental: H/W and S/W part of computer system, Computer Block Diagram, online processing, time sharing system, real time system, batch system, multiprogramming, multiprocessing, SPOOLING, distributed data processing. Element of computer file, types of files, file processing activities, file design factors, access methods, pros and cons of file organization.

Unit-II: MS office I: Introduction to MS Office; Introduction to MSWord; Features & area of use. Working with MS Word.; Menus & Commands; Toolbars & Buttons; Shortcut Menus, Wizards & Templates; Creating a New Document; Different Page Views and layouts;

Unit-III: MS office II: Applying various Text Enhancements; Working with – Styles, Text Attributes; Paragraph and Page Formatting; Text Editing using various features ; Bullets, Numbering, Auto formatting, Printing & various print options.

Unit-IV: MS Excel: Introduction and area of use; Working with MS Excel.; concepts of Workbook & Worksheets; Using Wizards; Various Data Types; Using different features with Data, Cell and Texts; Inserting, Removing & Resizing of Columns & Rows

Unit-V: Working with Data & Ranges; Column Freezing, Labels, Hiding, Splitting etc.; Using different features with Data and Text; Use of Formulas, Calculations & Functions; Cell Formatting including Borders & Shading; Working with Different Chart Types; Printing of Workbook.

Course Learning Outcomes (CLOs):

CLO1: Problem solving through computer programming,
CLO2: Familiarity of programming environment in Linux operating system.
CLO3: Ability to use different memory allocation methods.
CLO4: Ability to deal with different input/output methods.
CLO-5: Ability to use different data structures.

Text Books:

- Joe Habraken, Microsoft Office 2000, 8 in 1 by, Prentice Hall of India
- Deitel & Deitel: C How to Program (Prentice Hall), 1996.
- Yashwant Kanetker, Let us C, BPB Publications.

Reference Books:

- R. B. Patel, Fundamental of Computers and Programming in C, Khanna Book Publishing Company PVT.LTD. Delhi, India, 1st edition, 2008, ISBN: 13: 978-81-906988-7-0, pp. 1-962.
- Gottfried, Programming with C, Tata McGraw Hill. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd Ed. Prentice Hall of India.

Online links for study & reference materials:
https://lecturenotes.in/download/note/18532-note-for-cprogramming-by-anshuman

B.Sc.. (H) Biotechnology 1st Year
SEMESTER-I

ENVIRONMENTAL SCIENCES- EVS (STUGBT1/AECC1)

L	T	P
2	0	0

Course Name: Environmental Sciences **Course Code:** STUGBT1/AECC1
Course Credit Hour: 2 hrs **Total Contact hour:** 30 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of Environmental Sciences. People working in industries or elsewhere essentially require the knowledge of environmental science to enable them to work and produce the most efficient, economical and eco-friendly finished products.

Course Contents:

Unit I: Natural Resources: Forest resources: Use and over-exploitation, deforestation, case studies. Timberextraction, mining, dams and their effects on forests and tribal people, (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water,dams-benefits and problems. (c) Mineral resources: Use and exploitation, environmentaleffects of extracting and using mineral resources, case studies. (d) Food resources: Worldfood problems, changes caused by agriculture and overgrazing, effects of modernagriculture, fertilizer-pesticide problems, water logging salinity, case studies. (e) Energyresources: Growing energy needs, renewable and non- renewable energy sources, use ofalternate energy sources (f) Land resources: Land as a resource, landdegradation, man induced landslides, soil erosion and desertification.

Unit II: Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumersand decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, foodwebs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem :- (a) Forest ecosystem, (b) Grassland ecosystem, (c)Desert ecosystem, (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III: Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and option values. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity : In-situ and Ex situ conservation of biodiversity.

Unit VI: Environmental Pollution: Definition, Causes, effects and control measures of: (a) Air pollution, (b) Water pollution,(c) Soil pollution, (d) Marine pollution (e) Noise pollution, (f) Thermal pollution, (g) Nuclearhazards. Human health risks; Solid waste management: Control measures of urban and industrial waste. Pollution case studies.

Unit V: Environmental Policies & Practices: Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air and Water Wildlife Protection Act; Forest Conservation Act.; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept immune system and its importance.
CLO2. Discuss Structure, Functions and Properties of different type of Immune Cells and immune organs.
CLO3. Describe the Basic characteristics of an antigen and Structure, Types, Functions and Properties of antibodies.
CLO4. Explain the Major Histocompatibility Complex I & II molecules, basics of Components of the Complement system.
CLO5. Discuss the basic concept of Generation of Immune Response, in particular Generation of Humoral Immune and Cell Mediated Immune Response.

Text Books:

- S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi.
- C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011
- Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099
- Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.

Reference Books:

- O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi
- Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.
- Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic press, 2011.

Online links for study & reference materials:
www.cpcp.nic.in
www.cpcp.gov.in
www.conserve-energy-future.com

B.Sc. Biotechnology 1st Year
SEMESTER-II

FUNDAMENTALS OF BIOCHEMISTRY (STUGBT2/C03)

L	T	P
4	0	2

Course Name: Fundamentals of Biochemistry **Course Code:** STUGBT2/C03
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis, and to enable students to acquire a specialized knowledge and understanding of selected aspects by means of a stem/branch lecture series and a research project.

Course Description:
This course introduces students to the general families of biomolecules that comprise the science of biochemistry and to the principles that integrate biochemistry with other chemical and biological disciplines. They acquire knowledge in the quantitative and qualitative estimation of biomolecules.

Course Contents:

Unit 1: Classification and Study of macromolecules: Introduction and classification of Carbohydrate. Lipids, amino acids and Nucleic acid. Interaction between protein-protein, protein-nucleic acid and nucleic acid- nucleic acid. Biochemistry and its scope. Structure, general properties and function of cellular macromolecules.

Unit 2: Carbohydrate metabolism: Glucose Metabolism: Glycolysis; fermentation; anaerobic fate of pyruvate; control of glycolysis; metabolism of hexoses other than glucose; pentose phosphate pathway. **Citric Acid Cycle**: Synthesis of acetyl-coenzyme A; enzymes of the citric acid cycle; regulation of the citric acid cycle; glyoxylate pathway; electron transport and oxidative phosphorylation. Glycogen Metabolism and Gluconeogenesis: Glycogen breakdown; glycogen synthesis; control of glycogen metabolism. Starch Metabolism: Starch synthesis; storage and degradation; abnormal carbohydrate metabolism.

Unit 3: Lipid Metabolism: Digestion; absorption and transport; fatty acid oxidation; ketone bodies; regulation of fatty acid metabolism; cholesterol biosynthesis; fatty acid biosynthesis.

Unit 4: Nitrogen Metabolism: Amino acid biosynthesis (L-Serine, L-Asparagine, L-Alanine, L-Tyrosine, L-Methionine); Nitrogen fixation in plants and microorganisms; nitrate reduction; inborn errors of L-Phenylalanine and L-Tyrosine metabolism; essential amino acids; glucogenic &ketogenic amino acids.

Unit 5: Nitrogen Excretion: The urea cycle; inborn errors involving urea synthesis; catabolism of purine and pyrimidine nucleotides; disorders involving purine metabolism.

Course Learning Outcomes:

C01: Understanding of Biochemistry as a discipline and milestone discoveries in life sciences that led to establishment of Biochemistry as separate discipline

C02: Fundamental properties of elements, their role in formation of biomolecules and in chemical reactions within living organisms

C03: Understanding of the concepts of mole, mole fraction, molarity, etc. and to apply them in preparations of solutions of desired strengths

C04: Unique property of water as a universal solvent and its importance in biological system

C05: Understanding of concepts of acids, bases, indicators, pKa values, etc. Acquiring skill to determine pKa value of amino acids.

Text Books:

- A.L., Lehninger, PRINCIPLES OF BIOCHEMISTRY (1982), Worth Publishers, Inc. New York, ISBN: 9780716743392, 0716743396
- L. Stryer, BIOCHEMISTRY (1995) W.H. Freeman Press, San Francisco, USA, ISBN: 9781319248086, 131924808X

Reference Books:

- Voet, D. and Voet, J.G., Biochemistry, (2004). 3rd Edition, John Wiley & Sons, Inc.USA,
- U. Sathyanarayana, Biochemistry by Books and Allied (P) Ltd. Kolkata, ISBN 0-87893-214-3, (2014), ISBN: 9788187134800, 8187134801

Online links for study & reference materials:

https://www.khanacademy.org/test-prep/mcat/biomolecules
https://nptel.ac.in/courses/104/105/104105076/

B.Sc. Biotechnology 1st Year
SEMESTER-II

BASICS OF IMMUNOLOGY (STUGBT2/C04)

L	T	P
4	0	2

Course Name: Basics of Immunology
Course Code: STUGBT2/C04
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of Immunology. This course will introduce the students with basic principles of immunology and recent advancements in the field of host immunity, including innate and adaptive immunity.

Course Description:

This course is mainly focused on the host immune system which includes basic concept of immunology, Type of immune system, Classes of immune cells, Antigen-Antibody interaction immune cell tolerance, vaccine technology and other relevant topics.

Course Contents:

Unit 1: Introduction: Basic concepts of Innate and Adaptive immune system, Immune Cells and Immune Organs.

Unit 2: Structure, Functions and Properties of: Immune Cells: Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs: Bone Marrow, Thymus, Lymph Node, Spleen, etc.

Unit 3: Antigens and Antibodies: Antigen: Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens, Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants. **Antibodies:** Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; immunodiffusion, immunoelectrophoresis, ELISA, RIA, Monoclonal and Chimeric antibodies.

Unit 4: Major Histocompatibility Complex: Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocyticpathways), Complement System: Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement activation.

Unit 5: Generation of Immune Response: Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells), Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals), Killing Mechanisms by CTL and NK cells, Introduction to tolerance; Vaccines.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept immune system and its importance.
CLO2. Discuss Structure, Functions and Properties of different type of Immune Cells and immune organs.
CLO3. Describe the Basic characteristics of an antigen and Structure, Types, Functions and Properties of antibodies.
CLO4. Explain the Major Histocompatibility Complex I & II molecules, basics of Components of the Complement system.
CLO5. Discuss the basic concept of Generation of Immune Response, in particular Generation of Humoral Immune and Cell Mediated Immune Response.

Text Books:

- Immunology, V Edition - Richard A.Goldsby, Thomas. J. Kindt, A. Osborne, JanisKuby, 2003. W.H. Freeman and company.
- Topley and Wilson principles of bacteriology, Virology and immunology, G. Wilson, A.Miles, M.T.Paker, 2004.
- Arnold, HeinemanAbbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
- Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition WileyBlackwellScientific Publication, Oxford.

Reference Books:

- Basic and Clinical Immunology, 2010, D.P. Stities and J.D. Stobo.
- Vaccines, New Approaches to immunization, F.Brown, KA Lerner, 1986. Cold spring Harborolab.Goldsby RA, Kindt TJ, Osborne BA. (2007).
- Kuby's Immunology. 6th edition W.H. Freeman andCompany, New York.
- Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

Online links for study & reference materials:

https://nptel.ac.in/courses/102103038/
https://nptel.ac.in/courses/102103041/18

B.Sc. Biotechnology 1st Year
SEMESTER-II

BIOINFORMATICS (STUGBT2/GE2)

L	T	P
4	0	2

Course Name: Bioinformatics
Course Code: STUGBT2/GE2
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

This course is beneficial for students to understand the principles of analyzing biological data, building models and testing hypotheses using computer science algorithms. This course is a survey of algorithms and tools in biological sequence analysis, genome-wide disease association, and precision medicine. Basic concept machine learning and its application in the analysis of biological data are also included in this course.

Course Contents:

Unit 1: Introduction to Bioinformatics: Genomics and Proteomics. Bioinformatics – Online tools and offline tools. Biological databases. Types of data bases – Gen bank, Swiss port, EMBL, NCBL, and PDB. Database searching using BLAST and FASTA.

Unit 2: Sequence and Phylogeny analysis: Sequence Alignments, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.

Unit 3: Dynamic programming: Gene and Genome annotation – Tools used. Physical map of genomes. Molecular phylogeny - Concept methods of tree construction.

Unit 4: Bioinformatics tools in proteomics: Introduction, strategies and methods. Bioinformatics tools in proteomics. Application of proteomics. Protein-protein interactions.

Unit 5: Basic introduction of Proteomics technologies: Basic introduction of Proteomics technologies; 2D-electrophoresis, MALDI-TOF mass spectrometry. Biological Protein Databases: PDB, SWISSPROT, TREMBL. Protein secondary structure prediction. Protein 3D structure prediction.

Course Learning Outcomes (CLOs):
After successful completion of the course the students:

CLO1. Outlines the basic background of Bioinformatics, terminology, history and introduction to various databases

CLO2. Describe in detail the various mechanisms involved sequence similarity, algorithm matrices MSA and Phylogenetic analysis

CLO3. Introduces various programming and software tools involved in genome annotation, mol. Phylogeny.

CLO4. Discuss the basic background of proteomic and various tools and their application in understanding the proteome and its analysis

CLO5. Describes the mathematical tools involved in evaluation of the various dataset generated and their evaluation via statistics.

Text Books:

- D. Mount, Bioinformatics – Sequence and Genome Analysis, 2nd Ed. Cold Spring Harbor Laboratory Press, 9780879697129, 0879697121
- William Mendenhall, Robert J. Beaver, Barbara M. Beaver, Introduction to Probability & Statistics, 14th Edition, Cengage Learning,1133103758, 9781133103752,

Reference Books:

- Arthur M.Lesk, Introduction to Bioinformatics, 4th Ed. Oxford press, 9780199651566, 0199651566

Online links for study and reference materials:
https://nptel.ac.in/courses/102/106/102106065/
www.ncbi.nlm.gov

B.Sc. Biotechnology 2nd Year
SEMESTER-III

GENETICS (STUGBT3/C05)

L	T	P
4	0	2

Course Name: Genetics
Course Credit Hour: 4 hrs

Course Code: STUGBT3/C05
Total Contact hour: 60 hrs

Course Objective:

The objective of this course is to build knowledge on the fundamentals of genetics, heredity, or inheritance. To build the foundation on the understanding of biological principles.

Course Description:
This course provides a detailed understanding of Mendelian and non-Mendelian inheritance; various techniques and methodologies that decipher genetic recombination, gene mapping and other relevant topics.

Course Contents:

Unit I: Prokaryotic Genomes - Physical organization of bacterial genomes; Structure of the bacterial nucleoid, Replication and partitioning of the bacterial genome and Genome of Archaea.

Unit 2: Mechanism of genetic exchange: Plasmid and bacterial sex, Types of plasmids (F Plasmid: a Conjugate plasmid', Mobilization of Non-conjugative plasmid, R plasmid, Col plasmid Copy number and incompatibility), Episomes. Transposable elements (Insertion sequence and transposons, Integrons and Antibiotic-Resistance cassettes, Multiple Antibiotic Resistant bacteria, Mu–virus); Bacterial Genetics (Mutant phenotype, DNA mediated Transformation; Conjugation (Cointegrate Formation and Hfr Cells, Time–of–Entry Mapping, F' Plasmid); Transduction (Generalized transduction, Specialized Transduction)-gene mapping.

Unit 3: Molecular Mechanism of gene regulation in prokaryotes - Transcriptional regulation in prokaryotes (inducible and repressible system, positive regulation and negative regulation); Operon concept – lac, trp, Ara operons.

Unit 4: Bacteriophages: Stages in the Lytic Life Cycle of a typical phage, Properties of a phage infected bacterial culture, Specificity in phage infection, *E. coli* PhageT4, *E.coli* Phage T7, E.coli phage lambda, Immunity to infection, Prophage integration, Induction of prophage, Induction & Prophage excision, Repressor, Structure of the operator and binding of the repressor and the Cro product, Decision between the lytic and lysogenic Cycles, Transducing phages, *E.coli* phage phiX174, The lysogenic Cycle.

Unit 5: Bacteriophage Genetics: Plaque Formation and Phage Mutants, Genetic recombination in the lytic cycle, (concept of recon, muton, cistron)

Course Learning Outcomes (CLOs):
After successful completion of the course the students:

CLO 1. Will have knowledge of Mendelian, non- Mendelian inheritance and an insight of Gene concept and alleles

CLO 2. Will have an understanding of various methods employed in Gene mapping

CLO 3. Insight of differentiation of sex in plants and animals and various diseases associated with improper differentiation of sex. Evaluate difference between extra-chromosomal inheritances from chromosomal inheritance.

CLO 4. Biochemical changes that lead to difference in inheritance of characters & their expression

CLO 5. Various techniques involved in studying human genetics and their quantification

Text Books:

- P. K. Gupta, GENETICS. Rastogi Publication. 9788171338429, 8171338429
- Strickberger M. W., Genetics. Mac Millan Publishing Co., 9780024180902

Reference Books:

- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R., "Molecular Biology of the Gene", 5th Ed., Pearson Education, 9780321762436, 0321762436

Online links for study and reference materials:

- www.biologydiscussion.com
- www.khanacademy.org
- https://www.ncbi.nlm.nih.gov/pmc

B.Sc. Biotechnology 2nd Year
SEMESTER-III

CELL & TISSUE CULTURE TECHNOLOGY (STUGBT3/C06)

L	T	P
4	0	2

Course Name: Cell & Tissue Culture Technology
Course Code: STUGBT3/C06
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

The course intends to teach students about the traditional and new approaches used in crop improvement. This includes the conventional and marker assisted breeding approaches, plant tissue culture and its importance in generation of transgenic plants, methods to express large quantities of important proteins and modern tools for site directed mutagenesis in plants.

Course Description:

This course is mainly focused on the cell and tissue culture technology which includes basic concept of tissue culture laboratory, different culture media and culture methods, Basic techniques in plant and animal tissue culture.

Course Contents:

Unit 1: Tissue Culture Laboratory: Planning and organization of a Tissue Culture Laboratory

Unit 2: Plant and Animal Tissue Culture: Culture media and culture methods, Basic techniques in plant and animal tissue culture.

Unit 3: Culture Maintenance and Growth Measurement: Induction and maintenance of callus and suspension culture, Measurement of growth parameters.

Unit 4: Introduction to *in-vitro* Methods: Terms and definitions. Use of growth regulators, Ovary and Ovule culture, Embryo culture, Anther Culture, Embryo rescue after wide hybridization and its applications, Micropropagation- bud, shoot tip and meristem culture, Endosperm culture and production of triploids, *in-vitro* pollination & Fertilization.

Unit 5: Introduction to Protoplast Isolation: Principles and applications, Testing of viability of isolated protoplasts, Various steps in the regeneration of protoplasts, Somatic hybridization, Various methods for fusing protoplasts, chemical and electrical. Use of markers for selection of hybrid cells, Practical applications of somatic hybridizations, Cybridization.

Course Learning Outcomes (CLOs):

CLO1. be able to examine and analyze practical and theoretical principles of cell culture.
CLO2. be able to describe and explain the conditions under which cells can be cultured outside the body.
CLO3. be able to explain the advantages and limitations of cell culture in biomedical research.
CLO4. be able to carry out cell culture, and associated laboratory techniques.
CLO5. be able to carry out the most common analysis techniques associated with cell culture.

Text Books:

- Plant Tissue Culture: An Introductory Text, Sant Saran Bhojwani and Prem Kumar Dantu; Springer, India.
- Elements of Biotechnology, P.K.Gupta; Rastogi Publication, India
- Introduction to Plant Biotechnology, H.S.Chawla;Oxford and IBH

Reference Books:

- Introduction to Cell and Tissue Culture Theory and Technique, Jennie P. Mather and Penelope E. Roberts, Plenum Press, New York.

Online links for study & reference materials:
https://fenix.tecnico.ulisboa.pt/downloadFile/3779571815542/Lecture_30042008.pdf

B.Sc. Biotechnology 2nd Year
SEMESTER-III

ENVIRONMENTAL BIOTECHNOLOGY (STUGBT3/C07)

L	T	P
4	0	2

Course Name: Environmental Biotechnology
Course Code: STUGBT3/C07
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

To offer insights on the basic ecological and evolutionary theories and their interrelationships in the environment. Evolution- Definition, scope and history, Darwinian view of life.

Course Description:

This course presents the Study and the Management of the Environment Goals: To make the student to understood Ecology and Conservation of the Environment Objectives: On successful completion of the subject the student should have understood Ecosystem, energy flow and Uses and values of Biodiversity

Course Contents:

Unit 1: Microorganisms and their Habitats: Structure and function of ecosystems; Terrestrial Environment: Soil profile and soil microflora; Aquatic Environment: Microflora of fresh water and marine habitats; Atmosphere: Aeromicroflora and dispersal of microbes; Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body.Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic& osmotic pressures, salinity, & low nutrient levels. Microbial succession in decomposition of plant organic matter

Unit 2: Microbial Interactions: Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism,predation, Microbe-Plant interaction: Symbiotic and non symbiotic interactions. Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic luminescent bacteria

Unit 3: Biogeochemical Cycling: Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin, Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction, Phosphorus cycle: Phosphate immobilization and solubilisation, Sulphur cycle: Microbes involved in sulphur cycle, Other elemental cycles: Iron and manganese

Unit 4: Waste Management: Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill), Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary, sewage treatment

Unit 5: Microbial Bioremediation: Principles and degradation of common pesticides, organic (hydrocarbons, oil spills) and inorganic (metals) matter, biosurfactants.

Course Learning Outcomes:

CLO1. Provides knowledge about basic terminologies used in environmental biotechnology

CLO2. Explain the microbial processes and growth requirements underlying the activated sludge process, nitrification, denitrification, enhanced phosphorus removal, and anaerobic digestion

CLO3. Role of biogeochemical cycle concept and its applications in ecological balance

CLO4.To understand the knowledge of microbial clean up the polluted environmental biotechnology

CLO5. Evaluate the potential for biodegradation of organic pollutants, taking microbial and physical/chemical environments, as well as the chemical structure of the compound itself, into consideration

Text Books

- Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition.Pearson/ Benjamin Cummings
- Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, AcademicPress

Reference Books:

- Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, AcademicPress
- Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA

Web References/ NPTEL:

http://freebookcentre.net/Biology/Ecology-Books.html
www.khanacademy.org
www.biologydiscussion.org

B.Sc. Biotechnology 2nd Year
SEMESTER-III

FERMENTATION TECHNOLOGY (STUGBT3/SEEC1)

L	T	P
2	0	0

Course Name: Fermentation Technology
Course Code: STUGBT3/SEEC1
Course Credit Hour: 2 hrs
Total Contact hour: 30 hrs

Course Objective:

This course introduces various aspects of applied and industrial microbiology. The course helps the students to learn every important upstream and downstream components of fermentation process including strain selection, development, media design, formulation and recovery of products. Additionally, the course can educate the students about fermenter design, different types of fermentations and also the current trend of fermentation process in biotech-industry. Overall, the course helps in the student's exposure on industrial applications of bioprocesses.

Course Description:

To impact knowledge about biological and biochemical technology, with a focus on biological products, the design and operation of industrial practices

Course Contents:

Unit 1: Introduction to Fermentation technology: History, Scope and Development of Fermentation technology; Isolation and screening of industrially important microorganisms − primary and secondary screening; Maintenance of Strains; Strain improvement: Mutant selection and Recombinant DNA technology.

Unit 2: Fermentation media: Natural and Synthetic media; Basic components of an media (Carbon sources; Nitrogen sources; Vitamins; Minerals; Anti-foaming agents); Role of buffers in media; Process of aeration, and agitation.

Unit 3: Fermenter design: Basic designs of Fermenter; Type of fermenters: Wald of, Tower, Deepjet, Cyclone column, Packed tower and airlift fermenter; Scale up study and Product development; Down-stream processing and Product recovery; Regulation and safety.

Unit 4: Production of Microbial Products: Production of alcohol; Organic acid − Citric acid; Antibiotic − Penicillin, Amino acid − Glutamic acid; Vitamin − B1; Single Cell Protein (SCP).

Course Learning Outcomes (CLOs):

CLO1. The students shall get an adequate knowledge on evaluate factors that contribute in enhancement of cell and product formation during fermentation process..
CLO2. Understand the kinetics of cell and product formation in batch, continuous and fed-batch cultures and different types of fermenters.
CLO3. Students should get enough information on Basic designs of Fermenter; Type of fermenters
LO4. Discuss the protocol of the production of alcohol, organic acid, antibiotic, amino acid and other biological materials

Text Books:

- PF Stanbery, A. Whitaker and Steve Hall, Principles of Fermentation Technology, Third Edition, Elesvier (2016), ISBN No. 9781483292915, 1483292916
- M Shuler and F. Kargi, Bioprocess Engineering Basic Concepts, Prentice Hall Press (2015), ISBN No. 9781292025995, 1292025999

Reference Books:

- H C. Vogel and C M. Todaro, Fermentation and Biochemical Engineering Handbook, 2nd Editions, Elesvier (2014), ISBN No. 9780815517139, 0815517130

Online links for study & reference materials:
https://www.khanacademy.org/test-prep/mcat/biomolecules
https://nptel.ac.in/courses/104/105/104105076/

B.Sc. Biotechnology 2nd Year
SEMESTER-III

BIOETHICS, BIOSAFETY AND IPR (STUGBT3/GE3)

L	T	P
4	2	0

Course Name: Bioethics, Biosafety and IPR **Course Code:** STUGBT3/SEC1
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

To apprise the students of the various societal, governance and regulatory issues in biotechnology with special emphasis on ethics, safety and intellectual property rights. Through this course, the students develop a perspective on the importance of these aspects in the success of biotechnology products and services in the market. At the end of the course, they should be able to apply this perspective and the specific principles, laws, regulations etc., in academic and industrial settings for regulatory oversight and enforcement.

Course Description:

This course is mainly focused on the Bioethics, Biosafety and Intellectual Property Rights which includes basic concept of patents, patent regime (in India and abroad) registration aspects and other details.

Course Contents:

Unit 1: Biosafety: Introduction; biosafety issues in biotechnology; Biological Safety Cabinets & their types; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms

Unit 2: Biosafety Guidelines: Biosafety guidelines and regulations (National and International); GMOs/LMOs- Concerns and Challenges; Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of International Agreements - Cartagena Protocol. **AERB/RSD/RES:** Guidelines for using radioisotopes in laboratories and precautions.

Unit 3: Introduction to Intellectual Property: Patents, Types, Trademarks, Copyright & Related Rights, Industrial Design and Rights, Traditional Knowledge, Geographical Indications- importance of IPR – patentable and non patentables – patenting life – legal protection of biotechnological inventions – World Intellectual Property Rights Organization (WIPO).

Unit 4: Grant of Patent and Patenting Authorities: Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; An introduction to Patent Filing Procedures; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies, Rights and Duties of patent owner.

Unit 5: Agreements and Treaties: GATT, TRIPS Agreements; Role of Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty on international recognition of the deposit of microorganisms; UPOV & Brene conventions; Patent Co-operation Treaty (PCT); Indian Patent Act 1970 & recent amendments.

Course Learning Outcomes (CLOs):

CLO1. The students shall get an adequate knowledge on patent and copyright. This provide further way for developing their idea or innovations.
CLO2. Identify the role of regulatory committees in controlling the risk.
CLO3. Students should get enough information on ethical issues linked to research on animal models, transgenics, clinical trials.
CLO4. Students to consider Intellectual Property (IP) as a career option as IP Counsel/Patent Examiner/Patent agent.

Text Books:

- Singh K K (2015). Biotechnology and Intelectual Property Rights: Legal and Social Impliocations, Springer India.
- Senthil Kumar Sadhasivam and Mohammed Jaabir, M. S. 2008. IPR, Biosafety and biotechnology Management. Jasen Publications, Tiruchirappalli, India.

Reference Books:

- Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
- Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
- V Sreekrishna, 2017. Bioethics and Biosafety in Biotechnology by New Age International publishers.

Online links for study & reference materials:
- http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
- https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

B.Sc.. Biotechnology 2nd Year
SEMESTER-IV

MICROBIOLOGY (STUGBT4/C08)

L	T	P
4	0	2

Course Name: Microbiology
Course Credit Hour: 4 hrs

Course Code: STUGBT4/C08
Total Contact hour: 60 hrs

Course Objective:

This course focus on the basis of applied microbiology technology and their techniques. It basically covers the Air microbiology, sewage microbiology, water microbiology etc. It also covers the scope and importance of sources of contamination of milk, desirable and undesirable changes in milk, milk borne diseases, Microbial examination of water, Water borne diseases etc.

Course Description:

Microbiology course involves the study of microorganisms with particular emphasis on the biology of bacteria, viruses, fungi and protozoan parasites. You will also cover aspects of the biochemistry, physiology and genetics of microorganisms. Introduction to Microbiology is appropriate for students with some background in biology and chemistry whose career path intersects the study of microbes or simply have an interest in microbiology. This course introduces the basic principles of microbiology examining the microbes that inhabit our planet and their effect on the biosphere. Introduction to Microbiology explores this impact through the lens of all areas of microbiology.

Course Contents:

Unit 1: Historical developments: Discovery of microorganisms, Spontaneous Generation Controversy, Germ theory of fermentation, Germ theory of disease.

Unit 2: Air Microbiology: Definition and composition of air, sources of microorganisms in air, significance of microorganisms in air, droplet, droplet nuclei and droplet infection, air borne diseases, enumeration of microorganisms in air, control of microorganisms in air, air pollution.

Unit 3: Water Microbiology: Types of water, Sources of microorganisms in water, Significance of microorganisms in water, Fecal contamination of water, Index of water pollution, Different indicator microorganisms, Coliform bacteria, Microbial examination of water, Water borne diseases

Unit 4: Sewage Microbiology: Definition of sewage, composition and strength of sewage (BOD and COD), Microbiology of sewage, Domestic sewage treatment, Municipal sewage treatment, Water purification, Water reclamation.

Unit 5: Milk Microbiology: Definition and composition of milk, sources of contamination of milk, desirable and undesirable changes in milk, milk borne diseases, bacteriological examination of milk, reductase test, pasteurization of milk, application of microorganisms in dairy industry (examples and microflora).

Course Learning Outcomes: (CLOs):

CLO1. History of air microbiology and significance of microorganisms in air, water, sewage and soil.
CLO2. Micro-organisms in natural food products and their control.
CLO3. Scope and importance of Microbial examination of air, water and soil.
CLO4. Introduction to Water purification, Water reclamation.
CLO5. Objectives, importance and functions of Milk quality and milk borne diseases.

Text Books:

- Air Microbiology An environment And Health Prospective by Aithal, Wakte & Manwar. Cinnamonteal print and publishing Margao, Goa-403601
- Fundamental principles of bacteriology by A.J. Salle.

Reference Books:

- Fundamentals of Microbiology by Martin Frobisher
- General Microbiology by Stanier. Ingraham, Wheelis, Painter: Macmillan Press Ltd.

Online links for study & reference materials:
www.microbiologysummit.com
https://biopharmaceutics.pharmaceuticalconferences.com

B.Sc.. Biotechnology 2nd Year
SEMESTER-IV

FOOD TECHNOLOGY & BIOPROCESS TECHNOLOGY (STUGBT4/C09)

L	T	P
4	0	2

Course Name: Food and bioprocess technology
Course Code: STUGBT4/C09
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

This course focus on the basis of bioprocess technology and their techniques. It basically covers the spoilage of food stuffs and food processing. It also covers the scope and importance of packaging and functions of quality control, the essential prerequisites for preservation of food stuffs and preserving techniques.

Course Description:

Food Technology is a science branch that deals with the techniques involved in production, processing, preservation, packaging, labeling, quality management, and distribution of food products. To impart knowledge on different configurations of bioreactors, optimization and fermentation process control, which are required for novel bioprocess applications such as in food, environment, pharmaceutics and tissue culture systems.

Course Contents:

Unit 1: Foods as a substrate for microorganisms: Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general.

Unit 2: Microbial spoilage of various foods: Principles, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods. Food sanitation and control: HACCP, Indices of food sanitary quality and sanitizers

Unit 3: Principles and methods of food preservation: Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO2, nitrite and nitrates, ethylene, oxide, antibiotics and bacteriocins.

Unit 4: Fermented foods: Dairy starter cultures, fermented dairy products: yogurt, acidophilus milk, kumiss, kefir, dahi and cheese, other fermented foods: dosa, sauerkraut, soy sauce and tampeh, Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market.

Unit 5: Food borne diseases (causative agents, foods involved, symptoms and preventive measures): Food intoxications: *Staphylococcus aureus*, *Clostridium botulinum* and mycotoxins; Food infections: *Bacillus cereus*, *Vibrio parahaemolyticus*, *Escherichia coli*, *Salmonellosis*, *Shigellosis*, *Yersinia enterocolitica*, *Listeria monocytogenes* and *Campylobacter jejuni*. Cultural and rapid detection methods of food borne pathogens in foods.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic background of microbiology of food stuffs.
CLO2. Discuss the Micro-organisms in natural food products and their control.
CLO3. Describe the Basic Scope and importance of food processing.
CLO4. Explain the basic concept of food packaging.
CLO5. Discuss the basic concept of food intoxications and infections. Explain the cultural and rapid detection methods of food borne pathogens in foods.

Text Books:

- Neeser JR & German BJ. 2004. Bioprocesses and Biotechnology for Nutraceuticals.
- Chapman & Hall. Robert EC. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed.
- Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional,London.

Reference Books:

- Wildman. Shi J. (Ed.). 2006. Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC Press.
- Webb GP. 2006. Dietary Supplements and Functional Foods. Blackwell Publisher.
- Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBSPublishers and Distributors, Delhi, India.

Online links for study & reference materials:
www.bioprocessingsummit.com
https://biopharmaceutics.pharmaceuticalconferences.com

B.Sc.. Biotechnology 2nd Year
SEMESTER-IV

BASICS OF GENETIC ENGINEERING (STUGBT4/C10)

L	T	P
4	0	2

Course Name: Basics of **Genetic Engineering**
Course Code: STUGBT4/C10
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of genetic engineering. This course will make the students familiar about the translation machinery and concept of r-DNA technology and their application in advanced research.

Course Description:

This course is mainly focused on the basic concept of genetic engineering which includes basic knowledge in the area of molecular biology and recombinant DNA technology. The student would be able to understand the working details of the cloning of a gene. They would also be able to assimilate recent research findings, advancement and development in the relevant subject.

Course Contents:

Unit 1: Molecular Tools: Restriction Enzymes: Types I, II and III; Linkers and adaptors; Sites of cleavage (Isoschizomers, neoschizomers; and isocaudomers); DNA modifying enzymes; End-modifying enzymes and theirapplications.

Unit 2: Vectors: properties of vectors; Plasmid vectors; Viral vectors; Cosmids; Fosmids; YAC; PAC; shuttle vectors. Vectors for plants and Animals.

Unit 3: Recombinant Screening: Selection of transformed cells; DNA introduction into host cells- bacterial cell (chemical method and electroporation) and plant cell (Direct gene transfer and vector mediated gene transfer); in animals (transduction and transfection).

Unit 4: Polymerase chain reaction: Primer designing; Reaction cycles; Modifications to PCR techniques (Asymmetric PCR, RT-PCR, Quantitative Real time PCR, Inverse PCR, RACE, RAPD, AFLP.

Unit 5: Genetic Engineering in Animals: Primary and secondary cultures; cell lines; Culture media; Growth patterns. Applications of animal cell culture. **Genetic Engineering in Plants**: Gene transfer strategies; Ti plasmid; Strategies for production of transgenic plants; Applications; Molecular farming.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept of molecular tool such as restriction enzyme and its application.
CLO2. Discuss the concept of Plasmid vectors; Viral vectors; Cosmids; Fosmids; YAC; PAC; shuttle vectors
CLO3. Describe the preparation of transformed cells; DNA introduction into host cells-bacterial cell (chemical method and electroporation) and plant cell (Direct gene transfer and vector mediated gene transfer)
CLO4. Explain the major PCR techniques.
CLO5. Discuss the basic concept of genetic engineering n Animal and Plant cells.

Text Books:

- Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
- Watson JD, Baker TA, Bell SP et al. (2008) Molecular Biology of the Gene, 6th Ed., Benjamin Cummings
- Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India

Reference Books:

- Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings
- Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
- Maloy SR, Cronan JE and Friefelder D(2004) Microbial Genetics 2nd EDITION., Jones and Barlett Publishers

Online links for study & reference materials:
https://learn.genetics.utah.edu/
https://ocw.mit.edu/courses/biology/7-03-genetics-fall-2004/

B.Sc.. Biotechnology 2nd Year
SEMESTER-IV

BASICS OF FORENSIC SCIENCES (DNA) (STUGBT4/ SEEC2)

L	T	P
2	0	0

Course Name: Basics of Forensic Sciences (DNA)
Course Credit Hour: 2 hrs
Course Code: STUGBT4/SEEC2
Total Contact hour: 40 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of DNA forensic sciences. This course will make the students familiar about the general information about forensic sciences focused on DNA based methods and their application in forensic research.

Course Description:

This course is mainly focused on the basic concept of forensic sciences which includes basic knowledge in the area of molecular biology techniques and associated tools. The student would be able to understand the working details of the biological blueprint of life. They would also be able to assimilate recent research findings, advancement and development in the relevant subject.

Course Contents:

Unit 1: History of Development of Forensic Science in India: Functions of forensic science. Historical aspects of forensic science. Definitions and concepts in forensic science. Scope of forensic science. Need of forensic science. Basic principles of forensic science. Frye case and Daubert standard

Unit 2: Organizational set up of Forensic Science Laboratories in India: Hierarchical set up of Central Forensic Science Laboratories, State Forensic Science Laboratories, Fingerprint Bureaus, Basic services and optional services.

Unit 3: Basic Principles DNA as biological blueprint of life. Extraction of DNA for analysis. Quantitation of DNA – yield gel quantitation and slot blot quantitation. Forensic DNA Typing Collection of specimens. Polymerase chain reaction – historical perspective, sequence polymorphisms, individualization of evidence.

Unit 4: DNA forensic science: Instrumentation Sample preparation for chromatographic and spectroscopic evidence. Chromatographic methods. Fundamental principles and forensic applications of thin layer chromatography, gas chromatography and liquid chromatography.

Unit 5: Spectroscopic methods. Fundamental principles and forensic applications of Ultravioletvisible spectroscopy. Colorimetric analysis and Lambert-Beer law.

Course Learning Outcomes (CLOs):

CLO1. Understand the fundamental principles, functions and significance of forensic science to human society.
CLO2. Describe the organizational set up of Forensic Science Laboratories in India.
CLO3. Describe the collection method of specimens, isolation of DNA from different specimens, and amplification of DNA using PCR.
CLO4. Explain the basic tools used in DNA forensic science.
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Text Books:

- Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
- Watson JD, Baker TA, Bell SP et al. (2008) Molecular Biology of the Gene, 6th Ed., Benjamin Cummings
- Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India

Reference Books:

- Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings
- Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
- Maloy SR, Cronan JE and Friefelder D(2004) Microbial Genetics 2nd EDITION., Jones and Barlett Publishers

Online links for study & reference materials:
https://learn.genetics.utah.edu/
https://ocw.mit.edu/courses/biology/7-03-genetics-fall-2004/

B.Sc.. Biotechnology 2nd Year
SEMESTER-IV

PLANT PATHOLOGY (STUGBT4/SEC2)

L	T	P
4	0	2

Course Name: Plant Pathology
Course Code: STUGBT4/SEC2
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of Plant Pathology. This course will introduce the students with basic concept of plant disease- definitions of disease, disease cycle & pathogenicity, symptoms associated with microbial plant diseases.

Course Description:
This course is mainly focused on the host pathogen interaction. A study of the nature and causes of disease in plants, emphasizing the principal diseases in India. Practical hands on training for identification of disease symptoms at earliest stage. Making students aware about the ambience plants and related diseases and treatment if any, especially biological control.

Course Contents:

Unit 1: Introduction and History of plant pathology: Concept of plant disease- definitions of disease, disease cycle & pathogenicity, symptoms associated with microbial plant diseases, types of plant pathogens, economic losses and social impact of plant diseases. Significant landmarks in the field of plant pathology- Contributions of Anton DeBary, Millardet, Burrill, E. Smith, Adolph Mayer, Ivanowski, Diener, Stakman, H.H. Flor, Van Der Plank, molecular Koch's postulates. Contributions of eminent Indian plant pathologists.

Unit 2: Stages in development of a disease: Infection, invasion, colonization, dissemination of pathogens and perennation.

Unit 3: Plant disease epidemiology: Concepts of monocyclic, polycyclic and polyetic diseases, disease triangle & disease pyramid, forecasting of plant diseases and its relevance in Indian context.

Unit 4: Host Pathogen Interaction: A. Microbial Pathogenicity Virulence factors of pathogens: enzymes, toxins (host specific and non-specific) growth regulators, virulence factors in viruses (replicase, coat protein, silencing suppressors) in disease development. Effects of pathogens on host physiological processes (photosynthesis, respiration, cell membrane permeability, translocation of water and nutrients, plant growth and reproduction).

Unit 5: Control of Plant Diseases: Principles & practices involved in the management of plant diseases by different methods, viz. regulatory - quarantine, crop certification, avoidance of pathogen, use of pathogen free propagative material cultural - host eradication, crop rotation, sanitation, polyethylene traps and mulches chemical - protectants and systemic fungicides, antibiotics, resistance of pathogens to chemicals.

Unit VI: Specific Plant diseases: Study of some important plant diseases giving emphasis on its etiological agent, symptoms, epidemiology and control. Cucuta, Loranthuus, Orobanche and striga.

Course Learning Outcomes (CLOs):

CLO1. To introduce concepts and principles of plant pathology
CLO2. To acquaint with different strategies for management of plant diseases
CLO3. To acquaint with different strategies for management of higher yield from healthy soil.
CLO4. To impart knowledge on detection and diagnosis of plant diseases and their management.
CLO5. To study principles and application of ecofriendly and sustainable management strategies of plant diseases.

Text Books:

- Lucas JA. (1998). Plant Pathology and Plant Pathogens. 3rd edition. Blackwell Science, Oxford.
- Mehrotra RS. (1994). Plant Pathology. Tata McGraw-Hill Limited.

Reference Books:

- Agrios GN. (2006). Plant Pathology. 5th edition. Academic press, San Diego,

Online links for study & reference materials:
http://ecoursesonline.iasri.res.in/
https://phytopath.ca/education/websites/
https://bsppjournals.onlinelibrary.wiley.com/journal/13653059

B.Sc.. Biotechnology 3rd Year
SEMESTER-V

PRINCIPLE OF GENOMICS AND PROTEOMICS (STUGBT5/C11)

L	T	P
4	2	0

Course Name: Principle of Genomics and Proteomics **Course Code:** STUGBT5/C11
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of Genomics and Proteomics. It also aims to familiarize them with the developments in the experimental approaches used by researchers to understand the complexity and diversity of genomes. Recent advances in genomics have transformed the way in which biologists study cells and biological systems. Furthermore, this course also provides knowledge of the use of high throughput techniques to study the entire range of proteins present in any cell/tissue/organism under specific conditions, to obtain a global view of cellular processes at the protein level.

Course Description:
This course is mainly focused on the Genomics and Proteomics and discuss the basic concept of genomics, such as origin, evolution and application of genomics and proteomics. This course also focuses to elaborates the Genomic and Proteomics techniques; from basic to advance level. It covers basic understanding of Genomics, Annotation of whole genome sequence & functional genomics, Pharmacogenomics and Proteomics.

Course Contents:

Unit 1: Origin and Evolution of genomics: Study and Scope: Introduction, definition concepts and approaches of proteomics studies and activities. Origin of genomics, the first DNA genomes, microsatellite and SCOT, DNA based phylogenetic trees, genomes and human evolution, evolution of nuclear and organelle (mitochondrial and Chloroplast genome), Anticipated Benefits of Genome Research

Unit 2: Molecular maps of genomes and comparative genomics: Genetic maps, physical maps, EST and transcript maps, functional maps, comparative genomics and collinearity/synteny in maps.

Unit 3: Whole Genome sequencing: Whole genome shotgun sequencing, clone-by-clone or 'hierarchical shotgun' sequencing, microbial genomes, plant genomes and animal genomes.

Unit 4: Annotation of whole genome sequence and functional genomics: *In silico* methods, insertion mutagenesis (T-DNA and transport insertion), EST contigs and unigene sets, use of DNA chips and microarrays.

Unit 5: Pharmacogenomics: Use in biomedicine involving diagnosis and treatment of diseases, genomics in medical practice, personalized medicine, DNA polymorphism and treatment of diseases, use of SNP in pharmacogenomics, pharmacogenomics and industry.

Course Learning Outcomes (CLOs):

CLO1. Gain an understanding of the basic concepts of genomics and its scope.
CLO2. Outline the fundamental of DNA based phylogenetic trees.
CLO3. Discuss the Annotation of whole genome sequence and functional genomics.
CLO4. Describe the basic concepts of pharmacogenomics and its future prospective.
CLO5. Explain the fundamentals of proteomics and advance molecular biology techniques.

Text Books:

- Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Campbell AM & Heyer LJ, Benjamin Cummings 2007; CSH Press, NY.
- Introduction to Proteomics: Tools for the New Biology. Daniel C. Liebler, 2002 Humana Press Inc.
- Primrose SB and Twyman RM. Genomics: Applications in human biology. Blackwell Publishing, 2008 Oxford, U.K

Reference Books:

- Genome III – T.A. Brown Garland Science Publ. June 08, 2006
- Bioinformatics and Functional Genomics – Jonathan Pevsner - 2nd edition, Wiley-Blackwell, 2009.
- Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press

Online links for study & reference materials:

http://www.genomenewsnetwork.org/resources
http://www.pss.co.jp/english/sc_bio/contents4.html
http://www.premierbiosoft.com/tech_notes/microarray.html

B.Sc.. Biotechnology 3rd Year
SEMESTER-V

ELEMENTARY MOLECULAR BIOLOGY (STUGBT5/C12)

L	T	P
4	0	2

Course Name: Elementary Molecular Biology
Course Credit Hour: 4 hrs

Course Code: STUGBT5/C12
Total Contact hour: 60 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of Molecular Biology. This course will introduce the students with basic and advanced knowledge of molecular biology such as understand molecular Biological processes like DNA replication, transcription, repair systems and other relevant topics.

Course Description:

This course is mainly focused on the Elementary Molecular Biology which will provide the technical details and use of different gene expression systems for overexpression of recombinant proteins and protein complexes for different applications. The course will also provide details about the purification of proteins expressed in different expression systems..

Course Contents:

Unit 1: Molecular of Life: An introduction experimental proof of DNA and RNA as genetic Material, Nucleic Acids, Structure and function of DNA and RNA, Watson and Crick model of DNA and other forms of DNA (A and Z), Functions of DNA and RNA including ribosome's.

Unit 2: DNA Replication: Prokaryotic and Eukaryotic-Enzymes and proteins involved in replication, Theta model and Rolling circle model. Mechanism of DNA replication, replication origin and replication fork, DNA repair

Unit 3: DNA Repair: Causes and mechanism –photo reactivation, excision repair, mismatch repair, SOS repair. Recombination in prokaryotes, Transformations, Conjugation and Transduction. Wobble hypothesis.

Unit 4: Transcription and Translation: Transcription in Prokaryotes and Eukaryotes, Mechanism, promoters and RNA polymerase, transcription factors, post transcriptional, modifications a eukaryotic mRNA. Translation: Mechanism of translation in Prokaryotes and

Eukaryotes. Ribosomes, mechanism of translation, post translational modification, translational inhibitors, and genetic code.

Unit 5: Regulation of Gene expression: Regulation of Gene expression in Prokaryotes-Person concept (Lac and Trip), Regulation of Gene expression in Eukaryotes –transcriptional activation. Transposable elements in Maize and Drosophila, gene silencing.

Course Learning Outcomes (CLOs):

CLO1. Students who study the molecular biology re able to understand the central dogma

CLO2. Students who earn the plant pathology minor will integrate plant pathology principles into the understanding of their major discipline(s) through the study of agronomic diseases, horticultural diseases, turf diseases, entomology, applied microbiology, biotechnology and other relevant career fields**.**

CLO3. To learn to observe how mutation can cause the change in gene expression

CLO4. To learn various agents of DNA mutation and its repair

CLO5. Discuss the basic concept of Gene expression in Prokaryotes-Person concept (Lac and Trip), Regulation of Gene expression in Eukaryotes.

Text Books:

- Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
- Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009) The World of the Cell, 7th edition, Pearson Benjamin Cummings Publishing, San Francisco

Reference Books:

- De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia
- Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.

Online links for study & reference materials:
https:// Biologynotes.com
https:// Easy biology class.com/

B.Sc.. Biotechnology 3rd Year
SEMESTER-V

PLANT BIOTECHNOLOGY (STUGBT5/DSC1)

L	T	P
4	0	2

Course Name: Plant Biotechnology **Course Code:** STUGBT5/DSC1
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The goal of this course is to introduce biotechnology methods in plants. The objective of the course is to give students new knowledge and widening of the knowledge acquired in other course by handling of classical and modern plant biotechnology processes, including breeding of healthy plants, plants with improved characteristics and plants for biomolecule production.

Course Description:

This course offers the train the students in techniques used in plant breeding and understanding of biotechnological processes that have applicative value in pharmaceutical and food industry, in agriculture and in ecology. Apart from organogenesis and embryogenesis of plants this course focus also explains the various methods of gene transfer in plants and production of transgenic plants for crop improvement and commercial purposes.

Course Contents:

Unit I: Introduction: Introduction to Plant Biotechnology and Plant Breeding, Methods used in plant breeding.

Unit II: Organogenesis & Embryogenesis: Micropropagation: bud, shoot tip and meristem culture. Haploids: their production &applications, Somaclonal variations and their applications. Practical applications and examples of tissue and organ culture. Somatic Embryogenesis and its practical applications. Single cell suspension culture and their applications in selection of variants/mutants with or without mutagen treatment.

Unit III: Delivery System for Gene Transfer in Pants: Direct delivery of genes, viz. electroporation, microprojectile transformation, Vector mediated gene transfer in plants. Introduction to *Agrobacterium* Tumour formation on plants using *Agrobacterium tumifaciens.* Root-formation using *Agrobacterium rhizogenes.* Practical application of genetic transformation.

Unit IV: Production &Practical applications of Transgenic Plants: Production of human therapeutics & edible vaccines, production of herbicides and insecticide resistance, insect resistance, virus resistance, drought and salinity resistance plants, concepts and application of molecular farming.

Unit V: Genetic modification in Food industry: background, history, controversies over risks, future applications.

Course Learning Outcomes (CLOs):
After successful completion of the course the students:

CLO 1: will be able to explain plant breeding techniques and role of biotechnology in plant breeding.
CLO 2: can describe the methods and concept behind micropropagation of buds and shoots, somaclonal variation, tissue and organ culture, applications, somatic embryo genesis and their applications
CLO 3: use basic biotechnological techniques to explore molecular biology of plants. understand the processes involved in the planning, conduct and execution of plant biotechnology experiments. Production of transgenic crops- its merits and de-merits.
CLO 4: will have knowledge pertaining to plant based human therapeutics like edible vaccines, production of plants with herbicide, insecticide resistance, virus and draught resistance and molecular farming concepts and applications
CLO 5: can discuss the effect of genetic modifications on the food industry, its history, current controversies and risks and future applications.

Text Books:

- Chrispeels M.J., Sadava D.E. Plants, Genes and Crop Biotechnology, 2nd edition, Jones and Bartlett Publishers, ISBN: 0763715867
- Sarad R.Parekh (ed.). The GMO Handbook, Genetically Modified Animals, Microbes, and Plants in Biotechnology, Humana Press, ISBN: 1588293076.

Reference Books:

- Razdan M.K. Introduction to Plant Tissue Culture. 2nd edition Science Publishers Inc, ISBN: 1578082374.
- Heldt H.W. Plant Biochemistry and Molecular Biology, Oxford University Press, ISBN: 0198501803.
- Buchanan B.B., Gruissem W., Jones L.R. Biochemistry and Molecular Biology of Plants., 1 st edition, American Society of Plant Physiologists, ISBN: 0943088372.

Online links for study and reference materials:
1. https://nptel.ac.in/courses/102/103/102103016/

B.Sc.. Biotechnology 3rd Year
SEMESTER-V

ANIMAL BIOTECHNOLOGY (STUGBT5/DSC2)

L	T	P
4	0	2

Course Name: Animal Biotechnology **Course Code:** STUGBT5/DSC2
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The primary objective of the course is to provide students with the knowledge pertaining to techniques required for the generation of transgenic animals. Basic understanding of transgenic animals, their application and ethical issues pertaining the process of trans-genesis.

Course Description:

This course is a core subject of biotechnology undergrads and therefore will illustrate about methods that help in gene transfer in animals, scientifically and economically important transgenic animals- their production, application and drawbacks. Role of biotechnology in treating various diseases that affect animals. This course will also provide information to students about techniques used for animal propagation and conservation biology. And lastly it will provide appropriate knowledge regarding genetic modification in medicine.

Course Contents:

Unit I: Gene transfer methods in Animals: Microinjection, Embryonic Stem cell gene transfer, Retrovirus & Gene transfer.

Unit II: Transgenic Animals and Animal propagation: Mice, Cow, Pig, Sheep, Goat, Bird, Insects. Artificial insemination, Animal Clones

Unit III: Animal diseases need help of Biotechnology: Foot-and-mouth disease, Coccidiosis, Trypanosomiasis, Theileriosis.

Unit IV: Conservation Biology: Embryo transfer techniques, Cryopreservation and transport of animal germplasm (i.e. semen, ova and embryos).

Unit V: Genetic modification in Medicine: Gene therapy, types of gene therapy, vectors in gene therapy, molecular engineering, human genetic engineering, problems & ethics.

Course Learning Outcomes (CLOs):
Successful students will be able to:

CLO 1: explain the various techniques used for gene transfer in animals their advantages and disadvantages, and difference between these techniques.

CLO 2: describe transgenic animals-their production, application of various established transgenic animals like mice, sheep, pig, fish, etc.

CLO 3: identify, diagnose, and know the treatment of various animal diseases and elucidate the role of biotechnology in management of these diseases.

CLO 4: describe techniques of animal propagation like artificial insemination, animal cloning, cryopreservation and maintenance and transport of animal germplasm to facilitate animal conservation.

CLO 5: discuss the role of biotechnology by gene therapy- its types, vectors used in gene therapy, molecular engineering, human genetic engineering, problems & ethics of human genetic engineering.

Text Books:
- B Singh, Textbook of Animal Biotechnology, 1st Edition, Energy and Resources Institute (TERI), 9788179933275, 817993327X (2013).
- MM Ranga, Animal Biotechnology, 3rd edition, Agrobios, 9788177543094, 8177543091 (2010).

Reference Books:
- Ashish Verma, Anchal Singh, Animal Biotechnology 1st Edition, Elsevier, 9780128117101, 0128117109, (2019).

Online links for study and reference materials:
1. https://nptel.ac.in/courses/102/103/102103013/#
2. www.ncbi.nlm.gov

NOIDA INTERNATIONAL UNIVERSITY

B.Sc.. Biotechnology 3rd Year
SEMESTER-VI

NANOTECHNOLOGY (STUGBT6/C13)

L	T	P
4	0	2

Course Name: Nanotechnology
Course Code: STUGBT6/C13
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

This course is designed to make students understand the intersection of nanotechnology and biology. It will also acquaint students with Nano devices of biomedical applications. Students will know about the use of nanotechnology in diagnostic biology and learn about the health and environmental impacts of nanotechnology.

Course Description:

This course is mainly focused on the nanotechnology which is an interdisciplinary and emerging area. The students are taught the basics of nanotechnology and their applications. The course introduces the students to the new and novel applications to solve biomedical problems through nanotechnology.

Course Contents:

Unit I: Introduction: The ascale dimension and paradigm. Definitions and historical evolution (colloids etc.) and current practice.

Unit II: Types of nanomaterials and their classifications (1D, 2D and 3D etc. Nanocrystal, Nanoparticle, Quantum dot, Quantum Wire and Quantum Well etc).

Unit III: Polymer, Carbon, Inorganic, Organic and Biomaterials – Structures and characteristics.

Unit IV: Physical, Chemical and Biological Fundamentals of Nanomaterials.

Unit V: Overview of synthetic methods Surfactants, polymers, emulsions. Micelles/reverse micelles and colloids Top-down and bottom up approaches Biological Methods Growth and stabilization Self-assembly.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept and application of ascale dimension and paradigm.
CLO2. Discuss the different types of nanomaterials and their classifications.
CLO3. Describe the basic characteristics of Polymer, Carbon, Inorganic, Organic and Biomaterials.
CLO4. Explain the Physical, Chemical and Biological Fundamentals of Nanomaterials.
CLO5. Discuss the basic concept of synthetic methods Surfactants, polymers, emulsions. Micelles/reverse micelles and colloids Top-down and bottom up approaches Biological Methods Growth and stabilization Self-assembly.

Text Books:

- Introduction to Nanoscience and Nanotechnology, Chris Binns, 2010, Wiley, ISBN: 978-0471776475
- Introduction to Nanoscience, Stuart Lindsay, 2009, Oxford University Press, ISBN: 978-0199544219

Reference Books:

- Text book of Nanoscience and nanotechnology by Murthy, Shankar, raj, University press.
- Principles of Nanoscience and nanotechnology by MA Shah, Tokeer Ahmed

Online links for study & reference materials:
http://ethics.iit.edu/NanoEthicsBank/
https://www.nano.gov/nanotech-101/what/definition
http://web.mit.edu/research/topic/nano.html

B.Sc.. Biotechnology 3rd Year
SEMESTER-VI

ENTREPRENEURSHIP (STUGBT6/C14)

L	T	P
4	2	0

Course Name: Entrepreneurship
Course Code: STUGBT6/C14
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

This course focus on the basis of Skills of bio-entrepreneur and biotechnology entrepreneurship. It basically covers the patenting, licensing and partnership in biotechnology industry It also covers the scope and importance of product development in biotech industries. It also includes about the marketing of the desired pharmaceutical drug.

Course Description:

This is a course to introduce the student to understanding creative abilities, recognizing their creative abilities, changing their way of viewing creativity, understanding who they are as a creative person, promoting innovation in themselves and others, and demonstrating productive thinking.

Course Contents:

Unit 1: Introduction: Basic definition, history and scope of Biotechnology Entrepreneurship

Unit 2: Biotechnology Marketing & Companies 1: Biotechnology in capital market; Initial Public Offering (IPO) in the capital market; examples of success and failure of biotechnology companies and the possible reasons; factors that influence success of company; product selection; failure of the product ;

Unit 3: Biotechnology Marketing & Companies II: Product development ; R&D with expertise ; cost of product development. Mergers and acquisitions of biotechnology companies: Celera Genomica and Axys Pharmaceutical; Monsanto and other companies (use other examples).

Unit 4: Patenting, licensing and partnership in biotechnology industry: Patents on biological inventions, licensing revenue, selection of right partner; negotiations of the terms of the terms of the deal.

Unit 5: Entrepreneurship Skills: Entrepreneurship Skills of bio-entrepreneur, bio-entrepreneurial training; research experience, creativity, communication skills and other attributes; participation in conferences, training and educational courses; institutes offering entrepreneurship courses.

Course Learning Outcomes (CLOs):

CLO1. Discuss the basic introduction of biotechnology entrepreneurship.
CLO2. Discuss the Biotechnology Marketing & industries.
CLO3. Describe the basic knowledge patenting, licensing and partnership in biotechnology industry.
CLO4. Explain the Major Entrepreneurship Skills.
CLO5. Discuss the Training, entrepreneurship courses, educational courses offered by various institutes.

Text Books:

- Entrepreneuship by P.F. Stanbury, W. Whitaker &S.J. Hall, Aditya Books (P) Ltd., New Delhi, 1997.
- Biotech Entrepreneur-to-Entrepreneur: http://www.bioe2e.org

Reference Books:

- Startup junkies http://www.startupjunkies.org/research.html by N. Okafer, Scientific Publishers, Enfield, USA., 2017.
- Biopreneur serves as a focal point for bringing together scientists, Businesspeople and investors, 2019

Online links for study & reference materials:

http://www.biopreneur.org/biotech-investment.htm
http://www.bioenterprise.com/assets/entrepreneurguide.pdf
http://www.bioe2e.org

B.Sc.. Biotechnology 3rd Year
SEMESTER-VI

PARASITOLOGY (STUGBT6/DSC3)

L	T	P
4	2	0

Course Name: Parasitology
Course Credit Hour: 4 hrs
Course Code: STUGBT6/DSC3
Total Contact hour: 60 hrs

Course Objective:

This course will enable students to acquire knowledge on the fundamentals of Parasitology. It enables them to understand emerging and advanced concept in host pathogen interaction and this course also focuses on the host parasite interaction which include etiology, pathogenicity, life cycle, lab diagnosis and treatment. This program will facilitate the students to acquire knowledge in fields various aspects and molecular tools used in clinical application in alleviation of human disease.

Course Description:

This course is mainly focused to understand emerging and advanced concept in molecular pathogenesis of disease and role of biotechnology in diagnosis, prevention and therapeutics. An understanding of the basic biology and life cycles of human parasites; human parasitic infections, including epidemiology, clinical features, laboratory diagnosis, treatment and prevention.

Course Contents:

Unit 1: Introduction: Parasites, Classification of Parasites, Host, Types of host, Relationships between host and parasites

Unit 2: Protozoa: (introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment) Entamoeba, Giardia, Plasmodium, Leishmania, Trypanosoma

Unit 3: Platyhelminthes: (Introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment) Taenia, Echinococcus

Unit 4: Nemathelminthes: (introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment) Ascaris, Ancylostoma, Necator, Enterobius, Wuchereria

Unit 5: Lab Diagnosis: Different specimens of parasitology, Collection & transportation. Processing of parasitological specimens

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept Parasitology and its importance.
CLO2. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of protozoan parasite.
CLO3. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of Platyhelminthes.
CLO4. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of Nemathelminthes.
CLO5. Explain the method for collection and processing of parasitological specimens.

Text Books:

- Textbook of Microbiology' by CP Baveja, 2nd edition, 1998, Arya longman Pvt. Ltd
- Textbook of Medical Lab Technology' 2010, by Praful Godkar
- Text book of Medical Laboratory' by Satish Gupta, Edition - latest, 2006, J.P. Bros.

Reference Books:

- Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.
- Medical parasitology' by Chatarjee, 3th edition
- Medical Microbiology and Immunology' by Warren Levinson, eighth Edition, Lange Medical books/ McGraw-Hill Publication

Online links for study & reference materials:

https://www.cdc.gov/parasites/about.html
http://www.onlinebiologynotes.com/
http://www.biologydiscussion.com/parasites/classification-of-parasites-parasitology/62036

B.Sc.. Biotechnology 3rd Year
SEMESTER-VI

TRANSCRIPTOMICS AND METABOLOMICS (STUGBT6/DSC3)

L	T	P
4	2	0

Course Name: Basics of Immunology
Course Code: STUGBT6/DSC3
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

The primary objective of this course is to develop knowledge on the basics of omics and their versatile applications as well as integration of omics approaches for improvement of life. This subject will help in the development of technical skills and knowledge on versatile techniques in Omics.

Course Description:

An introduction to workflows for the resolution and characterization of complex mixtures of biomolecules, from DNA to small molecule metabolites. The course will emphasize the potential and challenges of omic approaches and will include data handling tasks and demonstration

Course Contents:

Unit 1: Gene, Genome and Genomics: Online genomics databases and tools. Standalone bioinformatics analysis of genomic data. Applications of genomics.

Unit 2: Proteomics: Aims, strategies and methods. Bioinformatics tools in proteomics. Application of proteomics. Proteomics technologies: 2D-electrophoresis, MALDI-TOF mass spectrometry, yeast 2-hybrid system. Protein-protein interactions: experimental and computational methods, databases.

Unit 3: Proteomics and Generation of Interactomics: High-throughput proteomics, Construction of interactomics, Bioinformatics and data visualization software for proteomics

Unit 4: Transcriptomics: Microarrays, EST, SAGE. Bioinformatical methods in transcriptomics. Application of transcriptomics

Unit 5: Metabolomics: Technologies in metabolomics, Nutrigenomics, Other omics, Nuclear Magnetic Resonance Spectroscopy and Mass Spectrometry in metabolomics.

Course Learning Outcomes:

By the end of this course students will be able to:

CO1: Critically discuss information flow in biology, and evaluate the benefits of the different levels of omic data collection; discuss challenges to omic data collection;

CO2: Evaluate strategies to characterize a genome/transcriptome/proteome/metabolome;

CO3: Compare and contrast data from different "-omic" data collection approaches (genomics, transcriptomics, proteomics, metabolomics).

CO4: Identify appropriate applications for different omic approaches and Design an experimental strategy to exploit an omic analysis

CO5: Critically discuss the importance of controls and validation in 'omics strategies

Text Books:

- Barh D, Azevedo V, Omics Technologies and Bio-engineering: Towards Improving Quality of Life, Academic Press, ISBN: 9780128158708, 0128158700
- Wittmann, C, Lee SY, Systems Metabolic Engineering, Springer Science & Business Media, ISBN: 9789400745346, 9400745346
- Dunkler D, Sánchez-Cabo F, Heinze G. Statistical Analysis Principles for Omics Data. Methods in Molecular Biology. Totowa, NJ: Humana Press; 2011.

Reference Books:

- Pevsner J, Bioinformatics and Functional Genomics, Wiley-Blackwell , ISBN: 978-81-265-3834-8
- Kihara, D, Protein Function Prediction for Omics Era, Springer Science & Business Media, ISBN: 9789400708815, 9400708815
- Microbial Proteomics: Functional Biology of Whole Organisms by Ian Humphery-Smith and Michael Hecker (2006) Publisher: Wiley-Interscience; 1st edition ISBN-10: 0471699756, ISBN-13: 978-0471699750
- Microbial Genomics and Drug Discovery by Thomas J. Dougherty and Steven J. Projan(2003) Publisher: CRC; 1st ed. ISBN-10: 0824740416, ISBN-13: 978-0824740412

Online links for study & reference materials:
https://www.khanacademy.org/
https://nptel.ac.in/

B.Sc.. Biotechnology 3rd Year
SEMESTER-VI

CLINICAL RESEARCH (STUGBT6/DSC4)

L	T	P
4	2	0

Course Name: Clinical Research
Course Credit Hour: 4 hrs

Course Code: STUGBT6/DSC4
Total Contact hour: 60 hrs

Course Objective:

This course focus on the basis of Drug development process. It basically covers the (Preclinical, clinical and toxicological studies). It also covers the scope and importance of product development in biotech industries. It also includes about the marketing of the desired pharmaceutical drug.

Course Description:

Clinical research is a study conducted to understand health and diseases in the particular human body. It is branch of healthcare that governs the safety and effectiveness of medications, diagnostic products, devices, and treatment procedures proposed for human use. Clinical research is a branch of healthcare sciences in which research is conducted to understand health and diseases in human beings.

Course Contents:

Unit 1: Drug discovery: Introduction, conventional drug design approaches, irrational Vs Rational, subacute and chronic toxicity studies. Irwin profile test, Drug development process (Preclinical, clinical and toxicological studies).

Unit 2: Clinical Research: Past, Present and future Importance, Mile stones of regulations. FDA, US, Indian clinical research, global scenario of clinical research, Regulatory agency.

Unit 3: Designing clinical trials- History, principles, scheme for conducting clinical trials, planning defining, objectives, variables, study populations, testable hypothesis.

Unit 4: Ethical Issues in clinical research: Introduction, codes, declaration and guidelines, informed concent, special issues, Roles and responsibilities of IRBS, issues with ethics review.

Unit 5: ICH-GCP: History of ICH, Objectives, ICH structure, Guidelines, Future of ICH.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept of Drug development process.
CLO2. Discuss the drug discovery, rational drug design. Delivery of biopharmaceuticals, Pre-clinical trials, and clinical trials.
CLO3. Describe the international pharmacopoeia, guide to good manufacturing practice, Manufacturing facility,sources of pharmaceuticals, production and analysis of final product..
CLO4. Explain the History of ICH, Objectives, ICH structure, Guidelines, Future of ICH.

Text Books:

- Research in Education- John V. Best, John V. Kahn 7th edition.
- Presentation skills - Michael Hallon- Indian Society for Institute education.

Reference Books:

- Practical Introduction of copyright.- Gavin Mcfarlane
- R2. Reference book on Thesis projects in Science & Engineering – Richard M. Davi.

Online links for study & reference materials:

https://europe.microbiologyconferences.com
https://nptel.ac.in/courses/102141/18

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

UNDERGRADUATE PROGRAMME

Choice Based Credit System (CBCS)

(Academic Year 2021-22)

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So, it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point

Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
   - **2.1 Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
   - **2.2 Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
   - **2.3 Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

     P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
   - **3.1** AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
   - **3.2** AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of courses

	Theory+ Practical	Theory + Tutorial
I. Core Course		
(14 Papers)	14X4= 56	14X5=70
Core Course Practical / Tutorial*		
(14 Papers)	14X2=28	14X1=14
II. Elective Course		
(8 Papers)		
A.1. Discipline Specific Elective	4X4=16	4X5=20
(4 Papers)		
A.2. Discipline Specific Elective Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		
B.1. Generic Elective/ Interdisciplinary	4X4=16	4X5=20
(4 Papers)		
B.2. Generic Elective Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		

- **Optional Dissertation or project work in place of one Discipline Specific** Elective **paper (6 credits) in 6th Semester**

III. Ability Enhancement Courses		
1. **Ability Enhancement Compulsory**		
(2 Papers of 2 credit each)	2 X 2=4	2 X 2=4
Environmental Science		
English/MIL Communication		
2. **Ability Enhancement Elective** (Skill Based)		
(Minimum 2)	2 X 2=4	2 X 2=4
(2 Papers of 2 credit each)		
Total credit	**140**	**140**

* wherever there is a practical there will be no tutorial and vice-versa

B.Sc. (Hons) Computer Science

Core Papers (C): (Credit: 06 each) (1 period/week for tutorials or 4 periods/week for practical)

1. STUGCS1/C01: Computer Organization and Architecture (4 + 2)
2. STUGCS1/C02: Programming in C (4 + 2)
3. STUGCS2/C03: Operating System (4 + 2)
4. STUGCS2/C04: Programming in C++ (4 + 2)
5. STUGCS3/C05: Data Structure (4 + 2)
6. STUGCS3/C06: Computer Network (4 + 2)
7. STUGCS3/C07: Programming in JAVA (4 + 2)
8. STUGCS4/C08: Design analysis and Algorithm (4 + 2)
9. STUGCS4/C09: Software Engineering (4 + 2)
10. STUGCS4/C10: Database Management System (4 + 2)
11. STUGCS5/C11: Dot (.) NET Framework (4 + 2)
12. STUGCS5/C12: Computer Graphics (4 + 2)
13. STUGCS6/C13: Artificial Intelligence (4 + 2)
14. STUGCS6/C14: Theory of Computation (4 + 2)

Discipline Specific Elective Papers: (Credit: 06 each) - DSE 1-4

(4 papers to be selected: 02 each for Odd semester and Even semester as listed below)

1. STUGCS/DSE01: Cloud computing (4 + 2)
2. STUGCS /DSE02: Cryptography and Network Security (4 + 2)
3. STUGCS /DSE03: Python (4) + Lab (4)
4. STUGCS /DSE04: Big Data (5) + Tutorial (1)
5. STUGCS /DSE05: Numerical Analysis(4) + Lab (4)
6. STUGCS /DSE06: Information Security Cyber Law(4) + Lab (4)
7. STUGCS /DSE07: Information Security (4) + Lab (4)
8. STUGCS /DSE08: Data Mining (4) + Lab (4)
9. STUGCS /DSE09: Operation Reseach (5) + Tutorial (1)
10. STUGCS /DSE12: Dissertation/ Project

Skill Enhancement Courses (02 to 04 papers) (Credit: 02 each)- SEC1 to SEC4

1. STUGCS/SEC01: Management Information System
2. STUGCS /SEC02: Web Technology
3. STUGCS /SEC03: Software Engineering
4. STUGCS /SEC04: Theory of Computation
5. STUGCS /SEC05: Microprocessor
6. STUGCS /SEC06: Digital Image Processing
7. STUGCS /SEC07: Machine Learning
8. STUGCS /SEC08: Data Mining
9. STUGCS /SEC09: Networking Programming

Generic Elective Papers (GE): (Credit: 06 each)

1. STUGCS/GE01: Internet Technologies (4) + Lab (4)
2. STUGCS /GE02: E-Commerce (4) + Lab (4)
3. STUGCS /GE03: Hypertext Pre-Processor (4) + Lab (4)
4. STUGCS /GE04: Mobile Computing (4) + Lab (4)

Course and Program outcome of B.Sc. (Computer Science)

Profile

- B.Sc. course of Noida International University aims to enhance the student's development skills and increase the employment areas.
- Making the students ready for the corporate world in aspects of handling different responsibilities.
- True leadership is being imparted on every student to make them take responsibilities and perform their duties.
- Hard work, punctuality and discipline are the main aspects of education in our institute.
- The bond of work and relations, on being a gentle is the basics of our education.

Program Offered: Graduate

- B.Sc. – Computer Science - 3 Years

VISION

Bachelor of Science Course of NIU is an exclusive platform to provide internship cum training to under graduate students. It aims to train students in technical knowledge and programming skills. It helps the students in sharpening their development skills. It focuses on developing android and web based application. This will help the students in gaining their full command in programming skills. The current scenario speaks up the need and requirement of technical skills.

MISSION

B.Sc. Course of NIU aims to work towards Student skill development, Entrepreneurship Development and deliver a sustainable learning platform in Information Technology. Skill development initiatives will actualize the inert potential of the students. We aim to development talented, employment ready youth for the nation. Our nation has to meet the raising aspiration of young graduates. Our efforts are in a view to enhance the quality of technical education for the country.

- To enhance the technical skills of students.
- Provide corporate ready students.
- Certification Programs, technical sessions with going course enhance the student's ability.
- Regular interaction with industries helps the students in building up their views and choose a better platform.
- Personal Assistance in final year projects and internal assessment.

PEOs & PO and PSO of B.Sc. Programme

PEOs of B.Sc. programme are:

B.Sc. programme of Noida International University will prepare its students

- **PEO 1:** To gain the potential in software development field. Efficient faculty members, easily available study resources and availability of different platform encourages the students to be a part of the development field.
- **PEO 2:** For research and implementation new techniques with different sceneries. Wide availability of networking lets the students come up with new and different variant of ideas and methodologies which is being imparted in the students.
- **PEO 3:** To entrepreneurship and industry based model. Students are provided with enormous resources that lead them stand as independent and self-developed individual.

Programme Outcome

On completion of B.Sc degree, the graduates will be able to:

PO1. Gain proper employment in the fields of development and technical strategies.
PO2. Sustain in the competitive and corporate environment leading enhanced strategies in development.
PO3. Handle different fields, people in terms of jobs, technical assistance and monitoring data.
PO4. Work on large and huge a database which is the main aspects of social networking platform in the current scenario.
PO5. Gain inertia in development and monitoring strategies in development and maintenance field.
PO6. Update, alter, and modify the current existing technologies to new and upgraded ones.
PO7. Handle the research strategies, higher education and building a better platform for coming generations.
PO8. Will be able to handle new technologies, strategies and formation based structures.
PO9. Impart and elaborate new and existing technologies to the new generations.
PO10.test and identify bugs in the technical aspects of an organization.
PO11.present a better and enhanced strategies in development, testing and maintenance field.
PO12. To create and develop new fields in computer application leading to dynamic platforms and scenarios.

Program Specific Outcomes for B.Sc. (Information Technology)

PSO1: Apply fundamental principles and methods of Computer Science to a wide range of applications.

PSO2: Design, correctly implement and document solutions to significant computational problems.

PSO3: Impart an understanding of the basics of our discipline.

PSO4: Prepare for continued professional development.

PSO5: Develop proficiency in the practice of computing.

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for B.Sc. (Computer Sciences)
Effective from the Session: 2021-2022

B.Sc. Computer Sciences 1st Year
SEMESTER-I

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS1/ C01	Computer Organization and Architecture	4	0	0	20	20	40	60	100	4	C1
2	STUGCS1/ C01	Programming in C	4	0	0	20	20	40	60	100	4	C2
3	STUGCS1/ GE1	Internet Technology	4	0	0	20	20	40	60	100	4	GE1
4	STUGCS1/ AECC1	Environmental Sciences	2	0	0	20	20	40	60	100	2	AECC1
Practical												
1	SPUGCS1/ C01	Computer Organization and Architecture	0	0	2			25	25	50	2	C1
2	SPUGCS1/ C01	Programming in C	0	0	2			25	25	50	2	C2
3	SPUGCS1/ GE1	Internet Technology	0	2	0			25	25	50	2	GE1
Total										**550**	**20**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Computer Sciences 1st Year
SEMESTER-II

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS2/ C03	Operating System	4	0	0	20	20	40	60	100	4	C3
2	STUGCS2/ C04	Programming in C++	4	0	0	20	20	40	60	100	4	C4
3	STUGCS2/ GE02	E-Commerce/ Discrete Mathematics	4	0	0	20	20	40	60	100	4	GE2
4	STUGCS2/ AECC2	Technical Communication	2	0	0	20	20	40	60	100	2	AECC2
Practical												
1	SPUGCS2/ C03	Operating System	0	0	2			25	25	50	2	C3
2	SPUGCS2/ C04	Programming in C++	0	0	2			25	25	50	2	C4
3	SPUGCS2/ GE02	E-Commerce/ Discrete Mathematics	0	2	0			25	25	50	2	AECC2
Total										**550**	**20**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Computer Science 2nd Year
SEMESTER-III

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS3/ C05	Data Structure	4	0	0	20	20	40	60	100	4	C5
2	STUGCS3/ C06	Computer Network	4	0	0	20	20	40	60	100	4	C6
3	STUGCS3/ C07	Programming in JAVA	4	0	0	20	20	40	60	100	4	C7
4	STUGCS3/ SEEC1	Management Information System	2	0	0	20	20	40	60	100	2	SEC1
5	STUGCS3/ GE3	Hypertext Pre-processing/E-commerce	4	0	0	20	20	40	60	100	4	GE3
Practical												
1	SPUGCS3/ C05	Data Structure	0	0	2			25	25	50	2	C5
2	SPUGCS3/ C06	Computer Network	0	0	2			25	25	50	2	C6
3	SPUGCS3/ C07	Programming in JAVA	0	0	2			25	25	50	2	C7
4	SPUGCS3/ GE3	Hypertext Pre-processing/E-commerce	0	2	0			25	25	50	2	GE3
Total										**700**	**26**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Computer Science 2nd Year
SEMESTER-IV

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS4/ C08	Design analysis and Algorithm	4	0	0	20	20	40	60	100	4	C8
2	STUGCS4/ C09	Software Engineering	4	0	0	20	20	40	60	100	4	C9
3	STUGCS4/ C10	Database Management System	4	0	0	20	20	40	60	100	4	C10
4	STUGCS4/ SEEC2	Web Technology	2	0	0	20	20	40	60	100	2	SEC2
5	STUGCS4/ GE4	Mobile Computing	4	0	0	20	20	40	60	100	4	GE4
Practical												
1	SPUGCS4/ C08	Design analysis and Algorithm	0	0	2			25	25	50	2	C8
2	SPUGCS4/ C09	Software Engineering	0	0	2			25	25	50	2	C9
3	SPUGCS4/ C10	Database Management System	0	0	2			25	25	50	2	C10
4	SPUGCS4/ GE4	Mobile Computing	0	2	0			25	25	50	2	GE4
Total										**700**	**26**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Computer Science 3rd Year
SEMESTER-V

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS5/ C11	Dot (.) NET Framework	4	0	0	20	20	40	60	100	4	C11
2	STUGCS5/ C12	Computer Graphics	4	0	0	20	20	40	60	100	4	C12
3	STUGCS5/ DSC1	Cloud computing	4	0	0	20	20	40	60	100	4	DSC1
4	STUGCS5/ DSC2	Data Mining	4	0	0	20	20	40	60	100	4	DSC2
Practical												
1	SPUGCS5/ C11	Dot (.) NET Framework	0	2	0			25	25	50	2	C11
2	SPUGCS5/ C12	Computer Graphics	0	0	2			25	25	50	2	C12
3	SPUGCS5/ DSC1	Cloud computing	0	0	2			25	25	50	2	DSC1
4	SPUGCS5/ DSC2	Data Mining	0	2	0			25	25	50	2	DSC2
Total										**600**	**24**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Computer Science 3rd Year
SEMESTER-VI

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS6 /C13	Artificial Intelligence	4	0	0	20	20	40	60	100	4	C13
2	STUGCS6 /C14	Theory of Computation	4	0	0	20	20	40	60	100	4	C14
3	STUGCS6 /DSC3	Cryptography and Network Security	4	0	0	20	20	40	60	100	4	DSC3
4	STUGCS6 /DSC4	Project	4	0	0	20	20	40	110	150	6	DSC4
Practical												
1	SPUGCS6/ C11	Artificial Intelligence	0	0	2			25	25	50	2	C13
2	SPUGCS6/ C12	Theory of Computation	0	0	2			25	25	50	2	C14
3	SPUGCS6/ DSC3	Cryptography and Network Security	0	0	2			25	25	50	2	DSC3
4	SPUGCS6/ DSC4	Project	0	0	2			25	25	50	2	DSC4
Total										**600**	**24**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

OVERALL CREDIT SCHEME

S. No.	SEMESTER	Theory Total	Practical Total	Subject Total	Total Credit
1	I	400	150	550	20
2	II	400	150	550	20
3	III	500	200	700	26
4	IV	500	200	700	26
5	V	400	200	600	24
6	VI	400	200	600	24
			Grand Total	**3700**	**140**

B.Sc. (H) Computer science 1st Year
SEMESTER-I

Course Code: STUGCS1/C01 Course Name: Computer Organization and Architecture
Course Credit Hour: 4hr Total Contact Hour: 60hr

Course Objective:

- To facilitate the students learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.
- To facilitate the students to be familiarized with the hardware components and concepts related to the input-output organization.
- To facilitate the students to be familiarized with the hardware components and concepts related to the memory organization.
- To facilitate the students to be familiarized with the concepts related to the 8086 micro controller like pin diagram, different types of registers and addressing modes.

Course Description:

- Computer architecture is a specification detailing how a set of software and hardware technology standards interact to form a computer system or platform. computer architecture refers to how a computer system is designed and what technologies it is compatible with. There are three categories of computer architecture:
- System Design: This includes all hardware components in the system, including data processors aside from the CPU, such as the graphics processing unit and direct memory access. It also includes memory controllers, data paths and miscellaneous things like multiprocessing and virtualization
- Instruction Set Architecture (ISA): This is the embedded programming language of the central processing unit. It defines the CPU's functions and capabilities based on what programming it can perform or process. This includes the word size, processor register types, memory addressing modes, data formats and the instruction set that programmers use.
- Micro architecture: Otherwise known as computer organization, this type of architecture defines the data paths, data processing and storage elements, as well as how they should be implemented.

Course Contents:

Unit - I: Basis Computer Architecture, Functional Organization, Register Organization, Arithmetic and Logic Unit, Central Processing unit, Instruction Formats. CPU architecture, instruction format, addressing mode, stacks and handling of interrupts. Assembly language - Elementary problems.

Unit - II: Addressing Modes. Data Transfer and Manipulation, interrupts RISC/CISC architecture. Register transfer and macro-operations, Register Transfer Languages (RTL). Arithmetic, Logic and Shift Macro-operations, Sequencing, Micro-program sequences.

Unit - III: Memory & Storage: Processor Vs. Memory speed: Cache memory. Associative memory, Virtual memory and Memory management. Pipeline & vector processing.

Unit - IV: Input/ Output organization: Peripheral devices, I/O Asynchronous Data Transfer: Strobe Control, Data Transfer Schemes (Programmed, Initiated, DW, and Transfer).

Unit - V: Memory Hierarchy, Main Memory, Auxiliary Memory, Cache Memory

Course learning outcome:

- **CO1.** this unit is for understanding function and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer.

- **CO2.** Machine instructions, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.

- **CO3.** Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Microprogrammed control unit

- **CO4.** Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Address t l ti H d t f t translation, Har dware suppor t for memory manage

- **CO5.** : Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O Interrupt controlled I/O and DMA controlled I/O I/O interfaces Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infiniband, I/O peripherals - Input devices, Output devices, Secondary storage devices.

Text books :

- Moris Mano, “Computer System Architecture”, PHI Publications, 2002
- R. P. Jain, “Modern Digital Electronics”, TMH, 3rd Edition, 2003

Reference Books:

- Computer System Architecture (Third Edition),. Morris Mono - Pearson PrenticeHall,2007. .

Online links for study & reference materials :

- http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS1/C02 **Course Name: Programming in C**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:
- The course is intended to create an understanding of the fundamentals of high level structural programming concepts through the medium of C language.
- C language is a general purpose, procedural computer programming language.

Course Description:
- The course is used to demonstrate the understanding of computer programming languages.
- Able to define data types and use them in simple data processing applications also student must be able to understand the concept of array of structures.

Course Contents :

Unit-I

Fundamental: H/W and S/W part of computer system, Computer Block Diagram, online processing, time sharing system, real time system, batch system, multiprogramming, multiprocessing, SPOOLING, distributed data processing. Element of computer file, types of files, file processing activities, file design factors, access methods, pros and cons of file organization

Unit-II

MS office: Introduction to MS Office; Introduction to MSWord; Features & area of use. Working with MS Word.; Menus & Commands; Toolbars & Buttons; Shortcut Menus, Wizards & Templates; Creating a New Document; Different Page Views and layouts; Applying various Text Enhancements; Working with – Styles, Text Attributes; Paragraph and Page Formatting; Text Editing using various features ; Bullets, Numbering, Auto formatting, Printing & various print options

Unit-III

MS Excel: Introduction and area of use; Working with MS Excel.; concepts of Workbook & Worksheets; Using Wizards; Various Data Types; Using different features with Data, Cell and Texts; Inserting, Removing & Resizing of Columns & Rows; Working with Data & Ranges; Column Freezing, Labels, Hiding, Splitting etc.; Using different features with Data and Text; Use of Formulas, Calculations & Functions; Cell Formatting including Borders & Shading; Working with Different Chart Types; Printing of Workbook.

Unit-IV

Elements of C: C character set, identifiers and keywords, Data types: declaration and definition, storage classes in C, Type conversion, Types of error, 'C' macro, macro vs function.

Operators: Arithmetic, relational, logical, bitwise, unary, assignment and conditional operators and their hierarchy & associativity. Data input/output.

Control statements: Sequencing, Selection: if and switch statement; alternation, Repetition: for, while, and do-while loop; break, continue, goto.

Unit-V

Functions: Definition, prototypes, passing parameters, recursion.
Data Structures: arrays, structure, union, string.
Pointers: Declaration, operations on pointers, array of pointers, pointers to arrays.
String & file handling, Streams, String I/ O, File Operations, Formatted I/O, Character I/ O, **Line I/O, Block I/O, File positioning, File handling.**

Course Learning Outcomes (CLOs):
CLO-1: Problem solving through computer programming,
CLO-2: Familiarity of programming environment in Linux operating system.
CLO-3: Ability to use different memory allocation methods.
CLO-4: Ability to deal with different input/output methods.
CLO-5: Ability to use different data structures.

References:

- Joe Habraken, Microsoft Office 2000, 8 in 1 by, Prentice Hall of India
- Deitel & Deitel: C How to Program (Prentice Hall), 1996.
- Yashwant Kanetker, Let us C, BPB Publications.
- R. B. Patel, Fundamental of Computers and Programming in C, Khanna Book Publishing Company PVT.LTD. Delhi, India, 1st edition, 2008, ISBN: 13: 978-81-906988-7-0, pp. 1-962.
- Gottfried, Programming with C, Tata McGraw Hill.
- Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd Ed., Prentice Hall of India.

Online links for study & reference materials :
https://lecturenotes.in/download/note/18532-note-for-cprogramming-by-anshuman

Assessment Method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS1/GE1 **Course Name: Internet Technology**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:
Study on internet protocols, client/server applications and web Services. Designing and applications of internet and intranet system.

Course Description:
This course deals on the practical application of internetworking technologies to private intranets for information management and public internets for electronic commerce students will learn theoretical details, strategies for designing sites, Techniques for creating their technical infrastructures, methods for developing content, and techniques for site deployment and management.

1. Introduction

- History and Development of Internets and Intranets
- IANA, RIR/NIR/LIR and ISPs for internet number management
- Internet Domain and Domain Name System
- Internet Access Overview
- Internet Backbone Networks: Optical Backbone, Marine Cables, Teleports, Satellite and Terrestrial Links

2. Internet Protocol Overview

- TCP/IP and the IP Layer overview
- IPv4 and IPv6 Address Types and Formats
- IPv4 and IPv6 Header Structure
- Internet RFCs

3. Protocols and client/server applications

- Standard protocols: SMTP, E-mail, Message (RFC22), PGP, POP, IMAP, HTTP, FTP
- N-Tiered Client/Server Architecture
- Universal Internet Browsing
- Multiprotocol Support

4. Designing internet systems and servers

- Designing of Internet System Network Architecture

- Choice of platforms
- Sever Concepts: WEB, Proxy, RADIUS, MAIL
- Cookies
- Load Balancing: Proxy Arrays
- Server Setup and Configuration Guidelines
- Security and System Administration Issues, Firewalls and Content Filtering.

5. Internet and Intranet Systems Development

- Introductions
- Benefits and drawbacks of intranets
- Protocols, Structure and Scope of Networks
- Intranets Resources Assessments: Network Infrastructure, Clients and Server
- Resources
- Intranet Implementation Guidelines
- Content Design, Development, Publishing and Management
- Intranet Design with Open Source Tools: DRUPAL, JUMLA
- Tunneling Protocols: VPN

Instructional Method and Pedagogy:

• At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

• Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

• Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.

• One internal exam will be conducted as a part of internal theory evaluation.

• Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.

• Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.

• The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

• Experiments shall be performed in the laboratory related to course contents. Learning Outcome: After Studying that subject students would have capability to make own web site and host their own web site on internet. Also students would have enough knowledge about what are the technologies used in internet.

Reference Books:

1. Steven Holzner,"HTML Black Book" Dremtech press.

2. Web Technologies, Black Book, dreamtech Press

3. Web Applications: Concepts and Real World Design, Knuckles, Wiley-India

4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel. Pearson.

Course Code: STUGCS1/AECC1 **Course Name: Environmental Sciences**
Course Credit Hour: 2hr **Total Contact Hour: 30hr**

Course Objective:
The Compulsory course on Environmental Science at Undergraduate level aims to train students to cater to the need for ecological citizenship through developing a strong foundation on the critical linkages between ecology-society-economy.

Course Description:
Graduates will evolve into ecologically informed and socially responsible citizens who are empowered to protect the natural resources while ensuring sustainable lifestyle and developmental model.

Course Contents:

Unit 1: Introduction to Environmental Studies (2 lectures)
Multidisciplinary nature of environmental studies
Scope and importance; Concept of sustainability and sustainable development

Unit 2: Ecosystem (8 lectures)

Definition and concept of Ecosystem: Structure of ecosystem (biotic and abiotic components); Functions of Ecosystem. Physical (energy flow), Biological (food chains, food web, ecological succession) and Biogeochemical (nutrient cycling) processes. Concepts of productivity, ecological pyramids and homeostasis
Types of Ecosystem – Tundra, Forest, Grassland, Desert, Aquatic (ponds, streams, lakes, rivers, oceans, and estuaries) – their importance and threats on them with relevant examples from India Ecosystem services (Provisioning, Regulating, Cultural and Supporting). Basics of Ecosystem restoration.

Unit 3: Natural Resources (6 lectures)
Land resources and landuse change Land degradation, soil erosion and desertification. Forest resources and causes of deforestation; impacts of mining and dam building on environment, forests, biodiversity and tribal populations
Water resource: Use and over exploitation of surface and ground water, floods, drought conflicts over water (international & inter-state)
Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs
Case studies: National Solar Mission, Cauvery river water conflict etc

Unit 4: Biodiversity and Conservation (8 lectures)
Definition of Biodiversity; Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India.

India as a mega-biodiversity nation; Endemic and endangered species of India; IUCN Red list; biodiversity hotspots.
Value of biodiversity: Ecological, economic, social, ethical, aesthetic and informational value of biodiversity with examples; sacred groves and their importance with example
Current mass extinction crisis; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasion with emphasis to Indian biodiversity.
Biodiversity conservation strategies: in-situ and ex-situ methods of conservation; Biosphere reserves; Keystone and Flagship species; Species reintroduction and translocation. Case studies: Project Tiger, Vulture breeding program etc

Unit 5: Environmental pollution (8 lectures)
Environmental pollution (Air, water, soil, thermal and noise): causes, effects and controls; Air and water quality standards. Nuclear hazards and human health risks. Solid waste management: Control measures of urban and industrial waste. Pollution case studies: Ganga Action plan (GAP), Delhi air pollution and public health issues etc.

Field work/ Practicals (Equal to 5 lectures)
Field visit to any of the ecosystems found in Delhi like Delhi Ridge/ Sanjay lake/ Yamuna river and its floodplains etc. or any nearby lake or pond, explaining the theoretical aspects taught in the classroom.
Visit to any biodiversity park/ reserve forests/ protected area/ zoo/ nursery/ natural history museum in and around Delhi, explaining the theoretical aspects taught in the classroom.
Visit to a local polluted site (Urban/Rural/Industrial/Agricultural), Wastewater treatment plants
Study of common plants, insects, birds and basic principles of identification
Organize a seminar/ conference/ workshop/ panel discussion on relevant topics for enhancing awareness, capacity building and critical reasoning among students

Course Learning Outcomes (CLOs): The course will empower the undergraduate students by helping them to:
CLO-1 Gain in-depth knowledge on natural processes that sustain life, and govern economy.
CLO-2: Predict the consequences of human actions on the web of life, global economy and quality of human life.
CLO-3: Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.
CLO-4: Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participating actively in solving current environmental problems and preventing the future ones.
CLO-5: Adopt sustainability as a practice in life, society and industry.

Text books:

- William P. Cunningham, Mary Ann Cunningham, Barbara Woodworth Saigo, Environmental Science: A global concern, McGrawHill 2003 ¬
- William Cunningham, Mary Cunningham, Principles of Environmental Science: Seventh Edition, Mc Graw Hill 2014 UGC DOCUMENT ON LOCF ENVIRONMENTAL SCIENCE 24
- Rogers PP, Jalal, KF, Boyd JA, An introduction to sustainable development, Earthscan

Reference books:

- Roosa SA, Sustainable Development Handbook, CRC Press 2008 ¬
- Atkinson G., Dietz S., Neumayer E., Agarwala M, Handbook of Sustainable Development, Edward Elger, 2014 ¬
- Robbins P., Hintz J., Moore S.A., Environment and Society: A critical introduction, Wiley Blackwel 2014

Online links for study & reference materials:
https://www.hzu.edu.in/bed/E%20V%20S.pdf
Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1	- 05%
Assignment -2	- 05%
Assessment-3(Mid-Exam)	- 20%
Assignment-3/Quiz-1	- 05%
Assignment-4	- 05%
Total Internal Assessment	**- 40%**

B.Sc. (H) Computer science 1st Year
SEMESTER-II

Course Code: STUGCS2/C03 **Course Name: Operating System**
Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:
To study concepts related to operating systems, like process management, concurrency and control of processes, deadlocks, memory management, processor and disk scheduling, parallel processing, and file system organization and implementation. Also to study different methods for protection and security that is becoming vital now-a-days.

Course Description:
- To master the basic concepts related to operating systems. To learn in detail about process management.
- To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.
- To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.

Course Contents :

Unit – I: Operating system and function, Evolution of operating system, Batch, Interactive, multiprogramming, Time Sharing and Real Time System, multiprocessor system, Distributed system, System protection. Operating System structure, Operating System Services, System Program and calls.
Unit – II: Process concept, State model, and process scheduling, job and process synchronization, structure of process management, Threads interprocess Communication and Synchronization: Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Hardware Synchronization, Critical Regions, Conditional critical region, Monitor, Inter Process Communication. CPU Scheduling: Job scheduling functions, Process scheduling, Scheduling Algorithms, Non Preemptive and preemptive. Strategies, Algorithm Evaluation, Multiprocessor Scheduling. Deadlock: System Deadlock Model, Deadlock Characterization, Methods for handling deadlock, Prevention strategies, voidance and Detection, Recovery from deadlock combined approach.
Unit – III: Single Contiguous Allocation: H/W support, S/W support, Advantages and disadvantages, Fragmentation, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Swapping, Overlays

Unit – IV: Principles of I/O hardware, Device controller, Device Drivers, Memory mapped I/O, Direct Access Memory, Interrupts, Interrupt Handlers, Application I/O interface, I/O Scheduling, Buffering, Caching, Spooling, Disk organization, Disk space management, Disk allocation Method, Disk Scheduling, Disk storage.

Unit - V : File Concept, File Organization and Access Mechanism, File Directories, Basic file system, File Sharing, Allocation method, Free space management. Policy Mechanism, Authentication, Internal excess Authorization.

Course learning outcome:

CLO1 : To master the basic concepts related to operating systems. To learn in detail about process management.

CLO2 : To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.

CLO3: To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.

CLO4 : To familiar with file system implementation. To understand mass storage management functions of operating systems.

CLO5: To familiar with Protection and security aspects of operating systems. To expose to other operating systems like distributed OS, Multi-processor OS, RTOS and Mobile OS.

Text books :

- Operating System by Galvin,
  Operating System by Taneun Bomb
- Operating System by William Stalling

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS2/C04 **Course Name: Object Oriented Programming in C++**
Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective(s)

1. Understand and use the basic programming constructs of C++
2. Manipulate various C++ data types, such as arrays, strings, and pointers
3. Isolate and fix common errors in C++ programs
4. Use memory appropriately, including proper allocation/deal location procedures
5. Apply object-oriented approaches to software problems in C++
6. Write small-scale C++ programs using the above skills

Course Description:
Understand fundamentals of object-oriented **programming** in **C++**, including defining classes, invoking methods, using class libraries and also be aware of the important topics and principles of software development.

Course Contact
Unit I:
Introduction:
What is object oriented programming? Why do we need object oriented.Programming characteristics of object-oriented languages C and C++.
C++ Programming basics: Output using cout. Directives. Input with cin. Type bool. The setw manipulator. Type conversions.

Unit II:
Functions : Returning values from functions. Reference arguments. Overloaded function. Inline function. Default arguments. Returning by reference.
Object and Classes :
Making sense of core object concepts (Encapsulation, Abstraction, Polymorphism, Classes, Messages Association, Interfaces) Implementation of class in C++, C++ Objects as physical object, C++ object as data types constructor. Object as function arguments. The default copy constructor, returning object from function. Structures and classes. Classes objects and memory static class data. Const and classes.

Unit III:

Arrays and string arrays fundamentals. Arrays as class Member Data: Arrays of object, string, The standard C++ String class Operator overloading:

Overloading unary operations. Overloading binary operators, data conversion, pitfalls of operators overloading and conversion keywords. Explicit and Mutable.

Inheritance :

Concept of inheritance. Derived class and based class. Derived class constructors, member function, inheritance in the English distance class, class hierarchies, inheritance and graphics shapes, public and private inheritance, aggregation : Classes within classes, inheritance and program development.

Unit IV:

Pointer :

Addresses and pointers. The address of operator and pointer and arrays. Pointer and Faction pointer and C-types string. Memory management : New and Delete, pointers to objects, debugging pointers.

Virtual Function :

Virtual Function, friend function, Static function, Assignment and copy initialization, this pointer, dynamic type information.

Unit V:

Streams and Files :

Streams classes, Stream Errors, Disk File I/O with streams, file pointers, error handling in file I/O with member function, overloading the extraction and insertion operators, memory as a stream object, command line arguments, and printer output.

Templates and Exceptions :

Function templates, Class templates Exceptions

Course Learning Outcomes (CLOs):

CLO-1: Design the process of interaction between Objects and System w.r.t. Object Oriented Paradigm.

CLO-2: Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.

CLO-3: Analyze basic programming concepts in Java with different object related issues and various string handling functions as well as basic I/O operations.

CLO-4: Discuss basic Code Reusability concept w.r.t. Inheritance, Package and Interface.

CLO-5: Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Reference books:

1. Horstmann, Big Java, Wiley India
2. Herbert Schieldt, "The Complete Reference: Java", TMH, 7th Edition.
3. Nino," An Introduction to Programming and Object Oriented Design using Java, w/CD", Wiley India
4. James Rumbaugh etal, "Object Oriented Modeling and Design", PHI
5. Bjarne Stroustrup, "C++ Programming Language", Addison Wesley, 3rd Edition.

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS2/GE02 **Course Name: E-Commerce**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Objectives

1. To impart knowledge on E-Commerce and its various applications.
2. To understand E-Commerce framework and business model applications of E-Commerce
3. To understand e-payment mechanisms

Course Description:
Identify and analyze nature & inherent difficulties in the security of the Information System. Analyze various threats and attacks, corresponding counter measures and various vulnerability assessment and security techniques in an organization

Course Contents:

Unit 1

Introduction: Electronic Commerce - Technology and Prospects, Definition of E-Commerce, Economic potential of electronic commerce, Incentives for engaging in electronic commerce, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, Impact of E-commerce on business.

Network Infrastructure for E- Commerce: Internet and Intranet based E-commerce- Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY).

Unit II

Mobile Commerce: Introduction, Wireless Application Protocol, WAP technology, Mobile Information device, Mobile Computing Applications.

Unit III

Web Security: Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.

Unit IV

Encryption: Encryption techniques, Symmetric Encryption- Keys and data encryption standard, Triple encryption, Asymmetric encryption- Secret key encryption, public and private pair key encryption, Digital Signatures, Virtual Private Network.

Unit V

Electronic Payments: Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking. EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda.

Course Learning Outcomes (CLOs):
CLO-1: Define and differentiate various types of Ecommerce.
CLO-2: Define and describe E-business and its Models
CLO-3: Describe Hardware and Software Technologies for Ecommerce.
CLO-4: Understand the basic concepts of E-Commerce and identify different technologies used in E-Commerce.
CLO-5: Apply different tools used in E-Commerce.

References

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.
2. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH
3. P. Loshin, John Vacca, "Electronic commerce", Firewall Media, New Delhi

Online links for study & reference materials :

- http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : STUGCS2/AECC2 **Course Name: Technical communication**
Course Credit Hour : 2hr **Total Contact Hour : 60hr**

Course Objective :
To create an understanding in the mind of the student regarding formal and professional communication practiced in a professional environment .

Course Description:
In the present industrial scenario the role of instrumentation is becoming more vital day by day specially in case of industrial automation. More advanced, precise and complex instrumentations are being employed in the industry. These advance instruments requires communication of data from equipment/machines to instruments and vice versa for process and quality control.

Course Contents:

- **Unit - I: (Business Communication):** Difference between general and business communication, this should cover general and technicalwriting, oral communications and listening skill
- **Unit - II: (Expression)** Practical communication skill development, business presentation with multimedia,speaking skill, prepared speech, extempore speech
- **Unit - III :(Reading Skills)** Reading skill: comprehension test, technical report writing: precise, technical/businessletter, organization of writing material, poster presentation
- **UNIT-IV (Literature) :**Of Studies: Francis Bacon
- **UNIT-V (Presentation):**Writing technical document, preparing software user manual, preparing project documentation.

Course learning outcome:

- **CO1.** This unit is for understanding general business communication.
- **CO2.** This unit is for understanding skill development and confidence development.
- **CO3.** Reading skills are extremely important for any type of business communication.
- **CO4.** Understand the core values that shape the ethical behavior of an engineer and exposed awareness on professional ethics and human values.
- **CO5.** writing technical documentation

Text books :
Business Correspondence & Report Writing, Sharma, TMH 2.Business Communication Strategies, Monipally, TMH
English for Technical Communication , Laxminarayanan,Scitech
Business Communication, Kaul,PHI
Online links for study & reference materials :
- https://mgdic.files.wordpress.com/2016/12/3361704-industrial-data-communication.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

B.Sc. (H) Computer science 2nd Year
SEMESTER-III

Course Code: STUGCS3/CO5 **Course Name : Algorithm and Data Structure**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective:
The objective of the course is to teach programming (with an emphasis on problem solving) and introduce elementary data structures. The student should, at a rudimentary level, be able to prove correctness (loop invariants, conditioning, etc) and analyze efficiency (using the `O' notation).

Course Description :

- Design correct programs to solve problems.
- Choose efficient data structures and apply them to solve problems.
- Analyze the efficiency of programs based on time complexity.
- Prove the correctness of a program using loop invariants, pre-conditions and post-conditions in programs

Course Contents :
Unit – I: Arrays: Representation of single and multidimensional arrays; sparse arrays - lower and upper triangular matrices and Tri-diagonal matrices
Unit – II: .Stacks and Queues: Introduction and primitive operations on stack; Stack application, Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion from infix to postfix, Introduction and primitive operation on queues.
Unit – III: Lists: Introduction to linked lists; Sequential and linked lists, operations such as traversal, insertion, deletion, searching, Two way lists and Use of headers. Trees: Introduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion, deletion; threaded trees, binary search trees, trees in search algorithm. B- tree. B+ tree and applications.
Unit – IV: Sorting Techniques: Insertion sort, selection sort, merge sort, heap sort. Searching Techniques: Linear search, binary search and hashing
Unit - V :File structure: physical storage devices and their characteristics, constituents of a file viz. fields, records, fixed and variable length records, primary and secondary keys; file operations, basic file system operations, file organizations: serial sequential, index sequential, direct , inverted, hashing function and collision handling methods

Course learning outcome :
- **CLO1 :** this unit is to Review of Problem Solving using computers, Abstraction, Elementary Data Types. Algorithm design- Correctness via Loop

invariants as a way of arguing correctness of programs, preconditions, post conditions associated with a statement.develop a understanding of basic character sets keywords and identifiers used for the c programming dataset. Learning objective of this unit is define data types and use them in simple data processing applications .

- **CLO2:** Introduction to stacks , arrays and queues. Difference and various use case.
- **CLO3**: This unit is to introduce lists and tree terminology . introduction to graphs and trees .
- **CLO4** : various sorting techniques. Insertion , bubble etc.
- **CLO5:** this unit is for learning different modes of file storage. Records and there usage .

Text books :

Data Structures and Algorithm Analysis in C++, by Mark Allen Weiss (Pearson 2007)

Reference books :

- Data structures and Algorithms in C++ -- by Adam Drozdek (1994 2001).
- How to solve it by Computer -- by R G Dromey (PHI 1982, Paperback 2008).
- Fundamentals of Data Structures in C -- by Horowitz, Sahni and Anderson-Freed (Silicon Press 2007).
- Data Structure Using C and C++ -- by Y. Langsam, M. J. Augenstein and A. N. Tanenbaum (Pearson Education, 2nd Edition, 2015).

Online links for study & reference materials :

https://slideplayer.com/slide/5987087/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : STUGCS3/CO6 **Course Name : Computer Networks**
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :
Course will work with data communication and switching techniques.
The course work on networks and different layers of network and data processing.

Course Description :
Course will work on transferring of messages from one port to another.
Course will introduce the structure of Media Access Protocols .
Ability to distinguish various data transmission and modulation techniques.
Ability to analyses the impact of various channel impairments on data transmission.
Ability to identify different data networks and the networking hardware.

Course Contents :

Unit-I

Data communications concepts: Digital and analog , parallel and serial, synchronous and asynchronous, simplex, half duplex, duplex, multiplexing, Transmission media: Wired (physical): Twisted pair, Coaxial cable, Optical Fiber.
Communication switching techniques: Circuit switching, message switching, packet switching.

Unit-II

Introduction to Computer Network : Network Topologies, Types of Network, OSI and TCP/IP Models: Layers and their functions, comparison of models.
Data Link Layer Fundamentals: Framing, Basics of Error Detection, Forward Error Correction, Cyclic Redundancy Check codes for Error Detection.

Unit-III

Media Access Protocols : The advantages of Multiple-Access Sharing of Channel Resource, ALOHA, Carrier Sense Multiple Access (CSMA), CSMA with Collision Detection (CSMA/CD), Token Ring, Token Bus, Asynchronous Transfer Mode (ATM).

Unit-IV

Network Layer: Host to Host Delivery: IP Addressing and Routing, Gateway, N/W Layer Protocols: ARP, IPV4, ICMP, IPV6.
Transport Layer: Process-to-Process Delivery: UDP, TCP Congestion Control & Quality of Service.

Unit-V

Application Layer: Client Server Model, Domain Name System (DNS), E-mail (SMTP), File Transfer (FTP) and Model TCP/IP.

Course Learning Outcomes(CLOs) :
CLO-1 : Students will be able to work on different servers and communication models.

CLO-2 : Students will be able to work on Lam Man and Wan network.

CLO-3 : The students will be able to install a network system.

CLO-4 : Students will be able to host an application and web sites.

CLO-5 : Ability to identify basic components of data communication system

Text books :

- A.S. Tanebaum : Computer Networks (4th ed.), Prentice-Hall of India.
- W. Tomasi : Introduction to Data Communications and Networking, Pearson, Education.

Reference books :

- P.C. Gupta : Data Communications and Computer Networks, Prentice-Hall of India.
- Behrouz Forouzan and S.C., Fegan : Data Communications and Networking, McGraw Hill.
- L.L. Peterson and B.S. Davie : Computer Networks : A system Approach, Morgan Kaufmann.
- William Stalilngs : Data and Computer Communications, Pearson Education.

Online links for study & reference materials :
https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : STUGCS3/CO7 **Course Name :** Programming in Java
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective(s)

1. Be able to explain the difference between object oriented programming and procedural programming.
2. Be able to program using more advanced C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling, etc.
3. Be able to build classes using appropriate encapsulation and design principles
4. Be able to apply object oriented or non-object oriented techniques to solve bigger computing problems

Course Description:

Understand fundamentals of object-oriented **programming** in **Java**, including defining classes, invoking methods, using class libraries and also be aware of the important topics and principles of software development.

Course Contact

Unit I

Object Modeling: Objects and classes, links and association, generalization and inheritance, aggregation, abstract class, multiple inheritance, meta data, candidate keys, constraints. Dynamic Modeling: Events and states, operations, nested state diagrams and concurrency, advanced dynamic modeling concepts, a sample dynamic model.

Unit II

Functional Modeling: Data flow diagram, specifying operations, constraints, a sample functional model OMT (object modeling techniques) methodologies, examples and case studies to demonstrate methodologies, comparisons of methodologies, SA/SD, JSD.

Unit III

Java Programming: Introduction, Operator, Data types, Variables, Methods & Classes, Multithread Programming, I/O, Java Applet.

Unit IV

Java Library: String Handling, Input/Output exploring Java.io, Networking, Exception Handling, Event Handling, Introduction to AWT, Working with window, Graphics, AWT Controls, Layout Manager and Menus, Images.

Unit V

Software Development using Java:

Java Swing, Migrating from C++ to java, Application of java, JDBC.

Course Learning Outcomes (CLOs):

CLO-1: Design the process of interaction between Objects and System w.r.t. Object Oriented Paradigm.

CLO-2: Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java

CLO-3: Analyze basic programming concepts in Java with different object related issues and various string handling functions as well as basic I/O operations.

CLO-4: Discuss basic Code Reusability concept w.r.t. Inheritance, Package and Interface

CLO-5: Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Reference books:

1. Horstmann, Big Java, Wiley India
2. Herbert Schieldt, "The Complete Reference: Java", TMH, 7th Edition.
3. Nino," An Introduction to Programming and Object Oriented Design using Java, w/CD", Wiley India
4. James Rumbaugh etal, "Object Oriented Modeling and Design", PHI
5. Bjarne Stroustrup, "C++ Programming Language", Addison Wesley, 3rd Edition.

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS3/GE3 **Course Name: Hypertext Preprocessor**
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :
The course deals with the development of Back end of a web site and application.
Dealing with connection and communication with the databases and upgrading of the set up.

Course Description :
It will work on managing the database system for a server.
Manipulating and security issues will be dealt in.

Course Contents :

Unit-I

Introduction to PHP Evaluation of Php: Basic Syntax Defining variable and constant Php, Data types, Operator and Expression, Handling Html Form With Php, Capturing Form.

Unit-II

Data Dealing with Multi-value filed: Generating File uploaded form, Redirecting a form after submission, Decisions and loop Making, Decisions Doing Repetitive task with looping, Mixing Decisions and looping with Html.

Unit-III

Function: What is a function, Define a function Call by value and Call by reference, Recursive function.

String: Creating and accessing String, Searching & Replacing String, Formatting String, String Related Library function.

Unit-IV

Array: Anatomy of an Array, Creating index based and Associative array, Accessing array, Element Looping with Index based array, Looping with associative array, using each() and foreach(), Some useful Library function.

Unit-V

Working with file and Directories: Understanding file & directory, Opening and closing a file, Copying ,renaming and deleting a file, Working with directories, Building a text editor, File Uploading & Downloading, Generating Images with PHP.

Course Learning Outcomes(CLOs) :
CLO-1 :The students will be able to develop web site .
CLO-2 :Students will be able to work on back end of a web site and application. .
CLO-3 :Students will be able to communicate with database server.
CLO-4 :Students can work on different back end of a web sites or applications.
CLO5 : Students will be able to manage critical risk strategy of the development cycle.

Text books :

- Raghurama Krishnan : PHP, Johannes Gehrke, TMH.
- Siberschatz, Korth : Learn PHP, McGraw Hill, latest edition.

Reference books :

- C.J. Date : Introduction to Hypertext, Pearson, Education.
- Elmasri Navathe : Server Scripting PHP,

Online links for study & reference materials :

https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

B.Sc. (H) Computer science 2nd Year

SEMESTER-IV

Course Code: STUGCS4/C08 **Course Name: Design Analysis and Algorithm**
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Objectives
1. To understand the Object-based view of Systems
2. To develop robust object-based models for Systems
3. To inculcate necessary skills to handle complexity in software design

Course Description:
System Analysis and Design is a specification detailing how a set of software and hardware technology standards interact to form a computer system or platform. System Analysis and Design refers to how a computer system is designed and what technologies it is compatible with. There are three categories of computer architecture:

Course Contents:
Unit 1 :
Introduction to SAD Fundamentals of System, Important Terms related to Systems, Classification of Systems, Real Life Business Subsystems, Real Time Systems, Distributed Systems, Development of a successful System, Various Approaches for development of Information Systems Structured Analysis and Design Approach, Prototype, Joint Application Development.

Unit 2 :
Process of System Development Systems Development Life Cycle: Phases of SDLC, Project Identification and Selection, Project Initiation and planning, Analysis, Logical Design, Physical Design, Implementation, Maintenance, Product of SDLC Phases, Approaches to Development, Prototyping, Joint Application Design, Participatory Design, Case Study

Unit 3 :
Introduction to Documentation of Systems Concepts and process of Documentation: Types of Documentation, System Requirements Specification, System Design Specification, Test Design Document, User Manual, Different Standard for Documentation, Documentation and Quality of Software,

Unit 4:

Process of System Planning Fact finding Techniques: Interviews, Group Discussion, Site Visits, Presentations, Questionnaires, Issues involved in Feasibility Study, Technical Feasibility, Operational Feasibility, Economic Feasibility, Legal Feasibility, Cost Benefit Analysis, Preparing Schedule, Gathering Requirements of System, Joint Application Development, Prototyping

Unit 5 :
Modular and Structured Design Design Principles: Top Down Design, Bottom Up Design, Structure Charts, Modularity, Goals of Design, Coupling, Cohesion. Criteria for Report Design, Relevance, Accuracy, Clarity, Timeliness, Cost

Course Learning Outcomes (CLOs):
CLO-1: Ability to analyze and model software specifications.
CLO-2: Ability to abstract object-based views for generic software systems.
CLO-3: Ability to deliver robust software components
CLO-4: Ability to identify the issues related to performance improvement
CLO-5: Ability to distinguish performance tradeoff between different memory units and instruction sets

Reference:

1. Sara Baase and Allen Van Gelde, "Computer Algorithms, Introduction to Design and Analysis", 3rd Edition, Pearson Education, Delhi, 2002.
2. Aho, Hoporoft and Ullman, "The Design and Analysis of Computer Algorithm", Pearson Education, Delhi, 2001.
3. Basu S.K.,"Design Methods and Analysis of Algorithms", PHI, 2006.
4. Brassad and Bratley,"Fundamentals of Algorithms", PHI, 1995.
5. Sanjoy Dasgupta, Christos Papadimitriou, Umesh vazirani, "Algorithms", TMG, 2007.

Online links for study & reference materials :
https://www.dei.unipd.it/~capri/SI/MATERIALE/DWDM0405.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS4/CO9 **Course Name: Software Engineering**
Course Credit Hour: 4hr **Total Contact Hour : 60hr**

Course Objective:
Software Engineering (SE) comprises the core principles consistent in software construction and maintenance: fundamental software processes and life-cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools. iterative development, interpretation of requirements and use case documents into code; application of design notation in UML and use of commonly-used design patterns. Current industry-strength programming languages, technologies and systems feature highly in the practical components, electives and projects of the course, but they are also taught with a view to understanding and applying principles underlying their more ephemeral character.

Course Description:

- Knowledge of basic SW engineering methods and practices, and their appropriate application.
- Describe software engineering layered technology and Process frame work. 3
- A general understanding of software process models such as the waterfall and evolutionary models. Understanding of software requirements and the SRS documents. Understanding of the role of project management including planning, scheduling, risk management, etc.
- Describe data models, object models, context models and behavioral models. Understanding of different software architectural styles. Understanding of implementation issues such as modularity and coding standards. Understanding of approaches to verification and validation including static analysis, and reviews.

Course Contents :

Unit-I: Introduction Software life cycle models: Waterfall, Prototype,Evolutionary and Spiral models, Overview of Quality Standards like ISO 9001, SEI-CMM.

UNIT-II: Software Metrics and Project Planning Size Metrics like LOC, Token Count, Function Count, Design Metrics, Data Structure Metrics, Information Flow Metrics. Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management.

UNIT- III: Software Requirement Analysis, design and coding Problem Analysis, Software Requirement and Specifications, Behavioural and non-behavioural requirements, Software Prototyping Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design Top-down and bottom-up Structured programming, Information hiding.

UNIT- IV : Software Reliability, Testing and Maintenance Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Software process, Functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing: path testing, Data flow and mutation testing, unit testing, integration and system testing, Debugging, Testing Tools, & Standards. Management of maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software RE-engineering.

UNIT- V : UML: Introduction to UML, Use Case Diagrams, Class Diagram: State Diagram in UML Activity Diagram in UML.Sequence Diagram in UML Collaboration Diagram in UML

Course learning outcome :

CLO1 : Understand basic SW engineering methods and practices, and their appropriate application.

CLO2: Understand u of software process models such as the waterfall and evolutionary 10. models.

CLO3: problem analysis and description, This unit is to introduce Discuss data models, object models, context models and behavioural models.

CLO4 : Understand of different software architectural styles and Process frame work

CLO5: this unit is for learning different modes of file storage. Records and there usage .

Text books :

- K. K. Aggarwal & Yogesh Singh, .Software Engineering., 2nd Ed, New Age International, 2005.
- R. S. Pressman, ―Software Engineering – A practitioner‘s approach‖, 5th Ed., McGrawHill Int. Ed., 2001.

Online links for study & reference materials :

https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS4/SEEC2 **Course Name : Web Technology**
Course Credit Hour: 4hr **Total Contact Hour : 60hr**

Objectives: The objective of this course to make a student will be familiar with client server architecture and able to develop a web application using java technologies. Students will gain the skills and Project based experience needed for entry into web application and development career

Course Description:

The course structure deals with software development cycle and phases of development in a web application.

The course will deal with the cost and maintenance cycle of a web site.

Course Contents:

Unit-I

Introduction to Internet Basic : The Basic of the Internet, Concepts of Domain, IP Addressing, Resolving Domain Names, Overview of TCP/IP and its Services, WWW, web projects, web applications, Web Team, planning & process development.

Unit-II

Designing Pages with HTML: Introduction to HTML, Essential Tags, Deprecated Tags, Tags and Attributes, Text Styles and Text Arrangements, Text, Effects, Exposure to Various Tags, Color and Background of Web Pages, Lists and their Types, Attributes of Image Tag.

Unit-III

Link: Hypertext, Hyperlink and Hypermedia, Links, Anchors and URLs, Links to External Documents, Different Section of a Page and Graphics, Footnote and e-Mailing, Creating Table, Frame, Form and Style Sheet.

Unit-IV

DHTML: Dynamic HTML, Document Object Model, Features of DHTML, CSSP (Cascading Style Sheet Positioning) and JSSS (JavaScript assisted Style Sheet), Layers of Netscape, The ID Attribute, DHTML Events.

Unit-V

Web Page: Web Page Basics, Web Terminologies, Phases of Planning and Building Web Sites, The FTP, HTTP and WPP, Features, Web Page Views, Adding Pictures, Backgrounds, Links.

Scripting language: Java script and VB script JDBC database.

Course Learning Outcomes(CLOs) :
CLO-1 : The students will be able to work on web development and application development.
CLO-2 : Students will be able to develop software model .
CLO-3 : Students will be able to work on different data analyzing model.
CLO-4 : Students can work in testing phase of software .
CLO5 : Students will be able to manage critical risk strategy of the development cycle.

Text books :

- Web Development TMH.
- Nasib Singh : Learn HTML, Khanna Book Publishing Co. (P) Ltd. N. Delhi.
- Jalote, Pankaj : An Integrated Approach to HTML, Narosa Publications.
- Chhillar Rajender Singh : HTML, Metrics, Excel Books.

.

Reference books :

- Ghezzi, Carlo : Fundaments of HTML, PHI.
- Fairely, R.E. : HTMLEngineering Concepts, McGraw-Hill.
- Lewis, T.G.: Learn CSS, McGraw-Hill.

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Online links for study & reference materials :
https://noidatut.com/
Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS4/GE4 **Course Name: Mobile Computing**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective :
Understand fundamentals of wireless communications. Analyze security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks. Demonstrate basic skills for cellular networks design. Apply knowledge of TCP/IP extensions for **mobile** and wireless networking
Course Description :
This **course** will cover various topics of **mobile computing**, networking, and systems, including but not limited to: applications of smartphones, cellular networks, embedded sensor systems, localization systems, energy efficiency of **mobile** devices, wearable and vehicular **mobile** systems, **mobile** security, virtual reality.

Course Contents :
Unit-I: Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Unit-II: Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Bluetooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

Unit-III: Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.

Unit-IV: Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

Unit-V: Adhoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad-Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

Course Learning Outcomes(CLOs) :

CLO-1 :The students will be able to work on **Mobile development and application development.**
CLO-2 :Students will be able to develop network model .
CLO-3 :Students will be able to work on different data analyzing model.
CLO-4 :Students can work in testing phase of software .
CLO5 : Students will be able to manage critical risk strategy of the development cycle.

Text books :

- Mobile Communication and wireless technologies TMH.
- Nasib Singh : Learn HTML, Khanna Book Publishing Co. (P) Ltd. N. Delhi.
- Jalote, Pankaj : An Integrated Approach to HTML, Narosa Publications.
- Chhillar Rajender Singh : HTML, Metrics, Excel Books.

.

Reference books :

- Ghezzi, Carlo : Fundaments of HTML, PHI.
- Fairely, R.E. : HTMLEngineering Concepts, McGraw-Hill.
- Lewis, T.G.: Learn CSS, McGraw-Hill.

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Online links for study & reference materials :
https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

B.Sc. (H) Computer science 3rd Year

SEMESTER-V

Course Code : STUGCS5/C11 **Course Name : DOT NET Framework**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :
This course will cover the practical aspects of multi-tier application development using the .NET framework. The goal of this course is to introduce the students to the basics of distributed application development. We will introduce the students to Web Service development and .NET remoting. Technologies covered include the Common Language Runtime (CLR), .NET framework classes, C#, ASP.NET, and ADO.NET. We will also cover service oriented architecture, design, performance, security, content managements systems and deployment issues encountered in building multi-tier distributed applications.

Course Description :
The course deals in writing code using Visual Basic (**VB**) and C#; create **ASP**.**NET** Web applications and process Web forms and build SQL Server databases and access them using ADO.**NET**. Participants have the choice of using either **C#** (C Sharp) or **VB** (Visual Basic) – the **Microsoft** . **NET** core languages.

Course Contents :

UNIT - I

C# Fundamentals: Basic classes, declarations, conditionals, loops, arrays, strings, enumerations, structures, andEncapsulation, inheritance, polymorphism, Structured exception handling. Understanding interface types

UNIT - II

Delegates, Events, and Lambdas: basics of each -- very important for event driven (GUI), Understanding the garbage collector, creating and working with .NET assemblies.

UNIT - III

Windows Forms and WPF: Basic windows programming: forms, component class, control class, control events, menus, status bars, tool bars, interacting with the registry. Indexers, Operator Overloading, Custom Type Conversion, Extension Methods, Anonymous Types, Pointer Types

UNIT - IV

Input, Output, and Serialization: System.IO, Directory and File Types, StreamReaders and StreamWriters, working with binary data, configuring objects for serialization, Working with and creating custom generic types.

UNIT - IV

Processes, AppDomains, Contexts, Threading, Type Reflection, Late Binding, Attribute-based programming: Advanced topics from the text will be discussed as time permits. We can decide as a class on what to explore if we get to this point.

Course Learning Outcomes(CLOs) :

CLO-1 :The students will be able to work on different server, web sites and applications.

CLO-2 :Students will be able to develop the backend of any project.

CLO-3 :Students will have the idea of encryption , decryption and maintain the database and all the security parameters.

CLO-4 :Students can work as system administrator and technical support.

Text books :

1. C Sharp and Dot net framework by Andrew Troelsen
2. C Sharp in Depth by Jon Skeet
3. Pro VB 2008 and the .NET 3.5 Platform (Windows.Net) by Andrew Troelsen

Reference books :

Programming Entity Framework by Julia
Learning Visual Basic .NETJesse Liberty
Beginning VB.NET Databases by Thearon Willis
Professional VB 2005 with .NET 3.0 (Programmer to Programmer) by Bill Evjen, Billy Hollis, Bill Sheldon, and Kent Sharkey

Online links for study & reference materials :

https://noidatut.com/view-nts.php?vntpntsfxxvisurz=b6d767d2f8ed5d21a44b0e5886680cb9

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : STUGCS5/C12 **Course Name : Computer Graphics**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

Course will help the students understand the graphics controller of a system.
The course will help the students developing the graphical structure for a system.

Course Description :
Work on to deal with Graphics applications of a system.
Designing and graphical structure will be dealt in the module.

Course Contents :

Unit-I
Graphics Primitives: Introduction to computer graphics, Basics of Graphics systems, Application areas of Computer Graphics, overview of graphics systems, video-display devices, and raster-scan systems, random scan systems.

Unit-II
Output Primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms.
Filled area primitives: Scan line polygon fill algorithm, boundary fill and flood-fill algorithms.

Unit-III
2-D Geometrical Transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, .
2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping
algorithms, Sutherland –Hodgeman polygon clipping algorithm..

Unit-IV
3-D Object Representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces, polygon-rendering methods..

Unit-V
3-D Geometric Transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations.
3-D Viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

Course Learning Outcomes(CLOs) :

CLO-1 : Students will be able develop graphics application.

CLO-2 : Students will be able to work on designing model of a system. .

CLO-3 : The students will be able code new graphics and pictures for the system.

CLO-4 : Students will be able to understand the technologies behind the display units .

CLO-5 : Analyze and compare the different kinds of user interfaces in order to be able to decide which one will be more efficient and ergonomic according to the required specifications of the application to be developed.

Text books :

- Donald Hearn and M. Pauline Baker : Computer Graphics, PHI Publications.
- Plastock : Theory & Problem of Computer Gaphics, Schaum Series.

Reference:

- Donald Hearn and M. Pauline Baker : Computer Graphics, PHI Publications.
- Plastock : Theory & Problem of Computer Gaphics, Schaum Series.
- Foley & Van Dam : Fundamentals of Interactive Computer Graphics, Addison-Wesley.
- Newman : Principles of Interactive Computer Graphics, McGraw Hill.

Online links for study & reference materials :

https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : STUGCS5/DSC1 **Course Name : Cloud Computing**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :
Students understand the methodologies and concepts of computing and servers.
The course will help the students maintaining a server, difference between technology and methodology.

Course Description :
Will work on to deal with infrastructure, software and platform.
Course will work on different services like Iaas, Paas, Saas and its implementation methodologies.

Course Contents:

Unit 1: Overview of Cloud Computing
Introduction to cloud, features of cloud(benefits and disadvantages), architecture of cloud computing, types of service delivery in cloud ,their providers and examples of software for each type(Iaas, Paas, Saas), cloud deployment models: Public ,private and hybrid cloud.
Unit 2: Cloud Computing Concepts:
Virtualization: introduction to virtualization, characteristics of virtualization, how is virtualization achieved, what is hypervisor, types of hypervisor(type 1 and type 2),Multitenancy and its advantages and disadvantages, migration in cloud.
Unit 3: Distributed systems
Introduction to distributed systems, How are distributed systems managed, Introduction to mapreduce framework, importance of mapreduce , understanding how it works with an example. Introduction to Hadoop, What is hadoop, why hadoop ,HDFS ,Traditional file system vs HDFS, Big data: what is big data, features of big data, study sample dataset for big data, techniques and tools for handling big data, Hive
Unit 4: Saas
What is Saas, Agile programming, Introduction to OOP, Introduction to Ruby, simple programming using Ruby, Ruby on Rails.
Unit 5: Cloud security
Security risks in cloud, types of threat in cloud, ways of handling the threats, covert channel attacks in cloud, detection mechanisms for the threats, ways of making cloud secure.
Course Learning Outcomes(CLOs) :
CLO-1 : Students will be able to work on servers, networking and security issues.

CLO-2 : Students will be able to handle the backend of a network.

CLO-3 : The students will be able to work with organization in line and outline communication.

CLO-4 : Students will be able to develop and host domains and applications.

Text books :
Cloud computing by A. S Aggarwal.
Reference books :
1. Towards Expert Systems for Enhancing Quality of Services in Cloud Computing Research by Dr. Aadarsh Malviya
2. Cloud Computing and its Services by Manoj Desai.

Online links for study & reference materials :
https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS5/DSC2
Course Credit Hour: 4hr

Course Name: Data Mining
Total Contact Hour: 60hr

Course Objective: Understand the fundamentals of data mining and its application in various business and social domains. It is an introduction to the field of data mining (also known as knowledge discovery from data, or KDD for short). It focuses on fundamental data mining concepts and techniques for discovering interesting patterns from data in various applications It emphasizes techniques for developing effective, efficient, and scalable data mining tools

Course Description:

- Understand the fundamentals of data mining and its functionalities
- Obtain knowledge in different data mining techniques and algorithms
- Discuss about various application domains of data mining
- Understand advanced mining
- Apply on different case studies

Unit-I

Data Warehousing: Introduction- Definition and description, need for data ware housing, need for strategic information, failures of past decision support systems, OLTP vs DWH-DWH requirements-trends in DWH-Application of DWH.

Unit-II

Data Warehousing Architecture: Reference architecture- Components of reference architecture Data warehouse building blocks, implementation, physical design process and DWH deployment process. A Multidimensional Data, Model Data Warehouse Architecture.

Unit-III

Data Mining: Data mining tasks-Data mining vs KDD- Issues in data mining, Data Mining metrics, Data mining architecture - Data cleaning- Data transformation- Data reduction - Data mining primitives.

Association Rule Mining: Introduction - Mining single dimensional Boolean association rules from transactional databases - Mining multi-dimensional association rules.

Unit-IV

Classification and Prediction: Classification Techniques - Issues regarding classification and prediction - decision tree - Bayesian classification –Classifier accuracy – Clustering – Clustering Methods - Outlier analysis.

Unit-V

Applications and Other Data Mining Methods: Distributed and parallel Data Mining Algorithms, Text mining- Web mining.

Course learning outcome:

CLO1: Illustrate the concepts of data mining and data warehousing concepts and techniques.
CLO2: Apply data mining techniques using data mining tools.
CLO3: Implement different data mining techniques and algorithms
CLO4: Do web mining and spatial mining
CLO5: Implement data ware house

Books Recommended:

1. Jiawei Han and Micheline Kamber, " Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, USA, 2006.
2. Berson,"DataWarehousing, Data Mining and OLAP", Tata McGraw Hill Ltd, New Delhi, 2004.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, , Pearson Education.
4. Arun K Pujari,"Data mining techniques", Oxford University Press, London, 2003.
5. Dunham M H,"Data mining: Introductory and Advanced Topics". Pearson Education, New Delhi, 2003.
6. Mehmed Kantardzic," Data Mining Concepts, Methods and Algorithms", John Wiley and Sons, USA, 2003.
7. Soman K. P., DiwakarShyam, Ajay V., Insight into Data mining: Theory and Practice, PHI 2006

Online links for study & reference material
https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/download-course-materials/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

B.Sc. (H) Computer science 3rd Year

SEMESTER-VI

Course Code : STUGCS6/C11 **Course Name : Artificial intelligence**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

This course provides fundamental knowledge on artificial intelligence (AI) concepts. It includes study of AI foundations, sub-areas and applications. It followed the study of problem-solving methods in AI using search techniques. Game playing has always intrigued AI researchers and hence this topic is also covered. Knowledge representation and reasoning is the core of any automated AI systems and thus one unit has been dedicated to elaborately discuss about logic concepts

Course Description :
Advanced knowledge representation methods like case grammars and semantics web are briefly touched upon in the last units along with the concepts of natural language processing.

Course Contents :
Unit – I: INTRODUCTION - Overview of Artificial intelligence- Problems of AI, AI technique, Tic – Tac – Toe problem. Problems, Problem Space & search.
Unit – II: Heuristic Search Techniques, Knowledge representation issues. Representing knowledge using rules.
Unit – III: Symbolic reasoning under uncertainty. Statistical reasoning, Weak slot & filler structures. Strong slot & filler structures.
Unit – IV: Game planning –Minimax search procedure, adding alpha beta cut-off's, iterative deepening, Planning. Natural language processing, Understanding.
Unit – V: Expert systems- expert system shells, knowledge acquisition, Basic knowledge of programming language like Prolog & Lisp.

Course learning outcome :
CLO1 :Learn the fundamentals of AI. Gain Insights into information and uninformed search techniques with illustrations.
CLO2: : Understand principles of knowledge representation basics and advanced methods like case grammars and semantic web.
CLO3: Apply propositional and predicate logic to infer sentences in knowledge representation basics.
CLO4 : Understand the use and applications of expert systems.

CLO5:Apply probability theory to draw conclusions using Naïve Bayes and Bayesian networks.

Text books :

Artificial Intelligence, Ritch & Knight, TMH

Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI

Logic & Prolog Programming, Saroj Kaushik, New Age International 4.Expert Systems, Giarranto, VIKAS

Online links for study & reference material

https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/download-course-materials/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Mid exam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS6/C12 **Course Name : Theory of Computation**
Course Credit Hour: 4hr **Total Contact Hour : 60hr**

Course Objective :
Theory provides a simple, elegant view of the complex machine that we call a computer. Theory possesses a high degree of permanence and stability, in contrast with the ever-changing paradigms of the technology, development, and management of computer systems. Further, parts of the theory have direct bearing on practice, such as Automata on circuit design, compiler design, and search algorithms; Formal Languages and Grammars on compiler design; and Complexity on cryptography and optimization problems in manufacturing, business, and management.

Course Description :

Introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.

Enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

Course Contents :
Unit – I: Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition tabl e, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transi ion, Language of NFA, Equi valence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem
Unit – II: Regular expression (RE) , Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages . Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.
Unit – III: Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation , Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.
Unit – IV:Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack,

Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA

Unit - V :Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

Course learning outcome :

CLO1 : Automata, computability, and complexity ,Mathematical tools, Definitions, theorems, and proofs.

CLO2: Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression

CLO3: Understand recursive and recursively enumerable languages.

CLO4 : Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack

CLO5: Understand Turing Machines and the simple primitive mechanisms needed for all computation

Text books :

Hopcroft, Ullman, "Introduction to Automata Theory,Languages and Computation. Pearson Education.

K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science : Automata, Languages and Computation", PHI Learning Private Limited, Delhi India.

Reference books:

Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.

Y.N.Singh "Mathematical Foundation of Computer Science", New Age International.

Online links for study & reference materials :

http://www.cs.virginia.edu/~robins/cs3102/CS3102

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code STUGCS6/DSC3 **Course Name : Cryptography& Network Security**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :
Security works on encryption and decryption of data.
It works on the security and communication section of the applications and web portals.

Course Description :
Course covers basics of security and networking issues. .
Course will help the students in mastering the programming concepts and security issues

Course Contents :
UNIT I
Security trends, Attacks and services, Classical crypto systems, Different types of ciphers Ceaser, Transposition and Hill Cipher, sequences Group, Ring and Field, Congruence's Chinese Remainder theorem, Modular exponentiation, Fermat and Euler's theorem
UNIT II
Simple DES, Differential cryptanalysis, DES – Modes of operation – Triple DES –AES – RC4 – RSA – Attacks – Primality test, factoring.
UNIT III
Discrete Logarithms, Computing discrete logs, Diffie-Hellman key exchange, ElGamal Public key, cryptosystems: Hash functions, Secure Hash, Birthday attacks -MD5 – Digital signatures – RSA –Elgamel DSA
UNIT IV
Authentication applications, Kerberos, X.509, PKI, Electronic Mail security, PGP, S/MIME IP security, Web Security, SSL, TLS, SET
UNIT V
System security, Intruders, Malicious software, viruses, Firewalls, Security Standards

Course Learning Outcomes(CLOs) :
CLO-1 :The students will be able to work on different server, web sites and applications.

CLO-2 :Students will be able to develop the backend of any project.

CLO-3 :Students will have the idea of encryption , decryption and maintain the database and all the security parameters.

CLO-4 :Students can work as system administrator and technical support.

Text books :
William Stallings, “Cryptography and Network Security: Principles and Practice”, Prentice Hall, New Jersey.

Reference books :
1. Johannes A. Buchmann, “Introduction to cryptography”, Springer- Verlag.
2. Atul Kahate, “Cryptography and Network Security”, TMH
3. Mahtab Alam, “Information Security and Cryptography, BOOKSHELF.

Online links for study & reference materials :
https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

UNDERGRADUATE PROGRAMME

Choice Based Credit System (CBCS)

(Academic Year 2021-22)

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So, it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point

Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
   - **2.1 Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
   - **2.2 Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
   - **2.3 Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

     P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE

   Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
   - **3.1** AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
   - **3.2** AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of courses

	Theory+ Practical	Theory + Tutorial
I. Core Course		
(14 Papers)	14X4= 56	14X5=70
Core Course Practical / Tutorial*		
(14 Papers)	14X2=28	14X1=14
II. Elective Course		
(8 Papers)		
A.1. Discipline Specific Elective	4X4=16	4X5=20
(4 Papers)		
A.2. Discipline Specific Elective Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		
B.1. Generic Elective/ Interdisciplinary	4X4=16	4X5=20
(4 Papers)		
B.2. Generic Elective Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		

- **Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6th Semester**

III. Ability Enhancement Courses

1. **Ability Enhancement Compulsory**		
(2 Papers of 2 credit each)	2 X 2=4	2 X 2=4
Environmental Science		
English/MIL Communication		
2. **Ability Enhancement Elective** (Skill Based)		
(Minimum 2)	2 X 2=4	2 X 2=4
(2 Papers of 2 credit each)		
Total credit	**140**	**140**

* wherever there is a practical there will be no tutorial and vice-versa

B.Sc. (Hons) Information Technology

Core Papers (C): (Credit: 06 each) (1 period/week for tutorials or 4 periods/week for practical)

1. STUGCS1/C01: Computer Organization and Architecture (4 + 2)
2. STUGCS1/C02: Programming in C (4 + 2)
3. STUGCS2/C03: Operating System (4 + 2)
4. STUGCS2/C04: Programming in C++ (4 + 2)
5. STUGCS3/C05: Data Structure (4 + 2)
6. STUGCS3/C06: Computer Network (4 + 2)
7. STUGCS3/C07: Programming in JAVA (4 + 2)
8. STUGCS4/C08: Design analysis and Algorithm (4 + 2)
9. STUGCS4/C09: Software Engineering (4 + 2)
10. STUGCS4/C10: Database Management System (4 + 2)
11. STUGCS5/C11: Dot (.) NET Framework (4 + 2)
12. STUGCS5/C12: Computer Graphics (4 + 2)
13. STUGCS6/C13: Artificial Intelligence (4 + 2)
14. STUGCS6/C14: Theory of Computation (4 + 2)

Discipline Specific Elective Papers: (Credit: 06 each) - DSE 1-4

(4 papers to be selected: 02 each for Odd semester and Even semester as listed below)

1. STUGCS/DSE01: Cloud computing (4 + 2)
2. STUGCS /DSE02: Cryptography and Network Security (4 + 2)
3. STUGCS /DSE03: Python (4) + Lab (4)
4. STUGCS /DSE04: Big Data (5) + Tutorial (1)
5. STUGCS /DSE05: Numerical Analysis(4) + Lab (4)
6. STUGCS /DSE06: Information Security Cyber Law(4) + Lab (4)
7. STUGCS /DSE07: Information Security (4) + Lab (4)
8. STUGCS /DSE08: Data Mining (4) + Lab (4)
9. STUGCS /DSE09: Operation Reseach (5) + Tutorial (1)
10. STUGCS /DSE12: Dissertation/ Project

Skill Enhancement Courses (02 to 04 papers) (Credit: 02 each)- SEC1 to SEC4

1. STUGCS/SEC01: Management Information System
2. STUGCS /SEC02: Web Technology
3. STUGCS /SEC03: Software Engineering
4. STUGCS /SEC04: Theory of Computation
5. STUGCS /SEC05: Microprocessor
6. STUGCS /SEC06: Digital Image Processing
7. STUGCS /SEC07: Machine Learning

8. STUGCS /SEC08: Data Mining
9. STUGCS /SEC09: Networking Programming

Generic Elective Papers (GE): (Credit: 06 each)

1. STUGCS/GE01: Internet Technologies (4) + Lab (4)
2. STUGCS /GE02: E-Commerce (4) + Lab (4)
3. STUGCS /GE03: Hypertext Pre-Processor (4) + Lab (4)
4. STUGCS /GE04: Mobile Computing (4) + Lab (4)

Course and Program outcome of B.Sc. (Information Technology)

Profile

- B.Sc. course of Noida International University aims to enhance the student's development skills and increase the employment areas.
- Making the students ready for the corporate world in aspects of handling different responsibilities.
- True leadership is being imparted on every student to make them take responsibilities and perform their duties.
- Hard work, punctuality and discipline are the main aspects of education in our institute.
- The bond of work and relations, on being a gentle is the basics of our education.

Program Offered: Graduate

- B.Sc. – Information Technology - 3 Years

VISION

Bachelor of Science Course of NIU is an exclusive platform to provide internship cum training to under graduate students. It aims to train students in technical knowledge and programming skills. It helps the students in sharpening their development skills. It focuses on developing android and web based application. This will help the students in gaining their full command in programming skills. The current scenario speaks up the need and requirement of technical skills.

MISSION

B.Sc Course of NIU aims to work towards Student skill development, Entrepreneurship Development and deliver a sustainable learning platform in Information Technology. Skill development initiatives will actualize the inert potential of the students. We aim to development talented, employment ready youth for the nation. Our nation has to meet the raising aspiration of young graduates. Our efforts are in a view to enhance the quality of technical education for the country.

- To enhance the technical skills of students.
- Provide corporate ready students.
- Certification Programs, technical sessions with going course enhance the student's ability.
- Regular interaction with industries helps the students in building up their views and choose a better platform.

- Personal Assistance in final year projects and internal assessment.

PEOs & PO and PSO of B.Sc. Programme

PEOs of B.Sc. programme are:

B.Sc. programme of Noida International University will prepare its students

- **PEO 1:** To gain the potential in software development field. Efficient faculty members, easily available study resources and availability of different platform encourage the students to be a part of the development field.
- **PEO 2:** For research and implementation new techniques with different sceneries. Wide availability of networking lets the students come up with new and different variant of ideas and methodologies which is being imparted in the students.
- **PEO 3:** To entrepreneurship and industry based model. Students are provided with enormous resources that lead them stand as independent and self-developed individual.

Programme Outcome
On completion of B.Sc. degree, the graduates will be able to:

PO1. Gain proper employment in the fields of development and technical strategies.

PO2. Sustain in the competitive and corporate environment leading enhanced strategies in development.

PO3. Handle different fields, people in terms of jobs, technical assistance and monitoring data.

PO4. Work on large and huge a database which is the main aspects of social networking platform in the current scenario.

PO5. Gain inertia in development and monitoring strategies in development and maintenance field.

PO6. Update, alter, and modify the current existing technologies to new and upgraded ones.

PO7. Handle the research strategies, higher education and building a better platform for coming generations.

PO8. Will be able to handle new technologies, strategies and formation based structures.

PO9. Impart and elaborate new and existing technologies to the new generations.

PO10.test and identify bugs in the technical aspects of an organization.

PO11.present a better and enhanced strategies in development, testing and maintenance field.

PO12. To create and develop new fields in computer application leading to dynamic platforms and scenarios.

Program Specific Outcomes for B.Sc. (Information Technology)

PSO1: Apply fundamental principles and methods of Computer Science to a wide range of applications.

PSO2: Design, correctly implement and document solutions to significant computational problems.

PSO3: Impart an understanding of the basics of our discipline.

PSO4: Prepare for continued professional development.

PSO5: Develop proficiency in the practice of computing.

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES

Study & Evaluation Scheme for B.Sc. (Information Technology)
Effective from the Session: 2021-2022

B.Sc. Information Technology 1st Year
SEMESTER-I

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS1/ C01	Computer Organization and Architecture	4	0	0	20	20	40	60	100	4	C1
2	STUGCS1/ C01	Programming in C	4	0	0	20	20	40	60	100	4	C2
3	STUGCS1/ GE1	Internet Technology	4	0	0	20	20	40	60	100	4	GE1
4	STUGCS1/ AECC1	Environmental Sciences	2	0	0	20	20	40	60	100	2	AECC 1
Practical												
1	SPUGCS1/ C01	Computer Organization and Architecture	0	0	2			25	25	50	2	C1
2	SPUGCS1/ C01	Programming in C	0	0	2			25	25	50	2	C2
3	SPUGCS1/ GE1	Internet Technology	0	2	0			25	25	50	2	GE1
Total										**550**	**20**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Computer Sciences 1st Year
SEMESTER-II

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS2/ C03	Operating System	4	0	0	20	20	40	60	100	4	C3
2	STUGCS2/ C04	Programming in C++	4	0	0	20	20	40	60	100	4	C4
3	STUGCS2/ GE02	E-Commerce/ Discrete Mathematics	4	0	0	20	20	40	60	100	4	GE2
4	STUGCS2/ AECC2	Technical Communication	2	0	0	20	20	40	60	100	2	AECC 2
Practical												
1	SPUGCS2/ C03	Operating System	0	0	2			25	25	50	2	C3
2	SPUGCS2/ C04	Programming in C++	0	0	2			25	25	50	2	C4
3	SPUGCS2/ GE02	E-Commerce/ Discrete Mathematics	0	2	0			25	25	50	2	AECC 2
Total										**550**	**20**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Information Technology 2nd Year
SEMESTER-III

S. No	Course Code	Subject	Period L	Period T	Period P	Evaluation Scheme CA	Evaluation Scheme TA	Evaluation Scheme Total	External Exam	Subject Total	Credit	CBCS
1	STUGCS3/ C05	Data Structure	4	0	0	20	20	40	60	100	4	C5
2	STUGCS3/ C06	Computer Network	4	0	0	20	20	40	60	100	4	C6
3	STUGCS3/ C07	Programming in JAVA	4	0	0	20	20	40	60	100	4	C7
4	STUGCS3/ SEEC1	Management Information System	2	0	0	20	20	40	60	100	2	SEC1
5	STUGCS3/ GE3	Hypertext Pre-processing/E-commerce	4	0	0	20	20	40	60	100	4	GE3
Practical												
1	SPUGCS3/ C05	Data Structure	0	0	2			25	25	50	2	C5
2	SPUGCS3/ C06	Computer Network	0	0	2			25	25	50	2	C6
3	SPUGCS3/ C07	Programming in JAVA	0	0	2			25	25	50	2	C7
4	SPUGCS3/ GE3	Hypertext Pre-processing/E-commerce	0	2	0			25	25	50	2	GE3
Total										**700**	**26**	
Note: List of Practical will be supplied at the Start of every Semester												

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GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

NOIDA INTERNATIONAL UNIVERSITY

B.Sc. Information Technology 2nd Year
SEMESTER-IV

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS4/ C08	Design analysis and Algorithm	4	0	0	20	20	40	60	100	4	C8
2	STUGCS4/ C09	Software Engineering	4	0	0	20	20	40	60	100	4	C9
3	STUGCS4/ C10	Database Management System	4	0	0	20	20	40	60	100	4	C10
4	STUGCS4/ SEEC2	Web Technology	2	0	0	20	20	40	60	100	2	SEC2
5	STUGCS4/ GE4	Mobile Computing	4	0	0	20	20	40	60	100	4	GE4
Practical												
1	SPUGCS4/ C08	Design analysis and Algorithm	0	0	2			25	25	50	2	C8
2	SPUGCS4/ C09	Software Engineering	0	0	2			25	25	50	2	C9
3	SPUGCS4/ C10	Database Management System	0	0	2			25	25	50	2	C10
4	SPUGCS4/ GE4	Mobile Computing	0	2	0			25	25	50	2	GE4
Total										**700**	**26**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

NOIDA INTERNATIONAL UNIVERSITY

B.Sc Information Technology 3rd Year
SEMESTER-V

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGCS5/ C11	Dot (.) NET Framework	4	0	0	20	20	40	60	100	4	C11
2	STUGCS5/ C12	Computer Graphics	4	0	0	20	20	40	60	100	4	C12
3	STUGCS5/ DSC1	Cloud computing	4	0	0	20	20	40	60	100	4	DSC1
4	STUGCS5/ DSC2	Data Mining	4	0	0	20	20	40	60	100	4	DSC2
Practical												
1	SPUGCS5/ C11	Dot (.) NET Framework	0	0	2			25	25	50	2	C11
2	SPUGCS5/ C12	Computer Graphics	0	0	2			25	25	50	2	C12
3	SPUGCS5/ DSC1	Cloud computing	0	0	2			25	25	50	2	DSC1
4	SPUGCS5/ DSC2	Data Mining	0	0	2			25	25	50	2	DSC2
Total										**600**	**24**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Information Technology 3rd Year
SEMESTER-VI

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total	External Exam			
1	STUGCS6 /C11	Artificial Intelligence	4	0	0	20	20	40	60	100	4	C13
2	STUGCS6 /C12	Theory of Computation	4	0	0	20	20	40	60	100	4	C14
3	STUGCS6 /DSC3	Cryptography and Network Security	4	0	0	20	20	40	60	100	4	DSC3
4	STUGCS6 /DSC4	Project	4	0	0	20	20	40	110	100	6	DSC4
Practical												
1	SPUGCS6/ C11	Artificial Intelligence	0	0	2			25	25	50	2	C13
2	SPUGCS6/ C12	Theory of Computation	0	2	0			25	25	50	2	C14
3	SPUGCS6/ DSC3	Cryptography and Network Security	0	2	0			25	25	50	2	DSC3
												DSC4
Total										**600**	**24**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

OVERALL CREDIT SCHEME

S. No.	SEMESTER	Theory Total	Practical Total	Subject Total	Total Credit
1	I	400	150	550	20
2	II	400	150	550	20
3	III	500	200	700	26
4	IV	500	200	700	26
5	V	400	200	600	24
6	VI	400	200	600	24
			Grand Total	**3700**	**140**

B.Sc. (H) Information Technology 1st Year
SEMESTER-I

Course Code: STUGCS1/C01 Course Name: Computer Organization and Architecture
Course Credit Hour: 4hr Total Contact Hour: 60hr

Course Objective:

- To facilitate the students learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.
- To facilitate the students to be familiarized with the hardware components and concepts related to the input-output organization.
- To facilitate the students to be familiarized with the hardware components and concepts related to the memory organization.
- To facilitate the students to be familiarized with the concepts related to the 8086 micro controller like pin diagram, different types of registers and addressing modes.

Course Description:

- Computer architecture is a specification detailing how a set of software and hardware technology standards interact to form a computer system or platform. computer architecture refers to how a computer system is designed and what technologies it is compatible with. There are three categories of computer architecture:
- System Design: This includes all hardware components in the system, including data processors aside from the CPU, such as the graphics processing unit and direct memory access. It also includes memory controllers, data paths and miscellaneous things like multiprocessing and virtualization
- Instruction Set Architecture (ISA): This is the embedded programming language of the central processing unit. It defines the CPU's functions and capabilities based on what programming it can perform or process. This includes the word size, processor register types, memory addressing modes, data formats and the instruction set that programmers use.
- Micro architecture: Otherwise known as computer organization, this type of architecture defines the data paths, data processing and storage elements, as well as how they should be implemented

Course Contents:

Unit - I: Basis Computer Architecture, Functional Organization, Register Organization, Arithmetic and Logic Unit, Central Processing unit, Instruction Formats. CPU architecture, instruction format, addressing mode, stacks and handling of interrupts. Assembly language - Elementary problems.

Unit - II: Addressing Modes. Data Transfer and Manipulation, interrupts RISC/CISC architecture. Register transfer and macro-operations, Register Transfer Languages (RTL). Arithmetic, Logic and Shift Macro-operations, Sequencing, Micro-program sequences.

Unit - III: Memory & Storage: Processor Vs. Memory speed: Cache memory. Associative memory, Virtual memory and Memory management. Pipeline & vector processing.

Unit - IV: Input/ Output organization: Peripheral devices, I/O Asynchronous Data Transfer: Strobe Control, Data Transfer Schemes (Programmed, Initiated, DW, and Transfer).

Unit - V: Memory Hierarchy, Main Memory, Auxiliary Memory, Cache Memory

Course learning outcome:

- **CO1.** this unit is for understanding function and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer.

- **CO2.** Machine instructions, Operands, Addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.

- **CO3.** Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Microprogrammed control unit

- **CO4.** Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Address t l ti H d t f t translation, Har dware suppor t for memory manage

- **CO5.** : Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O Interrupt controlled I/O and DMA controlled I/O I/O interfaces Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infiniband, I/O peripherals - Input devices, Output devices, Secondary storage devices.

Text books :

- Moris Mano, "Computer System Architecture", PHI Publications, 2002
- R. P. Jain, "Modern Digital Electronics", TMH, 3rd Edition, 2003

Reference Books:

- Computer System Architecture (Third Edition),. Morris Mono - Pearson PrenticeHall,2007. .

Online links for study & reference materials :

- http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS1/C02 **Course Name: Programming in C**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:

- The course is intended to create an understanding of the fundamentals of high level structural programming concepts through the medium of C language.
- C language is a general purpose, procedural computer programming language.

Course Description:

- The course is used to demonstrate the understanding of computer programming languages.
- Able to define data types and use them in simple data processing applications also student must be able to understand the concept of array of structures.

Course Contents :

Unit-I

Fundamental: H/W and S/W part of computer system, Computer Block Diagram, online processing, time sharing system, real time system, batch system, multiprogramming, multiprocessing, SPOOLING, distributed data processing. Element of computer file, types of files, file processing activities, file design factors, access methods, pros and cons of file organization

Unit-II

MS office: Introduction to MS Office; Introduction to MSWord; Features & area of use. Working with MS Word.; Menus & Commands; Toolbars & Buttons; Shortcut Menus, Wizards & Templates; Creating a New Document; Different Page Views and layouts; Applying various Text Enhancements; Working with – Styles, Text Attributes; Paragraph and Page Formatting; Text Editing using various features ; Bullets, Numbering, Auto formatting, Printing & various print options

Unit-III

MS Excel: Introduction and area of use; Working with MS Excel.; concepts of Workbook & Worksheets; Using Wizards; Various Data Types; Using different features with Data, Cell and Texts; Inserting, Removing & Resizing of Columns & Rows; Working with Data & Ranges; Column Freezing, Labels, Hiding, Splitting etc.; Using different features with Data and Text; Use of Formulas, Calculations & Functions; Cell Formatting including Borders & Shading; Working with Different Chart Types; Printing of Workbook.

Unit-IV

Elements of C: C character set, identifiers and keywords, Data types: declaration and definition, storage classes in C, Type conversion, Types of error, 'C' macro, macro vs function.

Operators: Arithmetic, relational, logical, bitwise, unary, assignment and conditional operators and their hierarchy & associativity. Data input/output.

Control statements: Sequencing, Selection: if and switch statement; alternation, Repetition: for, while, and do-while loop; break, continue, goto.

Unit-V

Functions: Definition, prototypes, passing parameters, recursion.
Data Structures: arrays, structure, union, string.
Pointers: Declaration, operations on pointers, array of pointers, pointers to arrays.
String & file handling, Streams, String I/ O, File Operations, Formatted I/O, Character I/ O, **Line I/O, Block I/O, File positioning, File handling.**

Course Learning Outcomes (CLOs):
CLO-1: Problem solving through computer programming,
CLO-2: Familiarity of programming environment in Linux operating system.
CLO-3: Ability to use different memory allocation methods.
CLO-4: Ability to deal with different input/output methods.
CLO-5: Ability to use different data structures.

References:

- Joe Habraken, Microsoft Office 2000, 8 in 1 by, Prentice Hall of India
- Deitel & Deitel: C How to Program (Prentice Hall), 1996.
- Yashwant Kanetker, Let us C, BPB Publications.
- R. B. Patel, Fundamental of Computers and Programming in C, Khanna Book Publishing Company PVT.LTD. Delhi, India, 1st edition, 2008, ISBN: 13: 978-81-906988-7-0, pp. 1-962.
- Gottfried, Programming with C, Tata McGraw Hill.
- Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd Ed., Prentice Hall of India.

Online links for study & reference materials :
https://lecturenotes.in/download/note/18532-note-for-cprogramming-by-anshuman

Assessment Method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS1/GE1 **Course Name: Internet Technology**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:
Study on internet protocols, client/server applications and web Services. Designing and applications of internet and intranet system.

Course Description:
This course deals on the practical application of internetworking technologies to private intranets for information management and public internets for electronic commerce students will learn theoretical details, strategies for designing sites, Techniques for creating their technical infrastructures, methods for developing content, and techniques for site deployment and management.

1. Introduction

- History and Development of Internets and Intranets
- IANA, RIR/NIR/LIR and ISPs for internet number management
- Internet Domain and Domain Name System
- Internet Access Overview
- Internet Backbone Networks: Optical Backbone, Marine Cables, Teleports, Satellite and Terrestrial Links

2. Internet Protocol Overview

- TCP/IP and the IP Layer overview
- IPv4 and IPv6 Address Types and Formats
- IPv4 and IPv6 Header Structure
- Internet RFCs

3. Protocols and client/server applications

- Standard protocols: SMTP, E-mail, Message (RFC22), PGP, POP, IMAP, HTTP, FTP
- N-Tiered Client/Server Architecture
- Universal Internet Browsing
- Multiprotocol Support

4. Designing internet systems and servers

- Designing of Internet System Network Architecture

- Choice of platforms
- Sever Concepts: WEB, Proxy, RADIUS, MAIL
- Cookies
- Load Balancing: Proxy Arrays
- Server Setup and Configuration Guidelines
- Security and System Administration Issues, Firewalls and Content Filtering.

5. Internet and Intranet Systems Development

- Introductions
- Benefits and drawbacks of intranets
- Protocols, Structure and Scope of Networks
- Intranets Resources Assessments: Network Infrastructure, Clients and Server
- Resources
- Intranet Implementation Guidelines
- Content Design, Development, Publishing and Management
- Intranet Design with Open Source Tools: DRUPAL, JUMLA
- Tunneling Protocols: VPN

Instructional Method and Pedagogy:

• At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.

• Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

• Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.

• One internal exam will be conducted as a part of internal theory evaluation.

• Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.

• Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.

• The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

• Experiments shall be performed in the laboratory related to course contents. Learning Outcome: After Studying that subject students would have capability to make own web site and host their own web site on internet. Also students would have enough knowledge about what are the technologies used in internet.

Reference Books:

1. Steven Holzner,"HTML Black Book" Dremtech press.

2. Web Technologies, Black Book, dreamtech Press

3. Web Applications: Concepts and Real World Design, Knuckles, Wiley-India

4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel. Pearson.

Course Code: STUGCS1/AECC1 **Course Name: Environmental Sciences**
Course Credit Hour: 2hr **Total Contact Hour: 30hr**

Course Objective:
The Compulsory course on Environmental Science at Undergraduate level aims to train students to cater to the need for ecological citizenship through developing a strong foundation on the critical linkages between ecology-society-economy.

Course Description:
Graduates will evolve into ecologically informed and socially responsible citizens who are empowered to protect the natural resources while ensuring sustainable lifestyle and developmental model.

Course Contents:

Unit 1: Introduction to Environmental Studies (2 lectures)

Multidisciplinary nature of environmental studies
Scope and importance; Concept of sustainability and sustainable development

Unit 2: Ecosystem (8 lectures)

Definition and concept of Ecosystem: Structure of ecosystem (biotic and abiotic components); Functions of Ecosystem. Physical (energy flow), Biological (food chains, food web, ecological succession) and Biogeochemical (nutrient cycling) processes. Concepts of productivity, ecological pyramids and homeostasis
Types of Ecosystem – Tundra, Forest, Grassland, Desert, Aquatic (ponds, streams, lakes, rivers, oceans, and estuaries) – their importance and threats on them with relevant examples from India Ecosystem services (Provisioning, Regulating, Cultural and Supporting). Basics of Ecosystem restoration.

Unit 3: Natural Resources (6 lectures)

Land resources and landuse change Land degradation, soil erosion and desertification. Forest resources and causes of deforestation; impacts of mining and dam building on environment, forests, biodiversity and tribal populations
Water resource: Use and over exploitation of surface and ground water, floods, drought conflicts over water (international & inter-state)
Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs
Case studies: National Solar Mission, Cauvery river water conflict etc

Unit 4: Biodiversity and Conservation (8 lectures)

Definition of Biodiversity; Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India.
India as a mega-biodiversity nation; Endemic and endangered species of India; IUCN Red list; biodiversity hotspots.
Value of biodiversity: Ecological, economic, social, ethical, aesthetic and informational value of biodiversity with examples; sacred groves and their importance with example
Current mass extinction crisis; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasion with emphasis to Indian biodiversity.
Biodiversity conservation strategies: in-situ and ex-situ methods of conservation; Biosphere reserves; Keystone and Flagship species; Species reintroduction and translocation. Case studies: Project Tiger, Vulture breeding program etc

Unit 5: Environmental pollution (8 lectures)
Environmental pollution (Air, water, soil, thermal and noise): causes, effects and controls; Air and water quality standards. Nuclear hazards and human health risks. Solid waste management: Control measures of urban and industrial waste. Pollution case studies: Ganga Action plan (GAP), Delhi air pollution and public health issues etc.

Field work/ Practicals (Equal to 5 lectures)
Field visit to any of the ecosystems found in Delhi like Delhi Ridge/ Sanjay lake/ Yamuna river and its floodplains etc. or any nearby lake or pond, explaining the theoretical aspects taught in the classroom.
Visit to any biodiversity park/ reserve forests/ protected area/ zoo/ nursery/ natural history museum in and around Delhi, explaining the theoretical aspects taught in the classroom.
Visit to a local polluted site (Urban/Rural/Industrial/Agricultural), Wastewater treatment plants
Study of common plants, insects, birds and basic principles of identification
Organize a seminar/ conference/ workshop/ panel discussion on relevant topics for enhancing awareness, capacity building and critical reasoning among students

Course Learning Outcomes (CLOs): The course will empower the undergraduate students by helping them to:
CLO-1 Gain in-depth knowledge on natural processes that sustain life, and govern economy.
CLO-2: Predict the consequences of human actions on the web of life, global economy and quality of human life.
CLO-3: Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.
CLO-4: Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participating actively in solving current environmental problems and preventing the future ones.
CLO-5: Adopt sustainability as a practice in life, society and industry.

Text books:

- William P. Cunningham, Mary Ann Cunningham, Barbara Woodworth Saigo, Environmental Science: A global concern, McGrawHill 2003 ¬
- William Cunningham, Mary Cunningham, Principles of Environmental Science: Seventh Edition, Mc Graw Hill 2014 UGC DOCUMENT ON LOCF ENVIRONMENTAL SCIENCE 24
- Rogers PP, Jalal, KF, Boyd JA, An introduction to sustainable development, Earthscan

Reference books:

- Roosa SA, Sustainable Development Handbook, CRC Press 2008 ¬
- Atkinson G., Dietz S., Neumayer E., Agarwala M, Handbook of Sustainable Development, Edward Elger, 2014 ¬
- Robbins P., Hintz J., Moore S.A., Environment and Society: A critical introduction, Wiley Blackwel 2014

Online links for study & reference materials:
https://www.hzu.edu.in/bed/E%20V%20S.pdf

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1	- 05%
Assignment -2	- 05%
Assessment-3(Mid-Exam)	- 20%
Assignment-3/Quiz-1	- 05%
Assignment-4	- 05%
Total Internal Assessment	**- 40%**

B.Sc. (H) Information Technology 1st Year
SEMESTER-II

Course Code: STUGCS2/C03 **Course Name: Operating System**
Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective:
To study concepts related to operating systems, like process management, concurrency and control of processes, deadlocks, memory management, processor and disk scheduling, parallel processing, and file system organization and implementation. Also to study different methods for protection and security that is becoming vital now-a-days.

Course Description:
- To master the basic concepts related to operating systems. To learn in detail about process management.
- To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.
- To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.

Course Contents :

Unit – I: Operating system and function, Evolution of operating system, Batch, Interactive, multiprogramming, Time Sharing and Real Time System, multiprocessor system, Distributed system, System protection. Operating System structure, Operating System Services, System Program and calls.
Unit – II: Process concept, State model, and process scheduling, job and process synchronization, structure of process management, Threads interprocess Communication and Synchronization: Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Hardware Synchronization, Critical Regions, Conditional critical region, Monitor, Inter Process Communication. CPU Scheduling: Job scheduling functions, Process scheduling, Scheduling Algorithms, Non Preemptive and preemptive. Strategies, Algorithm Evaluation, Multiprocessor Scheduling. Deadlock: System Deadlock Model, Deadlock Characterization, Methods for handling deadlock, Prevention strategies, voidance and Detection, Recovery from deadlock combined approach.
Unit – III: Single Contiguous Allocation: H/W support, S/W support, Advantages and disadvantages, Fragmentation, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Swapping, Overlays
Unit – IV: Principles of I/O hardware, Device controller, Device Drivers, Memory mapped I/O, Direct Access Memory, Interrupts, Interrupt Handlers, Application I/O interface, I/O

Scheduling, Buffering, Caching, Spooling, Disk organization, Disk space management, Disk allocation Method, Disk Scheduling, Disk storage.

Unit - V : File Concept, File Organization and Access Mechanism, File Directories, Basic file system, File Sharing, Allocation method, Free space management. Policy Mechanism, Authentication, Internal excess Authorization.

Course learning outcome:

CLO1 : To master the basic concepts related to operating systems. To learn in detail about process management.

CLO2 : To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.

CLO3: To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.

CLO4 : To familiar with file system implementation. To understand mass storage management functions of operating systems.

CLO5: To familiar with Protection and security aspects of operating systems. To expose to other operating systems like distributed OS, Multi-processor OS, RTOS and Mobile OS.

Text books :

- Operating System by Galvin,
  Operating System by Taneun Bomb
- Operating System by William Stalling

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS2/C04 **Course Name: Object Oriented Programming in C++**
Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective(s)

1. Understand and use the basic programming constructs of C++
2. Manipulate various C++ data types, such as arrays, strings, and pointers
3. Isolate and fix common errors in C++ programs
4. Use memory appropriately, including proper allocation/deal location procedures
5. Apply object-oriented approaches to software problems in C++
6. Write small-scale C++ programs using the above skills

Course Description:

Understand fundamentals of object-oriented **programming** in **C++**, including defining classes, invoking methods, using class libraries and also be aware of the important topics and principles of software development.

Course Contact

Unit I:

Introduction:

What is object oriented programming? Why do we need object oriented.Programming characteristics of object-oriented languages C and C++.

C++ Programming basics: Output using cout. Directives. Input with cin. Type bool. The setw manipulator. Type conversions.

Unit II:

Functions : Returning values from functions. Reference arguments. Overloaded function. Inline function. Default arguments. Returning by reference.

Object and Classes :

Making sense of core object concepts (Encapsulation, Abstraction, Polymorphism, Classes, Messages Association, Interfaces) Implementation of class in C++, C++ Objects as physical object, C++ object as data types constructor. Object as function arguments. The default copy constructor, returning object from function. Structures and classes. Classes objects and memory static class data. Const and classes.

Unit III:

Arrays and string arrays fundamentals. Arrays as class Member Data: Arrays of

object, string, The standard C++ String class Operator overloading:

Overloading unary operations. Overloading binary operators, data conversion, pitfalls of operators overloading and conversion keywords. Explicit and Mutable.

Inheritance :

Concept of inheritance. Derived class and based class. Derived class constructors, member function, inheritance in the English distance class, class hierarchies, inheritance and graphics shapes, public and private inheritance, aggregation : Classes within classes, inheritance and program development.

Unit IV:

Pointer :

Addresses and pointers. The address of operator and pointer and arrays. Pointer and Faction pointer and C-types string. Memory management : New and Delete, pointers to objects, debugging pointers.

Virtual Function :

Virtual Function, friend function, Static function, Assignment and copy initialization, this pointer, dynamic type information.

Unit V:

Streams and Files :

Streams classes, Stream Errors, Disk File I/O with streams, file pointers, error handling in file I/O with member function, overloading the extraction and insertion operators, memory as a stream object, command line arguments, and printer output.

Templates and Exceptions :

Function templates, Class templates Exceptions

Course Learning Outcomes (CLOs):

CLO-1: Design the process of interaction between Objects and System w.r.t. Object Oriented Paradigm.

CLO-2: Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.

CLO-3: Analyze basic programming concepts in Java with different object related issues and various string handling functions as well as basic I/O operations.

CLO-4: Discuss basic Code Reusability concept w.r.t. Inheritance, Package and Interface.

CLO-5: Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Reference books:

1. Horstmann, Big Java, Wiley India
2. Herbert Schieldt, “The Complete Reference: Java”, TMH, 7th Edition.
3. Nino,” An Introduction to Programming and Object Oriented Design using Java, w/CD”, Wiley India
4. James Rumbaugh etal, “Object Oriented Modeling and Design”, PHI
5. Bjarne Stroustrup, “C++ Programming Language”, Addison Wesley, 3rd Edition.

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS2/GE02 **Course Name: E-Commerce**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Objectives

1. To impart knowledge on E-Commerce and its various applications.
2. To understand E-Commerce framework and business model applications of E-Commerce
3. To understand e-payment mechanisms

Course Description:
Identify and analyze nature & inherent difficulties in the security of the Information System. Analyze various threats and attacks, corresponding counter measures and various vulnerability assessment and security techniques in an organization

Course Contents:
Unit 1
Introduction: Electronic Commerce - Technology and Prospects, Definition of E-Commerce, Economic potential of electronic commerce, Incentives for engaging in electronic commerce, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, Impact of E-commerce on business.
Network Infrastructure for E- Commerce: Internet and Intranet based E-commerce- Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY).
Unit II
Mobile Commerce: Introduction, Wireless Application Protocol, WAP technology, Mobile Information device, Mobile Computing Applications.
Unit III
Web Security: Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.
Unit IV
Encryption: Encryption techniques, Symmetric Encryption- Keys and data encryption standard, Triple encryption, Asymmetric encryption- Secret key encryption, public and private pair key encryption, Digital Signatures, Virtual Private Network.
Unit V
Electronic Payments: Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking. EDI Application in business, E- Commerce Law, Forms of Agreement, Govt. policies and Agenda.

Course Learning Outcomes (CLOs):
CLO-1: Define and differentiate various types of Ecommerce.
CLO-2: Define and describe E-business and its Models
CLO-3: Describe Hardware and Software Technologies for Ecommerce.
CLO-4: Understand the basic concepts of E-Commerce and identify different technologies used in E-Commerce.
CLO-5: Apply different tools used in E-Commerce.

References

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.
2. Bajaj and Nag, "E-Commerce the cutting edge of Business", TMH
3. P. Loshin, John Vacca, "Electronic commerce", Firewall Media, New Delhi

Online links for study & reference materials :

- http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

NOIDA INTERNATIONAL UNIVERSITY

Course Code : STUGCS2/AECC2 **Course Name: Technical communication**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :
To create an understanding in the mind of the student regarding formal and professional communication practiced in a professional environment .

Course Description:
In the present industrial scenario the role of instrumentation is becoming more vital day by day specially in case of industrial automation. More advanced, precise and complex instrumentations are being employed in the industry. These advance instruments requires communication of data from equipment/machines to instruments and vice versa for process and quality control.

Course Contents:

- **Unit - I: (Business Communication):** Difference between general and business communication, this should cover general and technicalwriting, oral communications and listening skill
- **Unit - II: (Expression)** Practical communication skill development, business presentation with multimedia,speaking skill, prepared speech, extempore speech
- **Unit - III :(Reading Skills)** Reading skill: comprehension test, technical report writing: precise, technical/businessletter, organization of writing material, poster presentation
- **UNIT-IV (Literature) :**Of Studies: Francis Bacon
- **UNIT-V (Presentation):**Writing technical document, preparing software user manual, preparing project documentation.

Course learning outcome:

- **CO1.** This unit is for understanding general business communication.
- **CO2.** This unit is for understanding skill development and confidence development.
- **CO3.** Reading skills are extremely important for any type of business communication.
- **CO4.** Understand the core values that shape the ethical behavior of an engineer and exposed awareness on professional ethics and human values.
- **CO5.** writing technical documentation

Text books :

Business Correspondence & Report Writing, Sharma, TMH 2.Business Communication Strategies, Monipally, TMH
English for Technical Communication , Laxminarayanan,Scitech
Business Communication, Kaul,PHI

Online links for study & reference materials :

- https://mgdic.files.wordpress.com/2016/12/3361704-industrial-data-communication.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

B.Sc. (H) Information Technology 2nd Year
SEMESTER-III

Course Code: STUGCS3/CO5 **Course Name : Algorithm and Data Structure**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective:
The objective of the course is to teach programming (with an emphasis on problem solving) and introduce elementary data structures. The student should, at a rudimentary level, be able to prove correctness (loop invariants, conditioning, etc) and analyze efficiency (using the `O' notation).

Course Description :

- Design correct programs to solve problems.
- Choose efficient data structures and apply them to solve problems.
- Analyze the efficiency of programs based on time complexity.
- Prove the correctness of a program using loop invariants, pre-conditions and post-conditions in programs

Course Contents :
Unit – I: Arrays: Representation of single and multidimensional arrays; sparse arrays - lower and upper triangular matrices and Tri-diagonal matrices
Unit – II: .Stacks and Queues: Introduction and primitive operations on stack; Stack application, Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion from infix to postfix, Introduction and primitive operation on queues.
Unit – III: Lists: Introduction to linked lists; Sequential and linked lists, operations such as traversal, insertion, deletion, searching, Two way lists and Use of headers. Trees: Introduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion, deletion; threaded trees, binary search trees, trees in search algorithm. B- tree. B+ tree and applications.
Unit – IV: Sorting Techniques: Insertion sort, selection sort, merge sort, heap sort.
Searching Techniques: Linear search, binary search and hashing
Unit - V :File structure: physical storage devices and their characteristics, constituents of a file viz. fields, records, fixed and variable length records, primary and secondary keys; file operations, basic file system operations, file organizations: serial sequential, index sequential, direct , inverted, hashing function and collision handling methods

Course learning outcome :

- **CLO1 :** this unit is to Review of Problem Solving using computers, Abstraction, Elementary Data Types. Algorithm design- Correctness via Loop invariants as a way of arguing correctness of programs, preconditions, post conditions associated with a statement.develop a understanding of basic character sets keywords and identifiers used for the c programming dataset. Learning objective of this unit is define data types and use them in simple data processing applications .

- **CLO2:** Introduction to stacks , arrays and queues. Difference and various use case.
- **CLO3**: This unit is to introduce lists and tree terminology . introduction to graphs and trees .
- **CLO4** : various sorting techniques. Insertion , bubble etc.
- **CLO5:** this unit is for learning different modes of file storage. Records and there usage .

Text books :

Data Structures and Algorithm Analysis in C++, by Mark Allen Weiss (Pearson 2007)

Reference books :

- Data structures and Algorithms in C++ -- by Adam Drozdek (1994 2001).
- How to solve it by Computer -- by R G Dromey (PHI 1982, Paperback 2008).
- Fundamentals of Data Structures in C -- by Horowitz, Sahni and Anderson-Freed (Silicon Press 2007).
- Data Structure Using C and C++ -- by Y. Langsam, M. J. Augenstein and A. N. Tanenbaum (Pearson Education, 2nd Edition, 2015).

Online links for study & reference materials :

https://slideplayer.com/slide/5987087/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : STUGCS3/CO6 **Course Name : Computer Networks**
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :
Course will work with data communication and switching techniques.
The course work on networks and different layers of network and data processing.

Course Description :
Course will work on transferring of messages from one port to another.
Course will introduce the structure of Media Access Protocols .
Ability to distinguish various data transmission and modulation techniques.
Ability to analyses the impact of various channel impairments on data transmission.
Ability to identify different data networks and the networking hardware.

Course Contents :

Unit-I

Data communications concepts: Digital and analog , parallel and serial, synchronous and asynchronous, simplex, half duplex, duplex, multiplexing, Transmission media: Wired (physical): Twisted pair, Coaxial cable, Optical Fiber.
Communication switching techniques: Circuit switching, message switching, packet switching.

Unit-II

Introduction to Computer Network : Network Topologies, Types of Network, OSI and TCP/IP Models: Layers and their functions, comparison of models.
Data Link Layer Fundamentals: Framing, Basics of Error Detection, Forward Error Correction, Cyclic Redundancy Check codes for Error Detection.

Unit-III

Media Access Protocols : The advantages of Multiple-Access Sharing of Channel Resource, ALOHA, Carrier Sense Multiple Access (CSMA), CSMA with Collision Detection (CSMA/CD), Token Ring, Token Bus, Asynchronous Transfer Mode (ATM).

Unit-IV

Network Layer: Host to Host Delivery: IP Addressing and Routing, Gateway, N/W Layer Protocols: ARP, IPV4, ICMP, IPV6.
Transport Layer: Process-to-Process Delivery: UDP, TCP Congestion Control & Quality of Service.

Unit-V

Application Layer: Client Server Model, Domain Name System (DNS), E-mail (SMTP), File Transfer (FTP) and Model TCP/IP.

Course Learning Outcomes(CLOs) :

CLO-1 : Students will be able to work on different servers and communication models.

CLO-2 : Students will be able to work on Lam Man and Wan network.

CLO-3 : The students will be able to install a network system.

CLO-4 : Students will be able to host an application and web sites.

CLO-5 : Ability to identify basic components of data communication system

Text books :

- A.S. Tanebaum : Computer Networks (4th ed.), Prentice-Hall of India.
- W. Tomasi : Introduction to Data Communications and Networking, Pearson, Education.

Reference books :

- P.C. Gupta : Data Communications and Computer Networks, Prentice-Hall of India.
- Behrouz Forouzan and S.C., Fegan : Data Communications and Networking, McGraw Hill.
- L.L. Peterson and B.S. Davie : Computer Networks : A system Approach, Morgan Kaufmann.
- William Stalilngs : Data and Computer Communications, Pearson Education.

Online links for study & reference materials :

https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : STUGCS3/CO7 **Course Name :** Programming in Java
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective(s)

1. Be able to explain the difference between object oriented programming and procedural programming.
2. Be able to program using more advanced C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling, etc.
3. Be able to build classes using appropriate encapsulation and design principles
4. Be able to apply object oriented or non-object oriented techniques to solve bigger computing problems

Course Description:

Understand fundamentals of object-oriented **programming** in **Java**, including defining classes, invoking methods, using class libraries and also be aware of the important topics and principles of software development.

Course Contact

Unit I

Object Modeling: Objects and classes, links and association, generalization and inheritance, aggregation, abstract class, multiple inheritance, meta data, candidate keys, constraints. Dynamic Modeling: Events and states, operations, nested state diagrams and concurrency, advanced dynamic modeling concepts, a sample dynamic model.

Unit II

Functional Modeling: Data flow diagram, specifying operations, constraints, a sample functional model OMT (object modeling techniques) methodologies, examples and case studies to demonstrate methodologies, comparisons of methodologies, SA/SD, JSD.

Unit III

Java Programming: Introduction, Operator, Data types, Variables, Methods & Classes, Multithread Programming, I/O, Java Applet.

Unit IV

Java Library: String Handling, Input/Output exploring Java.io, Networking, Exception Handling, Event Handling, Introduction to AWT, Working with window, Graphics, AWT Controls, Layout Manager and Menus, Images.

Unit V

Software Development using Java:

Java Swing, Migrating from C++ to java, Application of java, JDBC.

Course Learning Outcomes (CLOs):

CLO-1: Design the process of interaction between Objects and System w.r.t. Object Oriented Paradigm.

CLO-2: Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java

CLO-3: Analyze basic programming concepts in Java with different object related issues and various string handling functions as well as basic I/O operations.

CLO-4: Discuss basic Code Reusability concept w.r.t. Inheritance, Package and Interface

CLO-5: Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Reference books:

1. Horstmann, Big Java, Wiley India
2. Herbert Schieldt, "The Complete Reference: Java", TMH, 7th Edition.
3. Nino," An Introduction to Programming and Object Oriented Design using Java, w/CD", Wiley India
4. James Rumbaugh etal, "Object Oriented Modeling and Design", PHI
5. Bjarne Stroustrup, "C++ Programming Language", Addison Wesley, 3rd Edition.

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS3/GE3 **Course Name: Hypertext Preprocessor**
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :
The course deals with the development of Back end of a web site and application.
Dealing with connection and communication with the databases and upgrading of the set up.

Course Description :
It will work on managing the database system for a server.
Manipulating and security issues will be dealt in.

Course Contents :
Unit-I
Introduction to PHP Evaluation of Php: Basic Syntax Defining variable and constant Php, Data types, Operator and Expression, Handling Html Form With Php, Capturing Form.
Unit-II
Data Dealing with Multi-value filed: Generating File uploaded form, Redirecting a form after submission, Decisions and loop Making, Decisions Doing Repetitive task with looping, Mixing Decisions and looping with Html.
Unit-III
Function: What is a function, Define a function Call by value and Call by reference, Recursive function.
String: Creating and accessing String, Searching & Replacing String, Formatting String, String Related Library function.
Unit-IV
Array: Anatomy of an Array, Creating index based and Associative array, Accessing array, Element Looping with Index based array, Looping with associative array, using each() and foreach(), Some useful Library function.
Unit-V
Working with file and Directories: Understanding file & directory, Opening and closing a file, Copying ,renaming and deleting a file, Working with directories, Building a text editor, File Uploading & Downloading, Generating Images with PHP.

Course Learning Outcomes(CLOs) :
CLO-1 :The students will be able to develop web site .
CLO-2 :Students will be able to work on back end of a web site and application. .
CLO-3 :Students will be able to communicate with database server.
CLO-4 :Students can work on different back end of a web sites or applications.
CLO5 : Students will be able to manage critical risk strategy of the development cycle.

Text books :

- Raghurama Krishnan : PHP, Johannes Gehrke, TMH.
- Siberschatz, Korth : Learn PHP, McGraw Hill, latest edition.

Reference books :

- C.J. Date : Introduction to Hypertext, Pearson, Education.
- Elmasri Navathe : Server Scripting PHP,

Online links for study & reference materials :

https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

B.Sc. (H) Information Technology 2nd Year

SEMESTER-IV

Course Code: STUGCS4/C08 **Course Name: Design Analysis and Algorithm**
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Objectives
1. To understand the Object-based view of Systems
2. To develop robust object-based models for Systems
3. To inculcate necessary skills to handle complexity in software design

Course Description:
System Analysis and Design is a specification detailing how a set of software and hardware technology standards interact to form a computer system or platform. System Analysis and Design refers to how a computer system is designed and what technologies it is compatible with. There are three categories of computer architecture:

Course Contents:
Unit 1 :
Introduction to SAD Fundamentals of System, Important Terms related to Systems, Classification of Systems, Real Life Business Subsystems, Real Time Systems, Distributed Systems, Development of a successful System, Various Approaches for development of Information Systems Structured Analysis and Design Approach, Prototype, Joint Application Development.

Unit 2 :
Process of System Development Systems Development Life Cycle: Phases of SDLC, Project Identification and Selection, Project Initiation and planning, Analysis, Logical Design, Physical Design, Implementation, Maintenance, Product of SDLC Phases, Approaches to Development, Prototyping, Joint Application Design, Participatory Design, Case Study

Unit 3 :
Introduction to Documentation of Systems Concepts and process of Documentation: Types of Documentation, System Requirements Specification, System Design Specification, Test Design Document, User Manual, Different Standard for Documentation, Documentation and Quality of Software,

Unit 4:
Process of System Planning Fact finding Techniques: Interviews, Group Discussion, Site Visits, Presentations, Questionnaires, Issues involved in Feasibility Study, Technical

Feasibility, Operational Feasibility, Economic Feasibility, Legal Feasibility, Cost Benefit Analysis, Preparing Schedule, Gathering Requirements of System, Joint Application Development, Prototyping

Unit 5 :
Modular and Structured Design Design Principles: Top Down Design, Bottom Up Design, Structure Charts, Modularity, Goals of Design, Coupling, Cohesion. Criteria for Report Design, Relevance, Accuracy, Clarity, Timeliness, Cost

Course Learning Outcomes (CLOs):
CLO-1: Ability to analyze and model software specifications.
CLO-2: Ability to abstract object-based views for generic software systems.
CLO-3: Ability to deliver robust software components
CLO-4: Ability to identify the issues related to performance improvement
CLO-5: Ability to distinguish performance tradeoff between different memory units and instruction sets

Reference:
1. Sara Baase and Allen Van Gelde, "Computer Algorithms, Introduction to Design and Analysis", 3rd Edition, Pearson Education, Delhi, 2002.
2. Aho, Hoporoft and Ullman, "The Design and Analysis of Computer Algorithm", Pearson Education, Delhi, 2001.
3. Basu S.K.,"Design Methods and Analysis of Algorithms", PHI, 2006.
4. Brassad and Bratley,"Fundamentals of Algorithms", PHI, 1995.
5. Sanjoy Dasgupta, Christos Papadimitriou, Umesh vazirani, "Algorithms", TMG, 2007.

Online links for study & reference materials :
https://www.dei.unipd.it/~capri/SI/MATERIALE/DWDM0405.pdf
Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS4/CO9 **Course Name: Software Engineering**
Course Credit Hour: 4hr **Total Contact Hour : 60hr**

Course Objective:
Software Engineering (SE) comprises the core principles consistent in software construction and maintenance: fundamental software processes and life-cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools. iterative development, interpretation of requirements and use case documents into code; application of design notation in UML and use of commonly-used design patterns. Current industry-strength programming languages, technologies and systems feature highly in the practical components, electives and projects of the course, but they are also taught with a view to understanding and applying principles underlying their more ephemeral character.

Course Description:
- Knowledge of basic SW engineering methods and practices, and their appropriate application.
- Describe software engineering layered technology and Process frame work. 3
- A general understanding of software process models such as the waterfall and evolutionary models. Understanding of software requirements and the SRS documents. Understanding of the role of project management including planning, scheduling, risk management, etc.
- Describe data models, object models, context models and behavioral models. Understanding of different software architectural styles. Understanding of implementation issues such as modularity and coding standards. Understanding of approaches to verification and validation including static analysis, and reviews.

Course Contents :
Unit-I: Introduction Software life cycle models: Waterfall, Prototype,Evolutionary and Spiral models, Overview of Quality Standards like ISO 9001, SEI-CMM.
UNIT-II: Software Metrics and Project Planning Size Metrics like LOC, Token Count, Function Count, Design Metrics, Data Structure Metrics, Information Flow Metrics. Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management.
UNIT- III: Software Requirement Analysis, design and coding Problem Analysis, Software Requirement and Specifications, Behavioural and non-behavioural requirements, Software Prototyping Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design Top-down and bottom-up Structured programming, Information hiding.
UNIT- IV : Software Reliability, Testing and Maintenance Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Software process, Functional testing:

Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing: path testing, Data flow and mutation testing, unit testing, integration and system testing, Debugging, Testing Tools, & Standards. Management of maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software RE-engineering.

UNIT- V : UML: Introduction to UML, Use Case Diagrams, Class Diagram: State Diagram in UML Activity Diagram in UML.Sequence Diagram in UML Collaboration Diagram in UML

Course learning outcome :

CLO1 : Understand basic SW engineering methods and practices, and their appropriate application.

CLO2: Understand u of software process models such as the waterfall and evolutionary 10. models.

CLO3: problem analysis and description, This unit is to introduce Discuss data models, object models, context models and behavioural models.

CLO4 : Understand of different software architectural styles and Process frame work

CLO5: this unit is for learning different modes of file storage. Records and there usage .

Text books :

- K. K. Aggarwal & Yogesh Singh, .Software Engineering., 2nd Ed, New Age International, 2005.
- R. S. Pressman, ―Software Engineering – A practitioner‗s approach‖, 5th Ed., McGrawHill Int. Ed., 2001.

Online links for study & reference materials :

https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS4/SEEC2 **Course Name : Web Technology**
Course Credit Hour: 4hr **Total Contact Hour : 60hr**

Objectives: The objective of this course to make a student will be familiar with client server architecture and able to develop a web application using java technologies. Students will gain the skills and Project based experience needed for entry into web application and development career

Course Description:

The course structure deals with software development cycle and phases of development in a web application.

The course will deal with the cost and maintenance cycle of a web site.

Course Contents:

Unit-I

Introduction to Internet Basic : The Basic of the Internet, Concepts of Domain, IP Addressing, Resolving Domain Names, Overview of TCP/IP and its Services, WWW, web projects, web applications, Web Team, planning & process development.

Unit-II

Designing Pages with HTML: Introduction to HTML, Essential Tags, Deprecated Tags, Tags and Attributes, Text Styles and Text Arrangements, Text, Effects, Exposure to Various Tags, Color and Background of Web Pages, Lists and their Types, Attributes of Image Tag.

Unit-III

Link: Hypertext, Hyperlink and Hypermedia, Links, Anchors and URLs, Links to External Documents, Different Section of a Page and Graphics, Footnote and e-Mailing, Creating Table, Frame, Form and Style Sheet.

Unit-IV

DHTML: Dynamic HTML, Document Object Model, Features of DHTML, CSSP (Cascading Style Sheet Positioning) and JSSS (JavaScript assisted Style Sheet), Layers of Netscape, The ID Attribute, DHTML Events.

Unit-V

Web Page: Web Page Basics, Web Terminologies, Phases of Planning and Building Web Sites, The FTP, HTTP and WPP, Features, Web Page Views, Adding Pictures, Backgrounds, Links.

Scripting language: Java script and VB script JDBC database.

Course Learning Outcomes(CLOs) :

CLO-1 : The students will be able to work on web development and application development.
CLO-2 : Students will be able to develop software model .
CLO-3 : Students will be able to work on different data analyzing model.
CLO-4 : Students can work in testing phase of software .
CLO5 : Students will be able to manage critical risk strategy of the development cycle.

Text books :

- Web Development TMH.
- Nasib Singh : Learn HTML, Khanna Book Publishing Co. (P) Ltd. N. Delhi.
- Jalote, Pankaj : An Integrated Approach to HTML, Narosa Publications.
- Chhillar Rajender Singh : HTML, Metrics, Excel Books.

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Reference books :

- Ghezzi, Carlo : Fundaments of HTML, PHI.
- Fairely, R.E. : HTMLEngineering Concepts, McGraw-Hill.
- Lewis, T.G.: Learn CSS, McGraw-Hill.

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Online links for study & reference materials :

https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS4/GE4 **Course Name: Mobile Computing**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective :
Understand fundamentals of wireless communications. Analyze security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks. Demonstrate basic skills for cellular networks design. Apply knowledge of TCP/IP extensions for **mobile** and wireless networking

Course Description :
This **course** will cover various topics of **mobile computing**, networking, and systems, including but not limited to: applications of smartphones, cellular networks, embedded sensor systems, localization systems, energy efficiency of **mobile** devices, wearable and vehicular **mobile** systems, **mobile** security, virtual reality.

Course Contents :
Unit-I: Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

Unit-II: Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802.11, Bluetooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

Unit-III: Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.

Unit-IV: Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

Unit-V: Adhoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad-Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

Course Learning Outcomes(CLOs) :

CLO-1: The students will be able to work on Mobile development and application development.

CLO-2: Students will be able to develop network model .

CLO-3 : Students will be able to work on different data analyzing model.

CLO-4 : Students can work in testing phase of software .

CLO5 : Students will be able to manage critical risk strategy of the development cycle.

Text books :
- Mobile Communication and wireless technologies TMH.
- Nasib Singh : Learn HTML, Khanna Book Publishing Co. (P) Ltd. N. Delhi.
- Jalote, Pankaj : An Integrated Approach to HTML, Narosa Publications.
- Chhillar Rajender Singh : HTML, Metrics, Excel Books.

.

Reference books :
- Ghezzi, Carlo : Fundaments of HTML, PHI.
- Fairely, R.E. : HTMLEngineering Concepts, McGraw-Hill.
- Lewis, T.G.: Learn CSS, McGraw-Hill.

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Online links for study & reference materials :
https://noidatut.com/
Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

B.Sc. (H) Information Technology 3rd Year

SEMESTER-V

Course Code : STUGCS5/C11 **Course Name : DOT NET Framework**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :
This course will cover the practical aspects of multi-tier application development using the .NET framework. The goal of this course is to introduce the students to the basics of distributed application development. We will introduce the students to Web Service development and .NET remoting. Technologies covered include the Common Language Runtime (CLR), .NET framework classes, C#, ASP.NET, and ADO.NET. We will also cover service oriented architecture, design, performance, security, content managements systems and deployment issues encountered in building multi-tier distributed applications.

Course Description :
The course deals in writing code using Visual Basic (**VB**) and C#; create **ASP**.**NET** Web applications and process Web forms and build SQL Server databases and access them using ADO.**NET**. Participants have the choice of using either **C#** (C Sharp) or **VB** (Visual Basic) – the **Microsoft** . **NET** core languages.

Course Contents :

UNIT - I

C# Fundamentals: Basic classes, declarations, conditionals, loops, arrays, strings, enumerations, structures, andEncapsulation, inheritance, polymorphism, Structured exception handling. Understanding interface types

UNIT - II

Delegates, Events, and Lambdas: basics of each -- very important for event driven (GUI), Understanding the garbage collector, creating and working with .NET assemblies.

UNIT - III

Windows Forms and WPF: Basic windows programming: forms, component class, control class, control events, menus, status bars, tool bars, interacting with the registry. Indexers, Operator Overloading, Custom Type Conversion, Extension Methods, Anonymous Types, Pointer Types

UNIT - IV

Input, Output, and Serialization: System.IO, Directory and File Types, StreamReaders and StreamWriters, working with binary data, configuring objects for serialization, Working with and creating custom generic types.

UNIT - IV

Processes, AppDomains, Contexts, Threading, Type Reflection, Late Binding, Attribute-based programming: Advanced topics from the text will be discussed as time permits. We can decide as a class on what to explore if we get to this point.

Course Learning Outcomes(CLOs) :

CLO-1 :The students will be able to work on different server, web sites and applications.

CLO-2 :Students will be able to develop the backend of any project.

CLO-3 :Students will have the idea of encryption , decryption and maintain the database and all the security parameters.

CLO-4 :Students can work as system administrator and technical support.

Text books :

1. C Sharp and Dot net framework by Andrew Troelsen
2. C Sharp in Depth by Jon Skeet
3. Pro VB 2008 and the .NET 3.5 Platform (Windows.Net) by Andrew Troelsen

Reference books :

Programming Entity Framework by Julia
Learning Visual Basic .NETJesse Liberty
Beginning VB.NET Databases by Thearon Willis
Professional VB 2005 with .NET 3.0 (Programmer to Programmer) by Bill Evjen, Billy Hollis, Bill Sheldon, and Kent Sharkey

Online links for study & reference materials :

https://noidatut.com/view-nts.php?vntpntsfxxvisurz=b6d767d2f8ed5d21a44b0e5886680cb9

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1 - 05%
Assessment-2 - 05%
Assessment-3(Midexam) - 20%
Assessment-3 - 05%
Assessment-4 - 05%
Total Internal Assessment - 40%

NOIDA INTERNATIONAL UNIVERSITY

Course Code : STUGCS5/C12 **Course Name : Computer Graphics**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

Course will help the students understand the graphics controller of a system.
The course will help the students developing the graphical structure for a system.

Course Description :
Work on to deal with Graphics applications of a system.
Designing and graphical structure will be dealt in the module.

Course Contents :

Unit-I
Graphics Primitives: Introduction to computer graphics, Basics of Graphics systems, Application areas of Computer Graphics, overview of graphics systems, video-display devices, and raster-scan systems, random scan systems.

Unit-II
Output Primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms.
Filled area primitives: Scan line polygon fill algorithm, boundary fill and flood-fill algorithms.

Unit-III
2-D Geometrical Transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, .
2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping
algorithms, Sutherland –Hodgeman polygon clipping algorithm..

Unit-IV
3-D Object Representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces, polygon-rendering methods..

Unit-V
3-D Geometric Transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations.
3-D Viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping.

Course Learning Outcomes(CLOs) :

CLO-1 : Students will be able develop graphics application.

CLO-2 : Students will be able to work on designing model of a system. .

CLO-3 : The students will be able code new graphics and pictures for the system.

CLO-4 : Students will be able to understand the technologies behind the display units .

CLO-5 : Analyze and compare the different kinds of user interfaces in order to be able to decide which one will be more efficient and ergonomic according to the required specifications of the application to be developed.

Text books :

- Donald Hearn and M. Pauline Baker : Computer Graphics, PHI Publications.
- Plastock : Theory & Problem of Computer Gaphics, Schaum Series.

Reference:

- Donald Hearn and M. Pauline Baker : Computer Graphics, PHI Publications.
- Plastock : Theory & Problem of Computer Gaphics, Schaum Series.
- Foley & Van Dam : Fundamentals of Interactive Computer Graphics, Addison-Wesley.
- Newman : Principles of Interactive Computer Graphics, McGraw Hill.

Online links for study & reference materials :

https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : STUGCS5/DSC1 **Course Name : Cloud Computing**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :
Students understand the methodologies and concepts of computing and servers.
The course will help the students maintaining a server, difference between technology and methodology.

Course Description :
Will work on to deal with infrastructure, software and platform.
Course will work on different services like Iaas, Paas, Saas and its implementation methodologies.

Course Contents:

Unit 1: Overview of Cloud Computing
Introduction to cloud, features of cloud(benefits and disadvantages), architecture of cloud computing, types of service delivery in cloud ,their providers and examples of software for each type(Iaas, Paas, Saas), cloud deployment models: Public ,private and hybrid cloud.
Unit 2: Cloud Computing Concepts:
Virtualization: introduction to virtualization, characteristics of virtualization, how is virtualization achieved, what is hypervisor, types of hypervisor(type 1 and type 2),Multitenancy and its advantages and disadvantages, migration in cloud.
Unit 3: Distributed systems
Introduction to distributed systems, How are distributed systems managed, Introduction to mapreduce framework, importance of mapreduce , understanding how it works with an example. Introduction to Hadoop, What is hadoop, why hadoop ,HDFS ,Traditional file system vs HDFS, Big data: what is big data, features of big data, study sample dataset for big data, techniques and tools for handling big data, Hive
Unit 4: Saas
What is Saas, Agile programming, Introduction to OOP, Introduction to Ruby, simple programming using Ruby, Ruby on Rails.
Unit 5: Cloud security
Security risks in cloud, types of threat in cloud, ways of handling the threats, covert channel attacks in cloud, detection mechanisms for the threats, ways of making cloud secure.
Course Learning Outcomes(CLOs) :
CLO-1 : Students will be able to work on servers, networking and security issues.

CLO-2 : Students will be able to handle the backend of a network.

CLO-3 : The students will be able to work with organization in line and outline communication.

CLO-4 : Students will be able to develop and host domains and applications.

Text books :
Cloud computing by A. S Aggarwal.
Reference books :
1. Towards Expert Systems for Enhancing Quality of Services in Cloud Computing Research by Dr. Aadarsh Malviya
2. Cloud Computing and its Services by Manoj Desai.

Online links for study & reference materials :
https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS5/DSC2 **Course Name: Data Mining**
Course Credit Hour: 4hr **Total Contact Hour: 60hr**

Course Objective: Understand the fundamentals of data mining and its application in various business and social domains. It is an introduction to the field of data mining (also known as knowledge discovery from data, or KDD for short). It focuses on fundamental data mining concepts and techniques for discovering interesting patterns from data in various applications It emphasizes techniques for developing effective, efficient, and scalable data mining tools

Course Description:

- Understand the fundamentals of data mining and its functionalities
- Obtain knowledge in different data mining techniques and algorithms
- Discuss about various application domains of data mining
- Understand advanced mining
- Apply on different case studies

Unit-I

Data Warehousing: Introduction- Definition and description, need for data ware housing, need for strategic information, failures of past decision support systems, OLTP vs DWH-DWH requirements-trends in DWH-Application of DWH.

Unit-II

Data Warehousing Architecture: Reference architecture- Components of reference architecture Data warehouse building blocks, implementation, physical design process and DWH deployment process. A Multidimensional Data, Model Data Warehouse Architecture.

Unit-III

Data Mining: Data mining tasks-Data mining vs KDD- Issues in data mining, Data Mining metrics, Data mining architecture - Data cleaning- Data transformation- Data reduction - Data mining primitives.

Association Rule Mining: Introduction - Mining single dimensional Boolean association rules from transactional databases - Mining multi-dimensional association rules.

Unit-IV

Classification and Prediction: Classification Techniques - Issues regarding classification and prediction - decision tree - Bayesian classification –Classifier accuracy – Clustering – Clustering Methods - Outlier analysis.

Unit-V

Applications and Other Data Mining Methods: Distributed and parallel Data Mining Algorithms, Text mining- Web mining.

Course learning outcome:

CLO1: Illustrate the concepts of data mining and data warehousing concepts and techniques.
CLO2: Apply data mining techniques using data mining tools.
CLO3: Implement different data mining techniques and algorithms
CLO4: Do web mining and spatial mining
CLO5: Implement data ware house

Books Recommended:

1. Jiawei Han and Micheline Kamber, " Data Mining Concepts and Techniques", Morgan Kaufmann Publishers, USA, 2006.
2. Berson,"DataWarehousing, Data Mining and OLAP", Tata McGraw Hill Ltd, New Delhi, 2004.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, , Pearson Education.
4. Arun K Pujari,"Data mining techniques", Oxford University Press, London, 2003.
5. Dunham M H,"Data mining: Introductory and Advanced Topics". Pearson Education, New Delhi, 2003.
6. Mehmed Kantardzic," Data Mining Concepts, Methods and Algorithms", John Wiley and Sons, USA, 2003.
7. Soman K. P., DiwakarShyam, Ajay V., Insight into Data mining: Theory and Practice, PHI 2006

Online links for study & reference material
https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/download-course-materials/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

B.Sc. (H) Information Technology 3rd Year

SEMESTER-VI

Course Code : STUGCS6/C11 **Course Name : Artificial intelligence**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

This course provides fundamental knowledge on artificial intelligence (AI) concepts. It includes study of AI foundations, sub-areas and applications. It followed the study of problem-solving methods in AI using search techniques. Game playing has always intrigued AI researchers and hence this topic is also covered. Knowledge representation and reasoning is the core of any automated AI systems and thus one unit has been dedicated to elaborately discuss about logic concepts

Course Description :
Advanced knowledge representation methods like case grammars and semantics web are briefly touched upon in the last units along with the concepts of natural language processing.

Course Contents :
Unit – I: INTRODUCTION - Overview of Artificial intelligence- Problems of AI, AI technique, Tic – Tac – Toe problem. Problems, Problem Space & search.
Unit – II: Heuristic Search Techniques, Knowledge representation issues. Representing knowledge using rules.
Unit – III: Symbolic reasoning under uncertainty. Statistical reasoning, Weak slot & filler structures. Strong slot & filler structures.
Unit – IV: Game planning –Minimax search procedure, adding alpha beta cut-off's, iterative deepening, Planning. Natural language processing, Understanding.
Unit – V: Expert systems- expert system shells, knowledge acquisition, Basic knowledge of programming language like Prolog & Lisp.

Course learning outcome :
CLO1 :Learn the fundamentals of AI. Gain Insights into information and uninformed search techniques with illustrations.
CLO2: : Understand principles of knowledge representation basics and advanced methods like case grammars and semantic web.
CLO3: Apply propositional and predicate logic to infer sentences in knowledge representation basics.
CLO4 : Understand the use and applications of expert systems.
CLO5:Apply probability theory to draw conclusions using Naïve Bayes and Bayesian networks.

Text books :

Artificial Intelligence, Ritch & Knight, TMH
Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
Logic & Prolog Programming, Saroj Kaushik, New Age International 4.Expert Systems, Giarranto, VIKAS

Online links for study & reference material

https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/download-course-materials/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: STUGCS6/C12 **Course Name : Theory of Computation**
Course Credit Hour: 4hr **Total Contact Hour : 60hr**

Course Objective :
Theory provides a simple, elegant view of the complex machine that we call a computer. Theory possesses a high degree of permanence and stability, in contrast with the ever-changing paradigms of the technology, development, and management of computer systems. Further, parts of the theory have direct bearing on practice, such as Automata on circuit design, compiler design, and search algorithms; Formal Languages and Grammars on compiler design; and Complexity on cryptography and optimization problems in manufacturing, business, and management.

Course Description :

Introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.

Enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

Course Contents :
Unit – I: Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition tabl e, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transi ion, Language of NFA, Equi valence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem
Unit – II: Regular expression (RE) , Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages . Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.
Unit – III: Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation , Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.
Unit – IV:Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack,

Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA

Unit - V :Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

Course learning outcome :

CLO1 : Automata, computability, and complexity ,Mathematical tools, Definitions, theorems, and proofs.

CLO2: Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression

CLO3: Understand recursive and recursively enumerable languages.

CLO4 : Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack

CLO5: Understand Turing Machines and the simple primitive mechanisms needed for all computation

Text books :

Hopcroft, Ullman, "Introduction to Automata Theory,Languages and Computation. Pearson Education.

K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science : Automata, Languages and Computation", PHI Learning Private Limited, Delhi India.

Reference books:

Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.

Y.N.Singh "Mathematical Foundation of Computer Science", New Age International.

Online links for study & reference materials :

http://www.cs.virginia.edu/~robins/cs3102/CS3102

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code STUGCS6/DSC3 **Course Name : Cryptography& Network Security**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :
Security works on encryption and decryption of data.
It works on the security and communication section of the applications and web portals.

Course Description :
Course covers basics of security and networking issues. .
Course will help the students in mastering the programming concepts and security issues

Course Contents :
UNIT I
Security trends, Attacks and services, Classical crypto systems, Different types of ciphers Ceaser, Transposition and Hill Cipher, sequences Group, Ring and Field, Congruence's Chinese Remainder theorem, Modular exponentiation, Fermat and Euler's theorem
UNIT II
Simple DES, Differential cryptanalysis, DES – Modes of operation – Triple DES –AES – RC4 – RSA – Attacks – Primality test, factoring.
UNIT III
Discrete Logarithms, Computing discrete logs, Diffie-Hellman key exchange, ElGamal Public key, cryptosystems: Hash functions, Secure Hash, Birthday attacks -MD5 – Digital signatures – RSA –Elgamel DSA
UNIT IV
Authentication applications, Kerberos, X.509, PKI, Electronic Mail security, PGP, S/MIME IP security, Web Security, SSL, TLS, SET
UNIT V
System security, Intruders, Malicious software, viruses, Firewalls, Security Standards

Course Learning Outcomes(CLOs) :
CLO-1 :The students will be able to work on different server, web sites and applications.

CLO-2 :Students will be able to develop the backend of any project.

CLO-3 :Students will have the idea of encryption , decryption and maintain the database and all the security parameters.

CLO-4 :Students can work as system administrator and technical support.

Text books :
William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, New Jersey.

Reference books :
1. Johannes A. Buchmann, "Introduction to cryptography", Springer- Verlag.
2. Atul Kahate, "Cryptography and Network Security", TMH
3. Mahtab Alam, "Information Security and Cryptography, BOOKSHELF.

Online links for study & reference materials :
https://noidatut.com/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

NOIDA INTERNATIONAL UNIVERSITY

GREATER NOIDA

School of Sciences

Department of Mathematics

COURSE SYLLABUS

as per CBCS

B.Sc. (Mathematics Hons.)

(ALL SEMESTERS)

w.e.f., 2019-2020

Preamble

Ministry of Human Resource Development (HRD), Govt. of India, has already initiated the process for developing New Education Policy (NEP) in our country to bring out reforms in Indian education system. University Grants Commission (UGC) participates more actively in developing National Education Policy, its execution and promotion of higher education in our country. The UGC has already initiated several steps to bring equity, efficiency and academic excellence in National Higher Education System. The important ones include innovation and improvement in course- curricula, introduction of paradigm shift in learning and teaching pedagogy, examination and education system. The education plays enormously significant role in building of a nation. There are quite a large number of educational institutions, engaged in imparting education in our country. Majority of them have entered recently into semester system to match with international educational pattern. However, our present education system produces young minds lacking knowledge, confidence, values and skills. It could be because of complete lack of relationship between education, employment and skill development in conventional education system. The present alarming situation necessitates transformation and/or redesigning of education system, not only by introducing innovations but developing "learner-centric approach in the entire education delivery mechanism and globally followed evaluation system as well. Majority of Indian higher education institutions have been following marks or percentage based evaluation system, which obstructs the flexibility for the students to study the subjects/courses of their choice and their mobility to different institutions. There is need to allow the flexibility in education system, so that students depending upon their interests and aims can choose interdisciplinary, intra-disciplinary and skill-based courses. This can only be possible when choice based credit system (CBCS), an internationally acknowledged system, is adopted. The choice based credit system not only offers opportunities and avenues to learn core subjects but also exploring additional avenues of learning beyond the core subjects for holistic development of an individual. The CBCS will undoubtedly facilitate us bench mark our courses with best international academic practices. The CBCS has more advantages than disadvantages. Advantages of the choice based credit system: Shift in focus from the teacher-centric to student-centric education. Student may undertake as many credits as they can cope with (without repeating all courses in a given semester if they fail in one/more courses). CBCS allows students to choose inter-disciplinary, intra-disciplinary courses, skill oriented papers (even from other disciplines according to their learning needs, interests and aptitude) and more flexibility for students). 3 CBCS makes education broad-based and at par with global standards. One can take credits by combining unique combinations. For example, Physics with Economics, Microbiology with Chemistry or Environment Science etc. CBCS offers flexibility for students to study at different times and at different institutions to complete one course (ease mobility of students). Credits earned at one institution can be transferred. Disadvantages: Difficult to estimate the exact marks Workload of teachers may fluctuate Demand good infrastructure for dissemination of education.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. Core Course:

A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. Elective Course:

Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.1 Discipline Specific Elective (DSE) Course:

Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 Dissertation/Project:

An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

2.3 Generic Elective (GE) Course:

An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective. P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. Ability Enhancement Courses (AEC):

The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). “AECC” courses are the courses based upon the content that leads to Knowledge enhancement;

i. Environmental Science and

ii. English/MIL Communication.

These are mandatory for all disciplines. SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

3.1 Ability Enhancement Compulsory Courses (AECC): Environmental Science, English Communication/MIL Communication.

3.2 Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

Introducing Research Component in Under-Graduate Courses

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of courses under B.Sc.(Hons.) Mathematics

Course	***Credits**	
	Theory + Practical	**Theory+ Tutorial**
I. Core Course (14Papers)	14×4=56	14×5=70
Core Course Practical/Tutorial*(14Papers)	14×2=28	14×1=14
II. Elective Course(8Papers)		
A.1.DisciplineSpecific Elective **(4Papers)**	4×4=16	4×5=20
A.2.DisciplineSpecificElectivePractical/Tutorial* **(4Papers)**	4×2=8	4×1=4
B.1.GenericElective/Interdisciplinary **(4Papers)**	4×4=16	4×5=20
B.2.GenericElective Practical/Tutorial* **(4Papers)**	4×2=8	4×1=4

- Optional Dissertation or project workingplace of one Discipline Specific Elective Paper(6 credits) in 6thSemester

III. Ability Enhancement Courses

1. Ability Enhancement Compulsory Courses(AECC)		
(2Papersof 2credit each)	2×2 =4	2×2=4
Environmental Science English /MIL Communication		
2. Skill Enhancement Courses (SEC)		
(Minimum2)	2×2 =4	2×2=4
(2Papersof 2crediteach)		
Total credit	140	140

Institute should evolve a system/policy about ECA/General Interest /Hobby /Sports /NCC /NSS /related courses on its own.

***wherever there is a practical there will be no tutorial and vice-versa**

Proposed Scheme for Choice Based Credit System

B.Sc.(Hons.)Mathematics

Semester	Core Course (14)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (2)	Discipline Specific Elective (DSE) (4)	Generic Elective (GE) (4)
1	C1: Calculus	AECC1			GE1
	C2: Probability and Statistical Methods				
2	C3: Real Analysis	AECC2			GE2
	C4: Differential Equations				
3	C5: Theory of Real Functions		SEC1		GE3
	C6: Group Theory I				
	C7: PDE and Systems of ODE				
4	C8: Numerical Methods (P)		SEC2		GE4
	C9: Riemann Integration and Series of Functions				
	C10: Ring Theory and Linear Algebra I				

	C12: Group Theory II			**DSE-2**	
6	**C13: Metric Spaces and Complex Analysis**			**DSE-3**	
	C14: Ring Theory And Linear Algebra II			**DSE-4**	
5	**C11: Multivariate Calculus**			**DSE-1**	

(P) *Means course with practical's*

Discipline Specific Electives (DSE)		
S. No	**Subject Code**	**Subject Name**
01	**STUGM DSE 11**	**Portfolio Optimization**
02	**STUGM DSE 12**	**Number Theory**
03	**STUGM DSE 13**	**Analytical Geometry**
04	**STUGM DSE 21**	**Industrial Mathematics**
05	**STUGM DSE 22**	**Boolean Algebra and Automata Theory**
06	**STUGM DSE 23**	**Algebra**
07	**STUGM DSE 31**	**Theory of Equations**
08	**STUGM DSE 32**	**Bio-Mathematics**
09	**STUGM DSE 33**	**Linear Programming**
10	**STUGM DSE 41**	**Mathematical Modeling**
11	**STUGM DSE 42**	**Mechanics**
12	**STUGM DSE 43**	**Differential Geometry**

Skill Enhancement Course (SEC)		
S. No	**Subject Code**	**Subject Name**
01	**STUGM SEC 11**	**Logic and Sets**
02	**STUGM SEC 12**	**Computer Graphic**
03	**STUGM SEC 21**	**Graph Theory**
04	**STUGM SEC 22**	**Operating System: Linux**

Generic Electives (GE)		
S. No	**Subject Code**	**Subject Name**
01	**STUGM GE 11**	**Fundamentals of Computer Application (with Practical)**
02	**STUGM GE 12**	**Finite Element Methods**
03	**STUGM GE 21**	**Mathematical Finance**
04	**STUGM GE 22**	**Econometrics**
05	**STUGM GE 31**	**Cryptography and Network Security**
06	**STUGM GE 32**	**Information Security**
07	**STUGM GE 41**	**Applications of Algebra**
08	**STUGM GE 42**	**Combinatorial Mathematics**

SEMESTER-I

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam	Subject Total	
			L	T	P	CA	TA	Total			
1	STUGM-C01	Calculus	5	1	0	20	20	40	60	100	6
2	STUGM-C02	Probability and Statistical Methods	5	1	0	20	20	40	60	100	6
3	Generic Electives (Choose any one)		4	0	0	20	20	40	60	100	4
	STUGM GE 11	Fundamentals of Computer Application									
	STUGM GE 12	Finite Element Methods									
4	AECC 01	Environmental Science	2	0	0	20	20	40	60	100	2
Practical											
1	SPUGM GE 11	Fundamentals Computer Application (Practical)	0	0	2			25	25	50	2
Total										450	20

SEMESTER II

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam	Subject Total	
			L	T	P	CA	TA	Total			
1	STUGM-C03	Real Analysis	5	1	0	20	20	40	60	100	6
2	STUGM-C04	Differential Equations	5	1	0	20	20	40	60	100	6
3	AECC 02	Technical Communication	2	0	0	20	20	40	60	100	2
4	Generic Electives (Choose any one)		5	1	0	20	20	40	60	100	6
	STUGM GE 21	Mathematical Finance									
	STUGM GE 22	Econometrics									
Total										400	20

SEMESTER III

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam	Subject Total	
			L	T	P	CA	TA	Total			
1	STUGM-C05	Theory of Real Functions	5	1	0	20	20	40	60	100	6
2	STUGM- C06	Group Theory I	5	1	0	20	20	40	60	100	6
3	STUGM-C07	PDE and Systems of ODE	5	1	0	20	20	40	60	100	6
4	Skill Enhancement Course (Choose any one)		2	0	0	20	20	40	60	100	2
	STUGM SEC 11	Logic and Sets									
	STUGM SEC 12	Computer Graphic									
5	Generic Electives (Choose any one)		5	1	0	20	20	40	60	100	6
	STUGM GE 31	Cryptography and Network Security									
	STUGM GE 32	Information Security									
Total										500	26

SEMESTER IV

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam	Subject Total	
			L	T	P	CA	TA	Total			
1	**STUGM-C08**	**Numerical Methods**	**5**	**1**	**0**	**20**	**20**	**40**	**60**	**100**	**6**
2	**STUGM-C09**	**Riemann Integration and Series of Functions**	**5**	**1**	**0**	**20**	**20**	**40**	**60**	**100**	**6**
3	**STUGM-C10**	**Ring Theory and Linear Algebra I**	**5**	**1**	**0**	**20**	**20**	**40**	**60**	**100**	**6**
4	**Skill Enhancement Course (Choose any one)**		**2**	**0**	**0**	**20**	**20**	**40**	**60**	**100**	**2**
	STUGM SEC 21	**Graph Theory**									
	STUGM SEC 22	**Operating System: Linux**									
5	**Generic Electives (Choose any one)**		**5**	**1**	**0**	**20**	**20**	**40**	**60**	**100**	**6**
	STUGM GE 41	**Applications of Algebra**									
	STUGM GE 42	**Combinatorial Mathematics**									
Total										**500**	**26**

SEMESTER V

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam	Subject Total	
			L	T	P	CA	TA	Total			
1	STUGM-C11	Multivariate Calculus	5	1	0	20	20	40	60	100	6
2	STUGM-C12	Group Theory II	5	1	0	20	20	40	60	100	6
3	**Discipline Specific Electives** (Choose any one)		5	1	0	20	20	40	60	100	6
	STUGM-DSE 11	Portfolio Optimization									
	STUGM-DSE 12	Number Theory									
	STUGM-DSE 13	Analytical Geometry									
4	**Discipline Specific Electives** (Choose any one)		5	1	0	20	20	40	60	100	6
	STUGM-DSE 21	Industrial Mathematics									
	STUGM-DSE 22	Boolean Algebra and Automata Theory									
	STUGM-DSE 23	Algebra									
Total										400	24

SEMESTER VI

S. No	Course Code	Subject	Period			Evaluation Scheme					Credit
						Sessional Exam			External Exam.	Subject Total	
			L	T	P	CA	TA	Total			
1	STUGM-C13	Metric Spaces and Complex Analysis	5	1	0	20	20	40	60	100	6
2	STUGM-C14	Ring Theory and Linear Algebra II	5	1	0	20	20	40	60	100	6
3	Discipline Specific Electives (Choose any one)		5	1	0	20	20	40	60	100	6
	STUGM-DSE 31	Theory of Equations									
	STUGM-DSE 32	Bio-Mathematics									
	STUGM-DSE 33	Linear Programming									
4	Discipline Specific Electives (Choose any one)		5	1	0	20	20	40	60	100	6
	STUGM-DSE 41	Mathematical Modeling									
	STUGM-DSE 42	Mechanics									
	STUGM-DSE 43	Differential Geometry									
Total										400	24

OVER ALL SCHEME

S. No.	Semester	Theory Total	Practical	Subject Total	Total Credits
1.	I	400	50	450	20
2.	II	400	-	400	20
3.	III	500	-	500	26
4.	IV	500	-	500	26
5.	V	400	-	400	24
6.	VI	400	-	400	24
Grand Total				2650	140

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM- C01
Course Credit Hour: 6hr

Course Name: Calculus
Total Contact Hour: 70hr

Course Objective:

The objective of studying calculus is simply to introduce your mind to the scientific method of analysis. The student will compute limits, derivatives, and integrals. Analyze functions using limits, derivatives, and integrals.

Course Description:

Students will learn to find higher order derivatives, curve tracing in Cartesian coordinates and its application in business, economics and life sciences, reduction formula, find volume by slicing, disks and washers method, scalar and vector triple product.

Course Contents:

Unit I - Hyperbolic functions, higher order derivatives, Leibniz rule and its applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$, concavity and inflection points, asymptotes,

Unit-II

Curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences.

Unit II - Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin nx\, dx$, $\int \cos nx\, dx$, $\int \tan nx\, dx$, $\int \sec nx dx$, $\int (\log x)^n\, dx$, $\int \sin^n x \sin^N x\, dx$, volumes by slicing, disks and washers methods, volumes by cylindrical shells, parametric equations,

Unit-III

Parameterizing a curve, arc length, arc length of parametric curves, area of surface of revolution. Techniques of sketching conics, reflection properties of conics, rotation of axes and second degree equations, classification into conics using the discriminant, polar equations of conics.

Unit IV - Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions,

Unit-V

Differentiation and integration of vector functions, tangent and normal components of acceleration, modeling ballistics and planetary motion, Kepler's second law.

Course Learning Outcomes(CLOs) :

CLO-1 : knowledge of Hyperbolic functions

CLO-2 :Knowledge of Reduction formulae

CLO-3 : Knowledge of Triple Product

Text books :

1. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005.

Reference books :

2. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
3. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), SpringerVerlag, New York, Inc., 1989

Online links for study & reference materials :

https://youtu.be/sPvTYIi2A2Q
https://youtu.be/j8XLYFzTJzE

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

	L	T	P
	5	1	0

Course Code : STUGM-C02 **Course Name :**Probability and Statistical Methods
Course Credit Hour : 6hr **Total Contact Hour :** 70hr

Course Objective :

Probability and statistics hold the key for enabling our students to better understand, process, and interpret the vast amounts of quantitative data that exist all around them, and to have a probabilistic sense in situations of uncertainty.

Course Description :

Students will learn to distinguish between primary and secondary data, how to find different measures of data, meaning of random variables and different types of probability distribution functions, meaning of regression and types of correlation**.**

Course Contents :

Unit I - Types and Presentation of data: Population and sample, quantitative and qualitative data, cross-sectional and Time-series data, discrete and continuous data, Different types of scales, Primary data – designing a questionnaire and a schedule, Secondary data – its major sources, Complete enumeration, Presentation of data: Construction of Tables, one or more factors of classification, diagrammatic representations, frequency distributions and cumulative frequency distributions and their graphical representations, stem and leaf displays.

Unit II - Theory of Measures: Different measures of location namely mean, median, mode for discrete data and continuous data and their merits and limitations, measures of dispersion-range, Quartiles, standard deviation, variance and coefficient of variance, Moments and measure of skewness and kurtosis based on moments, Box Plots.

Unit III - Random Variables: Random experiments, classical and relative frequency approach to probability, conditional probability, independent events, Bayes theorem and its applications. Discrete and continuous random variables, p.m.f., p.d.f., c.d.f., Expectation of random variable and its properties, Moment generating Function and Cumulant generating Function.

Unit IV - Distribution functions Discrete probability distributions: Degenerate, Bernoulli, Binomial, Poisson, Geometric, Negative Binomial, Geometric, Hypergeometric,Continuous probability distributions- Normal, Uniform, Triangular, Gamma, Beta, Exponential, Laplace, Weibul, Logistic, and Cauchy.

Unit V - Correlation and Regression Analysis: Types of correlation, Karl Pearson Coefficient (r) of correlation, Rank correlation coefficient, assumptions and properties for r, Concept of regression-fitting of straight line using Principle of least squares, properties of regression coefficients, distinction between correlation and regression. Fitting of second degree parabola, power curve of the type $Y=ax^b$

, exponential curves of the types $Y=ab^x$ and $Y=ae^{bx}$.

Course Learning Outcomes(CLOs) :

CLO-1 : knowledge of Probability.

CLO-2 : Understands the types of measures and where to apply it.

CLO-3 : Knowledge of Random Variables.

CLO-4 : Knowledge of Discrete and continuous probability distribution.

CLO-5 : Understand the types of correlation and concept of regression.

Text books :

- Gupta, S.C. and Kapoor, V.K. (2007): Fundamentals of Mathematical Statistics, 11th Edn., (Reprint), Sultan Chand and Sons.

Reference books :

- Croxton F.E., Cowden D.J. & Klein (1969): Applied General Statistics, Prentice Hall
- Rohatgi, V. K. and Saleh, A. K. Md. E. (2009): An Introduction to Probability and Statistics, 2 ndEdn. (Reprint). John Wiley and Sons.

Online links for study & reference materials :

https://youtu.be/cqK3uRoPtk0
https://youtu.be/WWv0RUxDfbs

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C04 **Course Name: Differential** Equations
Course Credit Hour: 6hr **Total Contact Hour:** 70hr

Course Objective:

A differential equation is an equation that relates one or more functions and their derivatives. In applications, the functions generally represent physical quantities, the derivatives represent their rates of change, and the differential equation defines a relationship between the two.

Course Description:

This course includes the study of first order differential equations, higher order linear differential equations, Euler's equation, Linear and Bernoulli equations and and applications of differential equations.

Course Contents :

Unit I - Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.

Unit II - Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), drug assimilation into the blood (case of a single cold pill, case of a course of cold pills), exponential growth of population, limited growth of population, limited growth with harvesting

Unit III - General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian: its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters.

Unit IV - Equilibrium points, Interpretation of the phase plane, predatory-prey model and its analysis, epidemic model of influenza and its analysis, battle model and its analysis.

Course Learning Outcomes(CLOs) :

CLO-1 :The student will be able to explain the concept of differential equation and classifies the Differential equation with respect to their order and linearity.

CLO-2 : Understands different models and their solution.

CLO-3 : Knowledge of second order homogenous equation.

CLO-4 : understand about Equilibrium points and predatory-prey model and its analysis.

Text books :

S.L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, India, 2004.

Reference books :

1 Belinda Barnes and Glenn R. Fulford, Mathematical Modeling with Case Studies,

2 A Differential EquationApproach using Maple and Matlab, 2nd Ed., Taylor and Francis group, London and New York, 2009.

3 C.H. Edwards and D.E. Penny, Differential Equations and Boundary Value problems Computing and Modeling, Pearson Education India, 2005.

Online links for study & reference materials :

https://youtu.be/LompT8T-9y4
https://youtu.be/UFWAu8Ptth0

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	**1**	**0**

Course Code: STUGM-C03
Course Credit Hour: 6hr

Course Name: Real Analysis
Total Contact Hour: 70hr

Course Objective:

Introduction to Real Analysis will cover algebraic and order properties of the real numbers, the least upper bound axiom, limits, continuity, differentiation, the Riemann integral, sequences, and series. Definitions and proofs will be stressed throughout the course.

Course Description:

A course that develops this basic material in a systematic and rigorous manner in the context of real-valued functions of a real variable. Sequences: convergence, , Cauchy sequences, The Archimedean Property, Bounded Sets. Bolzano-Weierstrass theorem for sets. convergence and divergence of infinite series. Tests for convergence: Convergence and divergence of infinite series.

Course Contents:

Unit I - Review of Algebraic and Order Properties of R, ð-neighborhood of a point in R, Idea of countable sets, uncountable sets and uncountability of R. Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of R,

Unit-II
The Archimedean Property, Density of Rational (and Irrational) numbers in R, Intervals. Limit points of a set, Isolated points, Illustrations of Bolzano-Weierstrass theorem for sets.

Unit III - Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.

Unit IV - Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's nth root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

Course Learning Outcomes(CLOs) :

CLO-1 :The student will find Suprema and Infima of the set

CLO-2 : Understands concept of the convergent sequence

CLO-3 : Knowledge of different types of convergence.

Text books :

R.G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.

Reference books :

S.K. Berberian, A First Course in Real Analysis, Springer Verlag, New York, 1994.
Brian S. Thomson, Andrew. M. Bruckner and Judith B. Bruckner, Elementary Real Analysis, Prentice Hall, 2001.

Online links for study & reference materials :

https://youtu.be/S-qzRWJOlf8
https://youtu.be/UbNE_beWlhU

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C05 **Course Name:** Theory of Real Functions
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective:

The course has a approach of continuous function and its theorem andread and
learn about the rolles theorem.and property define the Taylor's theorem also define Maclaurins series.
its also help to improve the analytical approach to real world.

Course Description:

evaluate, manipulate, and simplify expressions containing basic mathematical functions, such as polynomial, radical, rational, trigonometric, exponential, logarithmic, absolute-valued, composite, piecewise functions (in particular, in expressions containing powers, exponentials and logarithms, perform algebraic manipulations by applying specific properties of such functions.

Course Contents:

UnitI

Limits of functions (c — ð approach), sequential criterion for limits, divergence criteria. Limittheorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequentialcriterion for continuity and discontinuity. Algebra of continuous functions. Continuous functionson an interval, intermediate value theorem, location of roots theorem, preservation of intervalstheorem. Uniform continuity, non-uniform continuitycriteria, uniform continuitytheorem.

UnitII

Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra ofdifferentiable functions. Relative extrema, interior extremum theorem. Rolle's theorem, Meanvalue theorem, intermediate value property of derivatives, Darboux's theorem. Applications ofmean value theorem to inequalities and approximation of polynomials, Taylor's theorem toinequalities.

UnitIII

Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor'stheorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions,relativeextrema.Taylor'sseriesandMaclaurin'sseriesexpansionsofexponentialandtrigonometricfunctions, ln(1 +x), 1/ax+b and $(1+x)^n$.

Course Learning Outcomes (CLOs) :

This course will enable the students to:

CLO 1: Assimilatethenotionsoflimitofasequenceandconvergenceofaseriesofrealnumbers.

CLO 2: Calculatethelimitandexaminethecontinuityofafunctionatapoint.Understandtheconsequencesofvariousmeanvaluetheoremsfordifferentiablefunctions.

CLO 3: SketchcurvesinCartesianandpolarcoordinatesystems.Applyderivativetestsinoptimizationproblemsappearinginsocialsciences,physicalsciences,lifesciencesandahostofotherdisciplines.

Text books :

1. R.Bartle andD.R. Sherbert,*Introduction to RealAnalysis*, JohnWileyandSons,2003.
2. K.A.Ross,*ElementaryAnalysis: TheTheoryofCalculus*, Springer,2004.

Reference books :

1. A.Mattuck,*IntroductiontoAnalysis*, PrenticeHall,1999.
2. S.R.Ghorpade andB.V.Limaye,*A Coursein Calculus and Real Analysis,*Springer,2006.

Online links for study & reference materials :
https://nptel.ac.in/courses/111/106/111106053/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C06
Course Credit Hour: 6hr

Course Name: Group Theory -I
Total Contact Hour: 90hr

Course Objective:

To obtain proficiency in the study of symmetries of physical systems, and the use of groups to classify and quantify natural phenomenon.

Course Description:

This is a course in abstract algebra although connections with others fields will be stressed as often as possible. It is a systematic study of the basic structure of groups, finite and infinite.

Course Contents:

UnitI

Symmetriesofasquare,Dihedralgroups,definitionandexamplesofgroupsincludingpermutation groups and quaternion groups (illustration through matrices), elementary propertiesof groups. Subgroups and examples of subgroups, centralizer, normalizer, center of a group,productof two subgroups.

UnitII

Properties of cyclic groups, classification of subgroups of cyclic groups. Cycle notation forpermutations,propertiesofpermutations,evenandoddpermutations,alternatinggroup,propertiesofcosets, Lagrange'stheoremandconsequencesincludingFermat's Littletheorem.

UnitIII

Externaldirectproductofafinitenumberofgroups,normalsubgroups,factorgroups,Cauchy'stheoremforfinite abeliangroups.

UnitIV

Grouphomomorphisms,propertiesofhomomorphisms,Cayley'stheorem,propertiesofisomorphisms,First, Second and Third isomorphism theorems.

Course Learning Outcomes (CLOs) :

After studying this course, you should be able to:

CLO1: explain what is meant by symmetry of a plane figure

CLO2: find the composite of two symmetries; find the inverse of symmetry

CLO3: determine whether a given set and binary operation form a group by checking group axioms

CLO4: describe the symmetries of some bounded three-dimensional figures.

Text books:

1. JohnB. Fraleigh,*A FirstCourse in AbstractAlgebra*, 7thEd., Pearson,2002**.**

2. M.Artin, *Abstract Algebra*,2nd Ed., Pearson,2011.

3. Joseph A. Gallian, *Contemporary Abstract Algebra,* 4th Ed., Narosa Publishing House, NewDelhi,1999.

Reference books:

1. JosephJ.Rotman, *AnIntroduction to the Theory of Groups,*4th Ed., SpringerVerlag,1995.

2. I.N.Herstein,*TopicsinAlgebra*,WileyEasternLimited,India,1975.

Online links for study & reference materials :
https://www.maths.gla.ac.uk/~mwemyss/teaching/3alg1-7.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Mid exam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

1. .

Course Structure Template

L	T	P
5	1	0

Course Code : STUGM-C07 **Course Name :** PDE and system of ODE
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective:
Apply the fundamental concepts of Ordinary Differential Equations and Partial Differential Equations and the basic numerical methods for their resolution and Solve the problems choosing the most suitable method.

Course Description:
Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution.
1.Use computational tools to solve problems and applications of Ordinary Differential Equations and Partial Differential Equations.
2. Formulate and solve differential equation problems in the field of Industrial Organisation Engineering.
3. Use an adequate scientific language to formulate the basic concepts of the course.

Course Contents:

UnitI

Partial Differential Equations – Basic concepts and Definitions, Mathematical Problems. First-OrderEquations:Classification,ConstructionandGeometricalInterpretation.MethodofCharacteristics for obtaining General Solution of Quasi Linear Equations. Canonical Forms ofFirst-order Linear Equations. Method of Separation of Variables for solving first order partialdifferentialequations.

UnitII

Derivation of Heat equation, Wave equation and Laplace equation. Classification of second orderlinear equations as hyperbolic, parabolic or elliptic. Reduction of second order Linear Equationstocanonical forms.

UnitIII

TheCauchyproblem,theCauchy-Kowaleewskayatheorem,Cauchyproblemofaninfinitestring. Initial Boundary Value Problems, Semi-Infinite String with a fixed end, Semi-InfiniteStringwithaFreeend,Equationswithnon-homogeneousboundaryconditions,Non-Homogeneous Wave Equation. Method of separation of variables, Solving the Vibrating StringProblem,Solvingthe Heat Conductionproblem

UnitIV

Systemsoflineardifferentialequations,typesoflinearsystems,differentialoperators,anoperator method for linear systems with constant coefficients, Basic Theory of linear systems innormal form, homogeneous linear systems with constant coefficients: Two Equations in twounknown functions, The method of successive approximations, the Euler method, the modifiedEulermethod, TheRunge-Kutta method.

Course Learning Outcomes (CLOs) :

After the completion of the course, Students will be able to

CLO1. Classify partial differential equations and transform into canonical form, solve linear partial differential equations of both first and second order

CLO2: apply partial derivative equation techniques to predict the behavior of certain phenomena, apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of specialization.

CLO3: extract information from partial derivative models in order to interpret reality.

CLO4: Identify real phenomena as models of partial derivative equations

Text books :

1. Tyn Myint-U and Lokenath Debnath, *Linear Partial Differential Equations for Scientists andEngineers,*4th edition, Springer,Indianreprint,2006.

2. S.L.Ross,*Differential equations,* 3rdEd., JohnWileyandSons,India,2004.

Reference books :

1. Martha L Abell, James P Braselton, *Differential equations with MATHEMATICA,* 3rd Ed.,ElsevierAcademicPress,2004.

Online links for study & reference materials :
https://nptel.ac.in/courses/111/107/111107111/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C08
Course Name: Numerical Methods
Course Credit Hour: 5hr
Total Contact Hour: 68hr

Course Objective:

The course will also develop an understanding of the elements of error analysis for numerical methods and certain proofs.The main objective of this course is to provide students with an introduction to the field of numerical analysis. Derive appropriate numerical methods to solve interpolation based problems. Derive appropriate numerical integration methods.

Course Description:

This course includes the study of Algorithms, System of linear algebraic equations, Interpolation and numerical Integration Methods.

Course Contents:

Unit I –

Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation. Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods.

Unit II

System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.

Unit III –

Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.

Unit IV–

Numerical Integration: Trapezoidal rule, Simpson's rule, Simpsons 3/8th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule. Ordinary Differential Equations: Euler's method. Runge-Kutta methods of orders two and four. Use of Scientific Calculator is allowed.

List of Practicals (using any software)

(i) Calculate the sum 1/1 + 1/2 + 1/3 + 1/4 +---------- + 1/ N.
(ii) To find the absolute value of an integer.
(iii) Enter 100 integers into an array and sort them in an ascending order.
(iv) Bisection Method.
(v) Newton Raphson Method.
(vi) Secant Method.
(vii) RegulaiFalsi Method.
(viii) LU decomposition Method.
(ix) Gauss-Jacobi Method.
(x) SOR Method or Gauss-Siedel Method.
(xi) Lagrange Interpolation or Newton Interpolation.
(xii) Simpson's rule.

Note: For any of the CAS (Computer aided software) Data types-simple data types, floating data types, character data types, arithmetic operators and operator precedence, variables and constant declarations, expressions, input/output, relational operators, logical operators and logical expressions, control statements and loop statements, Arrays should be introduced to the students.

Course Learning Outcomes(CLOs) :

CLO-1: Understand the theoretical and practical aspects of the use of numerical analysis.
CLO-2 :Knowledge of System of linear algebraic equationsand learn different methods to solve
CLO-3 : Knowledge of Lagrange and Newton's Interpolation method
CLO-4 : understand Runge-Kutta methods of orders two and four.

Text books :

Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New age International Publisher, India, 2007

Reference books :

Uri M. Ascher and Chen Greif, A First Course in Numerical Methods, 7th Ed., PHI Learning Private Limited, 2013.
John H. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Ed., PHI Learning Private Limited, 2012.

Online links for study & reference materials :

https://youtu.be/_cgzqVmvqtQ
https://youtu.be/sykjkFF9oWo

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C09 **Course Name: Riemann** Integration and Series of Functions
Course Credit Hour: 5hr **Total Contact Hour:** 68hr

Course Objective:

The student will learn a regular partition of an interval, a Riemann sum for a function on a given interval, convergence of Beta and Gamma functions. Understand the theorems based on continuity and derivability and integrability.

Course Description:

The theory and applications of Riemann Integration of a bounded real valued functions defined on a closed and bounded interval. The improper integration, Beta and Gamma integrals and Differentiation and integration of power series. Pointwise and uniform convergence of sequence of functions.

Course Contents:

Unit I - Riemann integration; inequalities of upper and lower sums; Riemann conditions of integrability. Riemann sum and definition of Riemann integral through Riemann sums; equivalence of two definitions; Riemann integrability of monotone and continuous functions, Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals; Fundamental theorems of Calculus.

Unit II - Improper integrals; Convergence of Beta and Gamma functions.

Unit III - Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions. Series of functions; Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test.

Unit IV - Limit superior and Limit inferior. Power series, radius of convergence, Cauchy Hadamard Theorem, Differentiation and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem.

Course Learning Outcomes(CLOs) :

CLO-1 : compute specific Riemann sums for a function on a given interval.
CLO-2 : Knowledge of the Convergence of Beta and Gamma functions
CLO-3: Understand Cauchy criterion for uniform convergence and Weierstrass M-Test.
CLO-4 :Learn how to find Limit superior and Limit inferior.

Text books :

K.A. Ross, Elementary Analysis, The Theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Reference books :

R.G. Bartle D.R. Sherbert, Introduction to Real Analysis, 3rd Ed., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.
Charles G. Denlinger, Elements of Real Analysis, Jones & Bartlett (Student Edition),2011.

Online links for study & reference materials :

https://youtu.be/M67h1pW4Oc4
https://youtu.be/IjhuzA9m5CY

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C10 **Course Name: Ring** Theory and Linear Algebra I
Course Credit Hour: 5hr **Total Contact Hour:** 68hr

Course Objective:

The student will learn to write precise and accurate mathematical definitions of objects in ring theory and Explain the defining properties of a vector space and how find the nullspace, rank, basis of a given matrix.

Course Description:

This course includes the concept of Ring and its properties, Ring homomorphisms and theorms based on Isomorphism. The concept of Vector Space, basis and dimension, Linear transformations, null space, range, rank and nullity of a linear transformation

Course Contents:

Unit I - Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals.

Unit II - Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I, II and III, field of quotients.

Unit III - Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Unit IV - Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

Course Learning Outcomes(CLOs) :

CLO-1 :Knowledge of the Ring, Integral domain
CLO-2 : Isomorphism theorems I, II and III,
CLO-3 :Characterize a set of vectors and linear systems using the concept of linear independence
CLO-4 :Solve linear systems represented as linear transforms

Text books :

1. S. Kumaresan, Linear Algebra- A Geometric Approach, Prentice Hall ofIndia,1999.

2. Kenneth Hoffman, Ray Alden Kunze, Linear Algebra, 2nd Ed., Prentice-Hall of India Pvt. Ltd., 1971

Reference books :

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011

Online links for study & reference materials :

https://youtu.be/a7axWVY8qMY
https://youtu.be/1XlT3Y2oyAU

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C11
Course Name: Multivariate Calculus
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:
To present the fundamental concepts of multivariable calculus and to develop student understanding and skills in the topic necessary for its applications to science and engineering.

Course Description:

1. Solve mathematical problems using analytical methods.
2. Recognize the relationships between different areas of mathematics and the connections between mathematics and other disciplines.
3. Give clear and organized written and verbal explanations of mathematical ideas to a variety of audiences.

Course Contents :

UnitI

Functionsofseveralvariables,limitandcontinuityoffunctionsoftwovariablesPartialdifferentiation,totaldifferentiabilityanddifferentiability,sufficientconditionfordifferentiability. Chain rule for one and two independent parameters, directional derivatives, thegradient, maximal and normal property of the gradient, tangent planes, Extrema of functions oftwo variables, method of Lagrange multipliers, constrained optimization problems, Definition ofvectorfield, divergenceandcurl

UnitII

Doubleintegrationoverrectangularregion,doubleintegrationovernon-rectangularregion,Double integrals in polar co-ordinates, Triple integrals, Triple integral over a parallelepiped andsolidregions. Volume bytripleintegrals, cylindricaland spherical co-ordinates.

UnitIII

Change of variables in double integrals and triple integrals. Line integrals, Applications of lineintegrals: Mass and Work. Fundamental theorem for line integrals, conservative vector fields,independenceof path.

UnitIV

Green’stheorem,surfaceintegrals,integralsoverparametricallydefinedsurfaces.Stoke’stheorem,The Divergencetheorem.

Course Learning Outcomes (CLOs) : This course will be able the students to:

CLO-1 : Learnconceptualvariationswhileadvancingfromonevariabletoseveralvariablesincalculus. Apply multivariable calculus in optimization problems.

CLO-2 : Inter-relationshipamongstthelineintegral,doubleandtripleintegralformulations.

CLO3: Applications of multivariable calculus tool sin physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.

CLO-4: Realize importance of Green, Gauss and Stokes's theorems in other branches of mathematics.

Text books:

1. G.B.ThomasandR.L.Finney,*Calculus*,9thEd.,PearsonEducation, Delhi,2005.

2. M.J.Strauss,G.L.BradleyandK. J.Smith,*Calculus,* 3rdEd., DorlingKindersley(India)Pvt.Ltd.(Pearson Education), Delhi,2007.

Reference books :

1. E. Marsden, A.J. Tromba and A. Weinstein, *Basic Multivariable Calculus*, Springer (SIE),Indian reprint,2005.

2. James Stewart, *Multivariable Calculus, Concepts and Contexts*, 2nd Ed., Brooks /Cole,ThomsonLearning, USA,2001.

Online links for study & reference materials :

https://www.whitman.edu/mathematics/multivariable/multivariable.pdf
https://onlinecourses.nptel.ac.in/noc20_ma15/preview

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C12
Course Name: Group Theory-II
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:

1. Present the relationships between abstract algebraic structures with familiar numbers systems such as the integers and real numbers.
2. Present concepts of and the relationships between operations satisfying various properties (e.g. commutative property).
3. Present concepts and properties of various algebraic structures.
4. Discuss the importance of algebraic properties relative to working within various number systems.
5. Develop the ability to form and evaluate conjectures.

Course Description:

1. **Group action & sylow theorem**
2. **Automorphism and their properties**
3. **Explain Clayey's theorem and simplicity tests**

UnitI

Automorphism, inner automorphism, automorphism groups, automorphism groups of finite andinfinitecyclicgroups,applicationsoffactorgroupstoautomorphismgroups,Characteristicsubgroups,Commutatorsubgroupand its properties.

UnitII

Properties of external direct products, the group of units modulo n as an external direct product,internaldirect products,Fundamental Theorem of finite abeliangroups.

UnitIII

Group actions, stabilizers and kernels, permutation representation associated with a given groupaction,Applicationsof groupactions:GeneralizedCayley'stheorem,Indextheorem.

UnitIV

Groups acting on themselves by conjugation, class equation and consequences, conjugacy in S_n,p-groups, Sylow's theorems and consequences, Cauchy's theorem, Simplicity of A_n for $n \geq 5$,non-simplicitytests.

Course Learning Outcomes (CLOs) :

The course will enable the students to:

CLO 1: Recognize the mathematical objects called groups.

CLO 2: Linkthefundamentalconceptsofgroupsandsymmetriesofgeometricalobjects.

CLO 3: Explain the significance of the notions of co-sets, normal subgroups, and factor groups.

CLO 4: Learnaboutstructurepreservingmapsbetweengroupsandtheirconsequences.

Text books :

1. JohnB. Fraleigh, *A FirstCourse in Abstract Algebra*, 7th Ed., Pearson,2002**.**

2. M.Artin,*Abstract Algebra*,2nd Ed.,Pearson,2011.

3. JosephA.Gallian,*ContemporaryAbstractAlgebra,*4thEd.,NarosaPublishingHouse,1999.

Reference books :

1.JohnB. Fraleigh, *A FirstCourse in Abstract Algebra*, 7th Ed., Pearson,2002**.**

2 M.Artin,*Abstract Algebra*,2nd Ed.,Pearson,2011.

3.JosephA.Gallian,*ContemporaryAbstractAlgebra,*4thEd.,NarosaPublishingHouse,1999.

Online links for study & reference materials :

http://home.iitk.ac.in/~chavan/alg1.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C13
Course Name: Metric Space & Complex Analysis
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:

To present the fundamental concepts of metric space and complex analysis and to develop student understanding and skills in the topic necessary for its applications to science and engineering.

Course Description:

This course is designed as a basic introductory course in the analysis of metric for undergraduate students. It is aimed at providing the abstract analysis components for the degree course of a student majoring in mathematics. It is assumed that such students will have completed a first course in real analysis or a course in calculus which has been carefully developed with attention given to the real analysis foundations. It is also assumed that the student will have some background in elementary linear algebra. This course affords students majoring in mathematics to gain some familiarity with the axiomatic method in analysis for it provides a logically tight investigation of a basically simple abstract structure which manifests itself in a number of diverse examples.

Course Contents :

UnitI

Metricspaces:definitionandexamples.Sequencesinmetricspaces,Cauchysequences.Complete Metric Spaces. Open and closed balls, neighbourhood, open set, interior of a set. Limitpoint of a set, closed set, diameter of a set, Cantor’s theorem. Subspaces, dense sets, separablespaces.

UnitII

Continuous mappings, sequential criterion and other characterizations of continuity. Uniformcontinuity.Homeomorphism,Contractionmappings,BanachFixedpointTheorem.Connectedness,connected subsets of R.

UnitIII

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regionsinthecomplexplane,functionsofcomplexvariable,mappings.Derivatives,differentiationformulas,Cauchy-Riemann equations,sufficient conditionsfordifferentiability.

UnitIV

Analytic functions, examples of analytic functions, exponential function, Logarithmic function,trigonometricfunction,derivativesoffunctions,definiteintegralsoffunctions.Contours,Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursattheorem, Cauchyintegral formula.

UnitV

Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences andseries, Taylor series and its examples. Laurent series and its examples, absolute and uniformconvergenceof power series.

Course Learning Outcomes (CLOs) :

Upon successful completion of this course, the student will be able to:

CLO 1: identify the three properties of a metric or distance;

CLO 2: define the basic terms and concepts in metric space topology;

CLO 3: classify and explain open and closed sets, adherent points, convergent and Cauchy convergent sequences, complete spaces ; compactness and connectedness etc.;

CLO 4: prove logically theorems in metric space topology using the definitions of basic terms and properties of metric spaces.

Text books:

1. SatishShiraliandHarikishanL.Vasudeva,*Metric Spaces*, Springer Verlag,London,2006.
2. S.Kumaresan,*TopologyofMetricSpaces*,2ndEd.,NarosaPublishingHouse,2011.
3. G.F.Simmons,*IntroductiontoTopologyandModernAnalysis*,McGraw-Hill,2004.

Reference books:

3. James Ward Brown and Ruel V. Churchill, *Complex Variables and Applications,* 8th Ed.,McGraw–HillInternational Edition, 2009.
4. Joseph Bak and Donald J. Newman, *Complex Analysis,* 2nd Ed., Undergraduate Texts inMathematics,Springer-VerlagNew York,Inc., NewYork,1997.

Online links for study & reference materials :

https://sites.math.northwestern.edu/~scanez/courses/320/notes/metric-spaces.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-C14
Course Name: Ring Theory &Linear Algebra II
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:
To develop skills and to acquire knowledge on some advanced concepts of Modern Algebra i.e. different algebraic structures, Modules, Prime ideals, prime radical, Jacobson radical in commutative rings, complete ring of quotients, Prime ideal spaces.

Course Description:

Understand the concepts of commutative ring theory and special structure of inner product spaces and norms, orthogonal projections and spectral theorem also discussion with the minimal polynomial for linear operator.

Course Contents:

UnitI

Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion,uniquefactorizationinZ[x]**.**Divisibilityinintegraldomains,irreducibles,primes,uniquefactorizationdomains, Euclidean domains.

UnitII

Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators, Eigen spaces of a linear operator, diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator.

UnitIII

Innerproductspacesandnorms,Gram-Schmidtorthogonalisationprocess,orthogonalcomplements, Bessel's inequality, the Adjoint of a linear operator, Least Squares Approximation, minimal solutions to systems of linear equations, Normal and self-Adjoint operators, Orthogonal projections and Spectral theorem.

Course Learning Outcomes (CLOs) :

The course is designed to meet the following outcomes:

CLO1: Students will be proficient in reading and understanding mathematics.
CLO2: Students will be able to give coherent logical and formal arguments in BOTH written and verbal forms of communication.
CLO3: Students will be able to perform basic computations in group and ring theory.

Text books:

1. JohnB.Fraleigh, *A FirstCourse in Abstract Algebra*, 7th Ed., Pearson,2002**.**

2. M.Artin,*Abstract Algebra*,2nd Ed.,Pearson,2011.

3. JosephA.Gallian,*ContemporaryAbstractAlgebra*,4thEd.,NarosaPublishingHouse,1999.

4. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra,* 4th Ed., Prentice-HallofIndia Pvt.Ltd., New Delhi,2004.

Reference books:

1. S.Lang,*IntroductiontoLinear Algebra,*2ndEd.,Springer,2005.
2. GilbertStrang,*LinearAlgebra anditsApplications*,Thomson,2007.

3 S.Kumaresan,*Linear Algebra- A GeometricApproach*,PrenticeHall ofIndia,1999.

4 KennethHoffman,RayAldenKunze,*LinearAlgebra,*2ndEd.,Prentice-Hallof IndiaPvt.Ltd.,1971.

5 S.H.Friedberg,A.L. InselandL.E.Spence,*LinearAlgebra*,PrenticeHall ofIndiaPvt. Ltd.,2004.

Online links for study & reference materials :

https://www1.maths.leeds.ac.uk/~ppmartin/LEARN/rings/pdf/lecturesLeedsRPF.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 11 **Course Name:** Portfolio Optimization
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective : The art and science of making decisions about investment mix and policy, matching investments to objectives, asset allocation for individuals and institutions, and balancing risk against performance. (Investopedia) There has been a proliferation of new products and strategies in the asset management space in recent years, e.g., smart beta, alternative beta, fundamental indexing, low volatility, and leveraged and inverse ETFs.

Course Description:

This course applies portfolio theory to understand and evaluate these products and strategies in the context of the empirical evidence about return patterns across assets (i.e., the factors such as value/growth, momentum, and carry that drive returns) in multiple markets/asset classes (e.g., US and international equities and bonds, currencies, and commodities). Key questions include: • What factors drive asset returns? Is it risk or mispricing? • Can this structure of returns be used to construct better portfolios and products? • How should the performance of existing products be evaluated given the empirical evidence? The basic theoretical framework is standard portfolio theory, as developed in Foundations of Finance, and its extensions, and the course will rely heavily on Excel modeling using real world data. 2 The course also covers, to a lesser extent, the institutional landscape of the asset management business—the firms (e.g., Blackrock, Vanguard), the vehicles (e.g., mutual funds, ETFs, hedge funds), and the trends (e.g., active vs. passive, fee competition).

Course Contents:

UnitI

Financial markets.Investment objectives.Measuresofreturn andrisk.Typesofrisks.Riskfreeassets.Mutualfunds.Portfolioof assets.Expectedriskand returnofportfolio.Diversification.

UnitII

Mean-variance portfolio optimization- the Markowitz model and the two-fund theorem, risk-freeassetsandonefundtheorem,efficientfrontier.Portfolioswithshortsales.Capitalmarkettheory.

UnitIII

Capitalassets pricingmodel-thecapital marketline, beta ofan asset,betaofaportfolio,securitymarketline. Indextrackingoptimizationmodels.Portfolioperformanceevaluationmeasures.

Course Learning Outcomes (CLOs) :

After completing the course, students should be able to:

CLO 1: understand the concept of portfolio diversification and its benefits for risk-averse investors,compute optimal mean-variance portfolios,
CLO 2: compute optimal portfolios that take into account alternative risk measures,construct optimal bond portfolios,
CLO 3: factor investing theory,construct empirical test to evaluate the performance of optimal portfolios,understand the limitations of the mean-variance theory.

Text books:

1. F. K. Reilly, Keith C. Brown, *Investment Analysis and Portfolio Management*, 10th Ed.,South-WesternPublishers,2011.
2. H.M. Markowitz, *Mean-Variance Analysis in Portfolio Choice and Capital Markets*,Blackwell,NewYork,1987.

Reference books :

1. M.J.Best, *Portfolio Optimization*,Chapmanand Hall,CRCPress,2010.
2. D.G.Luenberger,*Investment Science*,2nd Ed.,Oxford UniversityPress,2013.

Online links for study & reference materials :

https://sites.google.com/site/mykolababiak/teaching/practical-portfolio-optimization

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 12
Course Credit Hour: 6hr

Course Name: Number Theory
Total Contact Hour : 90hr

Course Objective:

This course addresses the core objectives of critical thinking skills, communication skills, and empirical and quantitative skills
1). evaluate, or solve problems when given a set of circumstances or data. This common core objective will be assessed in the tests, quizzes and final exam.
2) In written, oral, and/or visual communication, A&M-Commerce students will communicate in a manner appropriate to audience and occasion, with an evident message and organizational structure. This common core objective will be assessed using class activities with class discussion, activities involving writing proofs.
3) utilize mathematical functions and empirical principles and processes. This common core objective will be assessed using class activities, homework problems, tests and a final exam.

Course Description:

Mathematical induction, divisibility, prime numbers, congruences, factorization, arithmetic functions, quadratic reciprocity, primitive roots, Diophantine equations.

COURSE CONTENT:

UnitI

Linear Diophantine equation, prime counting function, statement of prime number theorem,Goldbach conjecture, linear congruences, complete set of residues, Chinese Remainder theorem,Fermat's Littletheorem,Wilson'stheorem.

UnitII

Numbertheoreticfunctions,sumandnumberofdivisors,totallymultiplicativefunctions,definition and properties of the Dirichlet product, the Mobius Inversion formula, the greatestinteger function, Euler's phi-function, Euler's theorem, reduced set of residues, some propertiesofEuler'sphi-function.

UnitIII

Order of an integer modulo n, primitive roots for primes, composite numbers having primitiveroots, Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity, quadraticcongruences with composite moduli. Public key encryption, RSA encryption and decryption, theequation$x^2+y^2=z^2$, Fermat'sLasttheorem.

Course Learning Outcomes(CLOs) :

This course will enable the students to:

CLO 1: Learn about some important results in the theory of numbers including the primenumbertheorem,Chineseremaindertheorem,Wilson'stheoremandtheirconsequences.

CLO 2: Learn about number the or etic functions, modular arithmeticandtheirapplications. Familiarise with modulararithmeticandfindprimitiverootsofprimeandcompositenumbers.

CLO 3: Know about open problems in number theory, namely, the Gold bach conjecture and twin-prime conjecture. Apply public cryptosystems, in particular ,RSA.

Text books :

1. DavidM.Burton,*ElementaryNumberTheory,*6thEd.,TataMcGraw-Hill, Indianreprint,2007.
2. NevilleRobinns,*BeginningNumberTheory,*2ndEd.,NarosaPublishingHousePvt. Ltd.,Delhi,2007.

Reference books :

1. I.Niven(2012).*AnIntroductiontotheTheoryofNumbers*(5th edition).JohnWiley&Sons.
2. NealKoblitz(1994).*ACourseinNumberTheoryandCryptography*(2nd edition).Springer-Verlag.

Online links for study & reference materials :
https://math.unm.edu/~buium/unt.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 13
Course Name: Analytical Geometry
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:

This is a course designed for middle school teachers interested in deepening their conceptual understanding of the geometry taught in middle grades classrooms. It is part of the required course content sequence for undergraduates seeking a concentration in mathematics as part of their middle school licensure.

Course Description:

Topics will include dynamic geometry integrating use of computer software such as Cabri, and geometer's sketchpad; some basic geometry theorems and constructions using compasses, paper folding, or appropriate computer software; similarity, proportion, scaling, and geometric growth; tessellations; simple trigonometric and triangle relationships; van Hiele levels of geometric thought; geometric modeling and networking as problem solving tools; linear, 2D and 3D measurement; fractals & chaos; graphical representations; transformational geometry; and coordinate geometry with algebraic relationships (analytic geometry).

COURSE CONTENT:

UnitI

Techniques for sketching parabola,ellipse and hyperbola. Reflection properties of parabola, ellipse and hyperbola.

UnitII

Classification of quadratic equations representing lines, parabola, ellipse and hyperbola.

UnitIII

Spheres, Cylindrical surfaces. Illustrations of graphing standard quadric surfaces like cone, ellipsoid.

Course Learning Outcomes (CLOs) : The students will be able to

CLO 1: Parameterize curves, evaluate the distance and angle.

CLO 2: sketch conic sections, identify conic sections.

CLO 3: determine congruent conics, classify quadratic equations.

Text books:

1. G.B.ThomasandR.L.Finney,*Calculus*,9thEd.,PearsonEducation, Delhi,2005.
2. H.Anton,I.BivensandS. Davis,*Calculus*,JohnWileyandSons (Asia)Pvt.Ltd.2002.

Reference books :

1. S.L.Loney,*TheElements of CoordinateGeometry*, McMillan andCompany,London.
2. R.J.T. Bill, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan IndiaLtd., 1994

Online links for study & reference materials :

https://www.britannica.com/science/analytic-geometry

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	**1**	**0**

Course Code: STUGM- DSE 21

Course Name: Industrial Mathematics

Course Credit Hour: 6hr

Total Contact Hour: 90hr

Course Objective: This is the second course in the calculus series for science and engineering students. In this course, we are going to integration techniques as well as applications of integrals, parametric curves in a plane, as well as infinite sequences and series.

Course Description: This course is aligned with the following Applied Mathematics program learning outcomes:
1. Solve mathematical problems using analytical methods.
2. Recognize the relationships between different areas of mathematics and the connections between mathematics and other disciplines.
3. Give clear and organized written and verbal explanations of mathematical ideas to a variety of audiences.

COURSE CONTENT:

Unit I

Medical Imaging and Inverse Problems. The contents based on Mathematics of X-rayandCTscanbasedontheknowledgeofcalculus,elementarydifferentialequations,complexnumbers and matrices.

Unit II

Introduction to Inverse problems: Why should we teach Inverse Problems? Illustration of Inverse problems through problems taught in Pre-Calculus, Calculus, Matrices and differential equations. Geological anomalies in Earth's interior from measurements at its surface (Inverse problems for Natural disaster) and Tomography.

Unit III

X-ray: Introduction, X-ray behavior and Beers Law (The fundament question of image construction) Lines in the place.

Radon Transform: Definition and Examples, Linearity, Phantom (Shepp - Logan Phantom - Mathematical phantoms).Back Projection: Definition, properties and examples. CT Scan: Revision of properties of Fourier and inverse Fourier transforms and applications oftheirpropertiesinimagereconstruction.AlgorithmsofCTscanmachine.Algebraicreconstructiontec hniques abbreviated as ART with application to CT scan.

Course Learning Outcomes(CLOs) : Upon completion of this course, students should be able to:

CLO 1. Compute a given integral using the most efficient method;

CLO 2. Use integrals to formulate and solve application problems in science and engineering; Construct and plot parametric and polar curves;

CLO 3. Identify different types of series and determine whether a a particular series converges; Find the interval of convergence of a power series & Apply Taylor series to approximate functions and estimate the error of approximation.

Text books :

1. Timothy G. Feeman, *The Mathematics of Medical Imaging, A Beginners Guide*, SpringerUnder graduate Text in Mathematics and Technology,Springer,2010.
2. C.W .Groetsch, *InverseProblems*, Activities for Undergraduates, The Mathematical Association of America,1999.

Reference books :

1. Andreas Kirsch, *An Introduction to the Mathematical Theory of Inverse Problems*, 2nd Ed.,Springer,2011.

Online links for study & reference materials :
https://guides.library.uoit.ca/math/books

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 22 **Course Name:** Boolean Algebra & Automata Theory
Course Credit Hour : 6hr **Total Contact Hour :** 90hr

Course Objective :

Create a hypothesis and appreciate how it relates to broader theories.
1• Evaluate hypotheses, theories, methods and evidence within their proper contexts.
2• Solve complex problems by critical understanding, analysis and synthesis.
3• Demonstrate engagement with current research and developments in the subject.

Course Description:

Select, interpret and critically evaluate information from a range of sources that include books, scientific reports, journals, case studies and the internet.

1• Develop proficiency in the analysis of complex physical problems and the use of mathematical or other appropriate techniques to solve them.

2• Provide a systematic understanding of the concepts and theories of mathematics and their application in the real world – to an advanced level, and enhance career prospects in a huge array of fields.

3• Criticize mathematical arguments developed by themselves and others

4• Communicate effectively by oral, written, computing and graphical means.

5• Recognize the need to engage in lifelong learning through continuing education and research

COURSE CONTENT:

UnitI

Definition, examples and basic properties of ordered sets, maps between ordered sets, dualityprinciple,latticesasorderedsets,latticesasalgebraicstructures,sublattices,productsandhomomorphisms.Definition,examplesandpropertiesofmodularanddistributivelattices,Booleanalgebras,Booleanpolynomials,minimalformsofBooleanpolynomials,Quinn-McCluskeymethod,Karnaughdiagrams,switchingcircuitsandapplicationsofswitchingcircuits.

UnitII

Introduction:Alphabets,strings,andlanguages.FiniteAutomataandRegularLanguages:deterministic and non-deterministic finite automata, regular expressions, regular languages andtheirrelationshipwithfiniteautomata,pumpinglemmaandclosurepropertiesofregularlanguages.

Context Free Grammars and Pushdown Automata: Context free grammars (CFG), parse trees, ambiguities in grammars and languages, pushdown automaton (PDA) and the language accepted by PDA, deterministic PDA, Non- deterministic PDA, properties of context free languages; normal forms, pumping lemma, closure properties, decision properties.

Unit III

Turing Machines: Turing machine as a model of computation, programming with a Turing machine, variants of Turing machine and their equivalence.

Undesirability: Recursively enumerable and recursive languages, undesirable problems about Turing machines :halting problem, Post Correspondence Problem, and undesirability .

Course Learning Outcomes(CLOs) : Students will able to

CLO 1: Define Automata anddiscuss the acceptability of a string by finite automation

CLO 2: Construct non-deterministic finite state machine

CLO 3: Analyze different simplification methods for Boolean functions and design the logical circuits.

Text books:

1. B A. Davey and H. A. Priestley, *Introduction to Lattices and Order*, Cambridge UniversityPress,Cambridge,1990.

2. EdgarG.GoodaireandMichaelM.Parmenter,*DiscreteMathematicswithGraphTheory,* (2ndEd.),PearsonEducation(Singapore)P.Ltd., IndianReprint2003.

3. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts inMathematics,Springer(SIE),Indian reprint,2004.

Reference books:

1. J.E.Hopcroft,R.MotwaniandJ.D.Ullman, *IntroductiontoAutomataTheory,Languages,andComputation,* 2nd Ed., Addison-Wesley,2001.

2. H.R. Lewis, C.H. Papadimitriou, C. Papadimitriou, *Elements of the Theory of Computation*,2ndEd., Prentice-Hall, NJ,1997.

3. J.A.Anderson, *Automata Theory with Modern Applications*, CambridgeUniversityPress,2006.

Online links for study & reference materials:

https://www.vssut.ac.in/lecture_notes/lecture1423726104.pdf

Assessment method:(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

	L	T	P
	5	1	0

Course Code : STUGM-DSE 23 **Course Name :** Algebra
Course Credit Hour : 6hr **Total Contact Hour :** 90hr

Course Objective:

1 To classify numbers into number sets and to combine polynomial by addition or subtraction.

2 solve problems of simple Inequalities of Eigenvalues, Eigen Vectors and

Characteristic Equation of a matrix.

3 Interpret basic absolute value expression and to simplify algebraic expressions, using the commutative, associative and Distributive properties.

Course Description:

Algebra is a branch of mathematics that substitutes letters for numbers. Algebra is about finding the unknown or putting real-life variables into equations and then solving them. Algebra can include real and complex numbers, matrices, and vectors. An algebraic equation represents a scale where what is done on one side of the scale is also done to the other and numbers act as constants.

COURSE CONTENT:

UnitI

Polar representation of complex numbers, n^{th} roots of unity, De Moivre's theorem for rationalindicesandits applications.

UnitII

Equivalence relations, Functions, Composition of functions, Invertible functions, One to onecorrespondence and cardinality of a set, Well-ordering property of positive integers, Divisionalgorithm,DivisibilityandEuclideanalgorithm,Congruencerelationbetweenintegers,PrinciplesofMathematicalInduction,statement of FundamentalTheoremofArithmetic.

UnitIII

Systems of linear equations, row reduction and echelon forms, vector equations, the matrixequationAx=b,solutionsetsoflinearsystems,applicationsoflinearsystems,linearindependence.

UnitIV

Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix,characterizations of invertible matrices. Subspaces of R^n, dimension of subspaces of R^n and rankofamatrix, Eigenvalues, Eigen Vectorsand Characteristic Equationofamatrix.

.

Course Learning Outcomes(CLOs) : This course will enable the students to:

CLO 1: Understand the basic concepts of group actions and their applications.

CLO 2: RecognizeandusetheSylowtheoremstocharacterizecertainfinitegroups.

CLO 3: Know the fundamental concepts in ring theory such as the concepts of ideals ,quotient rings, integral domains ,and fields.

CLO 4: Learn in detail about polynomial rings, fundamental properties off initial extensions, and classification off invite fields.

Text books :

1. N.S.Gopalakrishnan(1986).*UniversityAlgebra*,NewAgeInternationalPublishers.
2. I.N.Herstein(2006).*TopicsinAlgebra*(2^{nd}edition).WileyIndia.

Reference books :

1. DavidC.Lay,*LinearAlgebraanditsApplications,*3rdEd.,PearsonEducationAsia, IndianReprint,2007.
2. NathanJacobson(2009).*BasicAlgebraI&II*(2ndedition).DoverPublications.

Online links for study & reference materials :

https://www.researchgate.net/publication/312368538_Advanced_Algebra

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	**T**	**P**
5	**1**	**0**

Course Code: STUGM- DSE 31
Course Name: Theory of Equations
Course Credit Hour: 6hr
Total Contact Hour : 90hr

Course Objective:

In algebra the **theory of equations** is the study of algebraic equation (also called "polynomial equations"), which are equations defined by a polynomials The main problem of the theory of equations was to know when an algebraic equation has an algebraic solution. This problem was completely solved in 1830 by Evariste Galois by introducing what is now called Galois Theory.

Before Galois, there was no clear distinction between the "theory of equations" and "algebra". Since then algebra has been dramatically enlarged to include many new subareas, and the theory of algebraic equations receives much less attention. Thus, the term "theory of equations" is mainly used in the context of the history of mathematics, to avoid confusion between old and new meanings of "algebra"

Course Description:

In this module, we will study about polynomial functions and various methods to find out the roots of polynomial equations. 'Solving equations' was an important problem from the beginning of study of Mathematics itself. The notion of complex numbers was first introduced because equations like $x^2 + 1 = 0$ has no solution in the set of real numbers. The "fundamental theorem of algebra" which states that every polynomial of degree >1 has at least one zero was first proved by the famous German Mathematician Karl Fredrich Gauss. We shall look at polynomials in detail and will discuss various methods for solving polynomial equations.

Course Contents:

UnitI

General properties of polynomials, Graphical representation of a polynomial, maximum andminimum values of a polynomials, General properties of equations, Descarte's rule of signspositiveand negativerule,Relation between theroots and thecoefficientsofequations.

UnitII

Symmetricfunctions,Applicationsofsymmetricfunctionoftheroots,Transformationofequations.Solutions of reciprocal and binomial equations.Algebraic solutions of the cubic andbiquadratic.Properties ofthe derived functions.

UnitIII

Symmetricfunctionsoftheroots,Newton'stheoremonthesumsofpowersofroots,homogeneous products, limits of the roots of equations. Separation of the roots of equations,Strums theorem, Applications of Strum’s theorem, Conditions for reality of the roots of anequationand biquadratic.Solution of numerical equations.

Course Learning Outcomes (CLOs) :

Upon completion of this chapter, the students will be able to

CLO 1: form polynomial equations satisfying given conditions on roots.determine the number of positive and negative roots of a polynomial equation using Descartes Rule.

CLO 2: demonstrate the techniques to solve polynomial equations of higher degree.identify and solve reciprocal equations.

CLO 3: solve equations of higher degree when some roots are known to be complex or surd, irrational, and rational.find solutions to some non-polynomial equations using techniques developed for polynomial equations.

Text books :

1.W.S.Burnside andA.W. Panton,*The Theory of Equations*,Dublin UniversityPress,1954.

Reference books :

1.C.C.MacDuffee,*Theoryof Equations*,John Wiley&SonsInc.,1954

Online links for study & reference materials :

https://www.britannica.com/science/mathematics/Theory-of-equations

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 32
Course Name: Bio-Mathematics
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:

By answering questions that cannot be addressed by other means, mathematics can be an indispensable tool for biological research. The interdisciplinary field of mathematical biology combines experiment, mathematical theory, statistics and computation to better understand biological systems. In this course you will engage in all of these areas by collecting data and implementing the essential modeling techniques of formulation, implementation, validation, and analysis. These tools will be applied to a wide variety of biological systems and disciplines.

Course Description:

Course have an enhanced knowledge and understanding of mathematical modeling and statistical methods in the analysis of biological systems; be better able to assess biological inferences that rest on mathematical and statistical arguments; be able to analyses data from experiments and draw sound conclusions about the under lying processes using their understanding of mathematics and statistics; be aware of the use of computers to assist them in studying mathematical functions and carrying out statistical tests.

Course Contents:

Unit I

Mathematical Biology and the modeling process: an overview. Continuous models: Malthus model, logistic growth, Allee effect, Gompertz growth, Michaelis-Menten Kinetics, Holling typegrowth, Bacterial growth in a Chemostat, Harvesting a single natural population, Prey predatorsystems and LotkaVolterra equations, Populations in competitions, Epidemic Models (SI, SIR,SIRS, SIC), Activator-Inhibitor system, Insect Outbreak Model: Spruce Budworm, Numericalsolutionof themodels and its graphical representation.

Unit II

Qualitative analysis of continuous models: Steady state solutions, stability and linearization,multiple species communities and Routh-Hurwitz Criteria, Phase plane methods and qualitativesolutions, bifurcations and limit cycles with examples in the context of biological scenario.Spatial Models: One species model with diffusion, Two species model with diffusion, Conditionsfordiffusiveinstability,Spreadingcoloniesofmicroorganisms,Bloodflowincirculatorysystem,Travelling wavesolutions, Spread of genesin a population.

Unit III

Discrete Models: Overview of difference equations, steady state solution and linear stabilityanalysis, Introduction to Discrete Models, Linear Models, Growth models, Decay models, DrugDeliveryProblem,DiscretePrey-Predatormodels,Densitydependentgrowthmodelswithharvesting, Host-Parasitoid systems (Nicholson-Bailey model), Numerical solution of the modelsand its graphical representation. Case Studies: Optimal Exploitation models, Models in Genetics, Stage Structure Models, Age Structure Models.

Course Learning Outcomes (CLOs) :
By the end of this course, students should be able to:

CLO1: Formulate discrete and differential equation models that represent a range of biological Problems, including identifying assumptions that are appropriate for the problem to be Solved. Choose and apply computational tools to perform parameter estimation and to solve Discrete and differential equation models.

CLO2: Interpret model and data output in terms of the original biological problem, and use results to Direct a follow-up experiment. Perform appropriate data manipulations, and graphically display model output and data clearly and accurately.

CLO3: Effectively communicate across the disciplines. Demonstrate appropriate laboratory Technique, designs an experiment, and collects data.

Text books :

1. L.E.Keshet,*Mathematical ModelsinBiology*, SIAM,1988.
2. J.D.Murray, *MathematicalBiology*, Springer,1993.
3. Y.C.Fung,*Biomechanics*,Springer-Verlag,1990.

Reference books :

1. F.Brauer, P.V.D. Driesscheand J. Wu,*Mathematical Epidemiology*, Springer,2008.
2. M.Kot,*ElementsofMathematical Ecology*,CambridgeUniversityPress,2001.

Online links for study & reference materials :
https://nptel.ac.in/courses/102/101/102101003/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 33
Course Credit Hour: 6hr

Course Name: Linear Programing
Total Contact Hour : 90hr

Course Objective:

This course presents the theory, application, and algorithms relevant to solving linear programming problems.
1)Be able to mathematically formulate an applied word problem involving revenue, costs, and constraints as a linear program.
2) Be able to geometrically solve a linear program in two variables.
3) Be able to convert a linear programing problem into standard form.
4) Be able to apply the simplex algorithm to solve a linear programming problem

Course Description:

An introduction to the concepts and applications of linear programming. Topics include the simplex method for linear programming, duality and sensitivity analysis. Some of these topics are illustrated by means of interactive computer packages.

Course Contents:

Unit I

Introductiontolinearprogrammingproblem,Theoryofsimplexmethod,optimalityandunboundedness ,the simplex algorithm,simplexmethodintableauformat,introductiontoartificialvariables, two-phase method, Big-M method and their comparison.

Unit II

Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual.

Unit III

Transportation problem and its mathematical formulation, northwest-corner method least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem ,assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

Unit IV

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure, line reprogramming solution of games.

Course Learning Outcomes (CLOs) :

At the end of the module the student will be able to

CLO 1. Formulate the LPP. Conceptualize the feasible region.

CLO 2. Solve the LPP with two variables using graphical method. Solve the LPP using simplex method.

CLO 3. Formulate the dual problem from primal.

CLO 4:Analyse the sensitivity of a decision variable. Run and analyse the results of user friendly software for LPP

Text books :

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear Programming and NetworkFlows,*2nd Ed., JohnWileyand Sons,India,2004.
2. F.S. Hillier and G.J. Lieberman, *Introduction to Operations Research,* 9th Ed., Tata McGrawHill,Singapore,2009.

Reference books :

1. HamdyA.Taha, *OperationsResearch,AnIntroduction,*8thEd.,Prentice-HallIndia,2006.
2. G.Hadley,*LinearProgramming*, NarosaPublishing House, NewDelhi,2002.

Online links for study & reference materials :

https://www.teachengineering.org/lessons/view/cub_linear_programming_lesson01

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 41
Course Name: Mathematical Modeling
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:

The overall goal of this course is to enable students to build mathematical models of real-world systems, analyze them and make predictions about behavior of these systems. Variety of modeling techniques will be discussed with examples taken from physics, biology, chemistry, economics and other fields. The focus of the course will be on seeking the connections between mathematics and physical systems, studying and applying various modeling techniques to creating mathematical description of these systems, and using this analysis to make predictions about the system's behavior.
.

Course Description:

This course is aligned with the following Applied Mathematics program learning outcomes: 1) Solve mathematical problems using analytical methods. 2) Solve mathematical problems using computational methods. 3) Recognize the relationships between different areas of mathematics and the connections between mathematics and other disciplines. 4) Give clear and organized written and verbal explanations of mathematical ideas to a variety of audiences. 5) Model real-world problems mathematically and analyze those models using their mastery of the core concepts.

Course Contents:

Unit I

Power series solution of a differential equation about an ordinary point, solution about a regular singular point, Bessel'sequationandLegendre'sequation,Laplacetransformandinversetransform,application to initial value problem up to second order.

Unit II

Monte Carlo Simulation Modeling: simulating deterministic behavior (are a underacurve, volume under a surface), Generating Random Numbers: middles qu are method, linear congruence, Queuing Models: harbor system, morning rush hour.

Unit III

Overview of optimization modeling, Linear Programming Model: geometric solution algebraic solution, simplex method, sensitivity analysis

List of Practicals (using any software)

(i) Plottingof Legendrepolynomialforn=1to5intheinterval[0,1]. Verifyinggraphicallythat all the rootsof Pn (x) lie intheinterval[0,1].
(ii) Automatic computation of coefficients in theseries solution nearordinarypoints.
(iii) Plottingof theBessel'sfunction offirstkind oforder0 to3.
(iv) Automatingthe FrobeniusSeriesMethod.
(v) Randomnumbergeneration andthenuseitforoneofthefollowing(a)Simulateareaunderacurve(b) Simulate volume under asurface.
(vi) Programmingof either oneofthequeuingmodel(a)Singleserver queue(e.g.Harborsystem)(b) Multiple server queue(e.g. Rushhour).
(vii) Programmingof theSimplexmethod for2/3variables.

Course Learning Outcomes (CLOs) :

On successful completion of this unit, students will be able to:

CLO1. Demonstrate understanding of powerful mathematical tools such as calculus of several variables, differential equations and elementary dynamical systems theory;

CLO2. Compute with these tools, manually and with mathematical software;

CLO3. Apply these tools to mathematically analyse and solve contemporary problems of both theoretical and practical importance;

CLO4. Recognise the power of mathematical modelling and analysis and be able to apply their understanding to their further studies.

Text books :

1. TynMyint-U andLokenathDebnath, *LinearPartialDifferentialEquationforScientistsandEngineers*,Springer,Indian reprint,2006.

Reference books :

1. Frank R. Giordano, Maurice D. Weir and William P. Fox, *A First Course in MathematicalModeling*,ThomsonLearning,London andNew York,2003.

Online links for study & reference materials :

https://www.ntnu.edu/studies/courses/TMA4195#tab=omEmnet

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 42
Course Credit Hour: 6hr

Course Name: Mechanics
Total Contact Hour: 90hr

Course Objective:

The primary purpose of the study of mechanics is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering. This capacity requires more than a mere knowledge of the physical and mathematical principles of mechanics; also required is the ability to visualize physical configurations in terms of real materials, actual constraints ,and the practical limitations which govern the behavior of machines and structures. One of the primary objectives in a mechanics course is to help the student develop this ability to visualize, which is so vital to problem formulation. Indeed, the construction of a meaningful mathematical model is often a more important experience than its solution. Maximum progress is mad e when the principles and their limitations are learned together within the context of application.

Course Description:

Introduction: course layout and physics revision.
2 Mass geometry: center of mass and moment of inertia tensor.
3 Kinematics: kinds of motion, absolute and relative velocities and accelerations, Coriolis acceleration, instant center of rotation, degrees of freedom.
4 Statics: free body diagram, joints and reactions, friction, work and energy, virtual work, mechanical efficiency.
5 Dynamics: conservation of linear momentum, angular momentum and energy, variable mass systems, dynamic equilibrium, rotor balancing, gyroscopes.
6 Machine theory: degrees of freedom and motion parameters, gear trains, dimensions of mechanisms.

Course Contents :

Unit I

Moment of a force about a point and an axis, couple and couple moment, Moment of a couple about a line, resultant of a force system, distributed force system, free body diagram, free bodyinvolvinginteriorsections,generalequationsofequilibrium,twopointequivalentloading,problemsarising from structures, static indeterminacy.

Unit II

Laws of Coulomb friction, application to simple and complex surface contact friction problems, transmission of power through belts, screw jack, wedge, first moment of an area and the centroid, other centers, Theorem of Pappus-Guldinus, second moments and the product of area ofa plane area, transfer theorems, relation between second moments and products of area, polar moment of area, principal axes.

Unit III

Conservative force field, conservation for mechanical energy, work energy equation, kinetic energy and work kinetic energy expression based on center of mass, moment of momentum equation for a single particle and a system of particles, translation and rotation of rigid bodies, Chasles'theorem,generalrelationshipbetweentimederivativesofavectorfordifferentreferences, relationship between velocities of a particle for different references, acceleration of particle for different references.

Course Learning Outcomes (CLOs) :

Students will be able to articulate and describe:

CLO 1: Relative motion. Inertial andnon inertial reference frames.Parameters defining the motion of mechanical systems and their degrees of freedom.

CLO 2: Study of the interaction of forces between solids in mechanical systems. Centre of mass and inertia tensor of mechanical systems. 5 Application of the vector theorems of mechanics and interpretation of their results.

CLO 3: Newton's laws of motion and conservation principles.Introduction to analytical mechanics as a systematic tool for problem solving.

Text books :

1. I.H.ShamesandG.KrishnaMohanRao, *EngineeringMechanics:Statics andDynamics,*(4thEd.),DorlingKindersley(India)Pvt.Ltd.(PearsonEducation),Delhi,2009.

Reference books :

1. R.C. Hibbeler and Ashok Gupta, *Engineering Mechanics: Statics and Dynamics,* 11th Ed.,DorlingKindersley(India)Pvt.Ltd. (Pearson Education),Delhi.

Online links for study & reference materials :

https://nptel.ac.in/courses/112/106/112106286/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM-DSE 43 **Course Name:** Differential Geometry
Course Credit Hour: 6hr **Total Contact Hour:** 90hr

Course Objective:

1• Introducing the concepts: Regular curves, arc length, and natural parameterization.
2• Introducing the concepts: Serret-Fernet apparatus.
3• Introducing the concepts: Simple surfaces, tangent vectors and tangent spaces, and first and second fundamental forms.
4• Introducing the concepts: Normal and geodesic curvatures, Weingarten map, principal curvatures, Gaussian and mean curvatures.
5• Introducing the concepts: Equations of Gauss and geodesics.
.
Course Description:

The course introduces the fundamentals of differential geometry primarily by focusing on the theory of curves and surfaces in three space. The theory of curves studies global properties of curves such as the four vertex theorem. The theory of surfaces introduces the fundamental quadratic forms of a surface, intrinsic and extrinsic geometry of surfaces, and the Gauss-Bonnet theorem.

Course Contents:

Unit I

Theory of Space Curves: Space curves, Planer curves, Curvature, torsion and Serret-Frenet formulae. Osculating circles, Osculating circles and spheres. Existence of space curves. Evolutes and involutes of curves.

Unit II

Theory of Surfaces:Parametric curves on surfaces. Direction coefficients.First and secondFundamental forms.Principal and Gaussian curvatures.Lines of curvature, Euler's theorem.Rodrigue'sformula, Conjugateand Asymptoticlines.

Developables:Developableassociatedwithspacecurvesandcurvesonsurfaces,Minimalsurfaces.

Unit III

Geodesics:Canonicalgeodesicequations.Natureofgeodesicsonasurfaceofrevolution.Clairaut's theorem.Normal property of geodesics.Torsion of a geodesic.Geodesic curvature.Gauss-Bonnet theorem.Surfaces of constant curvature.Conformal mapping.Geodesic mapping.Tissot'stheorem.

Unit IV

Tensors: Summation convention and indicial notation, Coordinate transformation and Jacobian,Contra-variantandCovariantvectors,Tensorsofdifferenttype,Algebraoftensorsandcontraction, Metric tensor and3-indexChristoffel symbols, Parallelpropagation ofvectors,Covariant and intrinsic derivatives, Curvature tensor and its properties, Curl, Divergence and Laplacianoperators in tensor form, Physical components.

Course Learning Outcomes (CLOs) :

Text books:

1. T.J.Willmore,*AnIntroduction to DifferentialGeometry*, DoverPublications,2012.
2. B.O'Neill,*Elementary DifferentialGeometry*, 2ndEd., Academic Press,2006.
3. C.E. Weatherburn, *Differential Geometry of Three Dimensions*, Cambridge University Press2003.

Reference books:

1. D.J.Struik,*Lectureson ClassicalDifferential Geometry*,Dover Publications,1988.
2. S. Lang,*FundamentalsofDifferentialGeometry*, Springer,1999.
3. B.Spain,*Tensor Calculus: A Concise Course*, Dover Publications,2003.

Online links for study & reference materials :

https://nptel.ac.in/courses/111/104/111104095/

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code: STUGM – SEC 11 **Course Name: Logic** and Sets
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

Mathematical logic is the framework upon which rigorous proofs are built. It is the study of the principles and criteria of valid inference and demonstrations. Logicians have analyzed set theory in great details, formulating a collection of axioms that affords a broad enough and strong enough foundation to mathematical reasoning

Course Description:

This course includes propositions, truth table, negation, conjunction and disjunction, Set operations and the laws of set theory and Venn diagrams, Relations with example of congruence modulo relation, Partial ordering relations.

Course Contents :

Unit I - Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.

Unit II- Sets, subsets, Set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.

Unit III -Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations, n-ary relations.

Course Learning Outcomes(CLOs) :

CLO-1 : Understand the different types of propositions.
CLO-2 : Learn the concept of Set operations and the laws of set theory and Venn diagrams.
CLO-3 :Understand Relation, Product set, Composition of relations, Types of relations

Text books :

R.P. Grimaldi, Discrete Mathematics and Combinatorial Mathematics, Pearson Education, 1998.

Reference books :

P.R. Halmos, Naive Set Theory, Springer, 1974.
E. Kamke, Theory of Sets, Dover Publishers, 1950

Online links for study & reference materials :

https://youtu.be/-lOgJki_h0E

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code: STUGM – SEC 12
Course Name: Computer Graphics
Course Credit Hour: 2hr
Total Contact Hour: 35hr

Course Objective:

Computer Graphics can be a tools for increasing the awareness in the sciences subjects such as Mathematics among students. Because of the application of the real time, interactive, and visual feedback, students can easily observe the effects of the use of Mathematics in produce a good designs.

Course Description:

This course includes Development of computer Graphics,Scan conversion, line-drawing algorithms, linear transformations, line and polygon clipping algorithms.

Course Contents :

Unit I - Development of computer Graphics: Raster Scan and Random Scan graphics storages, displays processors and character generators, colour display techniques, interactive input/output devices. Points, lines and curves.

Unit II- Scan conversion, line-drawing algorithms, circle and ellipse generation, conic-section generation, polygon filling anti aliasing.

Unit III -Two-dimensional viewing: Coordinate systems, linear transformations, line and polygon clipping algorithms.

Course Learning Outcomes(CLOs) :

CLO-1 : Understand the different colour display techniques.
CLO-2 : Learn the concept of circle and ellipse generation.
CLO-3 : Understand line and polygon clipping algorithms.

Text books :

D. Hearn and M.P. Baker, Computer Graphics, 2nd Ed., Prentice–Hall of India,2004.

Reference books :

J.D. Foley, A van Dam, S.K. Feiner and J.F. Hughes, Computer Graphics: Principals and Practices, 2nd Ed., Addison-Wesley, MA, 1990.

D.F. Rogers, Procedural Elements in Computer Graphics, 2nd Ed., McGraw Hill Book Company, 2001.

Online links for study & reference materials :

https://youtu.be/W5P8GlaEOSI

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code: STUGM – SEC 21
Course Credit Hour: 2hr

Course Name: Graph Theory
Total Contact Hour: 35hr

Course Objective:

To understand and apply the fundamental concepts in graph theory.
To understand the Graph theory based tools in solving practical problems and to improve the proof writing skills

Course Description:

This course includes and basic properties and types of graphs, travelling salesman's problem, shortest path,Dijkstra's algorithm and Floyd□Warshall algorithm.

Course Contents:

Unit I - Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bi□partite graphs, isomorphism of graphs, paths and circuits,

Unit II- Eulerian circuits, Hamiltonian cycles, the adjacency matrix, weighted graph, travelling salesman's problem, shortest path,

Unit III -Dijkstra's algorithm, Floyd□Warshall algorithm.

Course Learning Outcomes (CLOs) :

CLO-1 : Understand the basic types of the graphs.

CLO-2 :Learn the concept of travelling salesman's problem and find its shortest path.

CLO-3 : Understand Dijkstra's algorithm, Floyd□Warshall algorithm.

Text books :

Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

Reference books :

B.A. Davey and H.A. Priestley, Introduction to Lattices and Order, Cambridge University Press, Cambridge, 1990.

Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 2nd Edition, Pearson Education (Singapore) P. Ltd., Indian Reprint 2003.

Online links for study & reference materials :

https://youtu.be/XB4MIexjvY0

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code: STUGM – SEC 22
Course Name: Operating System: Linux
Course Credit Hour: 2hr
Total Contact Hour: 35hr

Course Objective:

Linux is an open source operating system (OS). An operating system is the software that directly manages a system's hardware and resources, like CPU, memory, and storage. The OS sits between applications and hardware and makes the connections between all of your software and the physical resources that do the work.

Course Description:

This course includes The Operating System: Linux, history, features and Resource Management.

Course Contents:

Unit I - Linux – The Operating System: Linux history, Linux features, Linux distributions, Linux's relationship to Unix, Overview of Linux architecture, Installation, Startup scripts, system processes (an overview), Linux Security, The Ext2 and Ext3 File systems: General Characteristics of, The Ext3 File system, file permissions. User Management: Types of users, the powers of Root, managing users (adding and deleting): using the command line and GUI tools.

Unit II- Resource Management in Linux: file and directory management, system calls for files Process Management, Signals, IPC: Pipes, FIFOs, System V IPC, Message Queues, system calls for processes, Memory Management, library and system calls for memory.

Course Learning Outcomes(CLOs) :

CLO-1 : Understand the concept of operating system Linux.

CLO-2 : Learn the Resource Management in Linux.

Text books :

Sumitabha Das, Unix Concepts and Applications, 4th Ed., TMH, 2009.

Reference books :

1. Arnold Robbins, Linux Programming by Examples The Fundamentals, 2nd Ed., Pearson Education, 2008.
2. Cox K, Red Hat Linux Administrator's Guide, PHI, 2009.
3. R. Stevens, UNIX Network Programming, 3rd Ed., PHI, 2008.

Online links for study & reference materials:

https://youtu.be/yXLlF6uYynQ

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

.

Course Structure Template

L	T	P
4	0	2

Course Code: STUGM – GE 11 **Course Name: Fundamental of Computer Application**
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

Object-oriented programming aims to implement real-world entities like inheritance, hiding, polymorphism in programming. The main aim of OOP is to bind together the data and the functions that operate on them so that no other part of the code can access this data except that function.

Course Description:

This course includes Structure of a C++ program, data abstraction and Implementing Class Functions within Class declaration

Course Contents:

Unit I - OOP Paradigm: Comparison of Programming paradigms, Characteristics of Object-Oriented Programming Languages, Object-based programming languages C++: Brief History of C++,Structure of a C++ program, Difference between C and C++ - cin, cout, new, delete operators, ANSI/ISO Standard C++, Comments, Working with Variables and const Qualifiers. Enumeration, Arrays and Pointer.

Unit II- Implementing oops concepts in C++ Objects, Classes, Encapsulation, Data Abstraction, Inheritance, Polymorphism, Dynamic Binding, Message Passing, Default Parameter Value,Using Reference variables with Functions.

Unit III - Abstract data types, Class Component, Object & Class, Constructors Default and Copy Constructor, Assignment operator deep and shallow coping, Access modifiers – private, publicand protected. Implementing Class Functions within Class declaration or outside the Class declaration. instantiation of objects, Scope resolution operator, Working with Friend Functions, Using Static Class members. Understanding Compile Time Polymorphism function overloading Rules of Operator Overloading (Unary and Binary) as member function/friend function, Implementation of operator overloading of Arithmetic Operators, Overloading Output/Input,Prefix/ Postfix Increment and decrement Operators, Overloading comparison operators, Assignment, subscript and function call Operator , concepts of namespaces.

Course Learning Outcomes (CLOs) :

CLO-1 : Understand the difference between C and C++.
CLO-2 : Learn the different concepts in C++ Objects like Classes, Inheritance, Polymorphism
CLO-3 : Implementing Class Functions within Class declaration or outside the Class declaration

Text books:

1 R. Venugopal, Rajkumar, and T. Ravishanker, Mastering C++, TMH, 1997

Reference books :

S. B. Lippman and J. Lajoie, C++ Primer, 3rd Ed., Addison Wesley, 2000.
Bruce Eckel, Thinking in C++, 2nd Ed., President, Mindview Inc., Prentice Hall.
D. Parasons, Object Oriented Programming with C++, BPB Publication.
Bjarne Stroustrup , The C++ Programming Language, 3rd Ed., Addison Welsley

Online links for study & reference materials :

https://youtu.be/h4kUiFOb_v0

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

	L	T	P
	5	1	0

Course Code: STUGM – GE 12 **Course Name: Finite** Element Methods
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

To learn basic principles of finite element analysis procedure. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Course Description:

This course includes **-** Introduction to finite element methods,Applications to solving simple problems of ordinary differential equations and Simplex elements in two and three dimensions.

Course Contents:

Unit I - Introduction to finite element methods, comparison with finite difference methods, Methods of weighted residuals, collocations, least squares and Galerkin's method.Variational formulation of boundary value problems equivalence of Galerkin and Ritz methods.

Unit II- Applications to solving simple problems of ordinary differential equations. Linear, quadratic and higher order elements in one dimensional and assembly, solution of assembled system.

Unit III - Simplex elements in two and three dimensions, quadratic triangular elements, rectangular elements, serendipity elements and isoperimetric elements and their assembly, discretization with curved boundaries, Interpolation functions, numerical integration, and modeling considerations. Solution of two dimensional partial differential equations under different Geometric conditions.

Course Learning Outcomes (CLOs) :

CLO-1 :Understand the concepts behind formulation methods in Finite Element Methods (FEM)

CLO-2 :Develop element characteristic equation and generation of global equation.

CLO-3 :Able to apply Simplex elements in two and three dimensions

Text books:

J.N. Reddy, Introduction to the Finite Element Methods, Tata McGraw-Hill, 2003.

Reference books :

1. K.J. Bathe, Finite Element Procedures, Prentice-Hall, 2001.
2. R.D. Cook, D.S. Malkus and M.E. Plesha, Concepts and Applications of Finite Element Analysis, John Wiley and Sons, 2002.
3. Thomas J.R. Hughes, The Finite Element Method: Linear Static and Dynamic Finite Element Analysis, Dover Publication, 2000.

Online links for study & reference materials :

https://youtu.be/__4REhFXmp

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

	L	T	P
	5	1	0

Course Code: STUGM – GE 21 **Course Name: Mathematical** Finance
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

Mathematical finance is an interdisciplinary study of financial markets. It helps economist/trader to make decisions and frame policies to his/her advantage.

Course Description:

This course includes Basic principles: Comparison, arbitrage and risk aversion, Interest, Asset return, short selling, portfolio return.

Course Contents:

Unit I - Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound, discrete and continuous), time value of money, inflation, net present value, internal rate of return (calculation by bisection and Newton-Raphson methods), comparison of NPV and IRR. Bonds, bond prices and yields, Macaulay and modified duration, term structure of interest rates: spot and forward rates, explanations of term structure, running present value, floating-rate bonds, immunization, convexity, putable and callable bonds.

Unit II- Asset return, short selling, portfolio return, (brief introduction to expectation, variance, covariance and correlation), random returns, portfolio mean return and variance, diversification, portfolio diagram, feasible set, Markowitz model (review of Lagrange multipliers for 1 and 2 constraints), Two fund theorem, risk free assets, One fund theorem, capital market line, Sharpe index. Capital Asset Pricing Model (CAPM), betas of stocks and portfolios, security market line, use of CAPM in investment analysis and as a pricing formula, Jensen's index.

Course Learning Outcomes (CLOs) :

CLO-1: Understand the Basic principles of Finance
CLO-2: Learn different types of model like Markowitz mode etc.

Text books:

1. David G. Luenberger, Investment Science, Oxford University Press, Delhi, 1998.
2. John C. Hull, Options, Futures and Other Derivatives, 6th Ed., Prentice-Hall India, Indian reprint, 2006.

Reference books :

1. Sheldon Ross, An Elementary Introduction to Mathematical Finance, 2nd Ed., Cambridge University Press, USA, 2003.

Online links for study & reference materials :

https://youtu.be/bkqyRseAbWY

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM – GE 22
Course Name: Econometrics
Course Credit Hour: 6hr
Total Contact Hour: 90hr

Course Objective:

Econometrics deals with the measurement of economic relationships.There is a need of finding the stochastic relationship in mathematical format, the econometric methods and tools help. The econometric tools are helpful in explaining the relationships among variables.

Course Description:

This course includes Statistical Concepts and different types of the distribution, simple linear regression model, multiple regression model and Detection and Remedies Multicollinearity, heteroscedasticity.

Course Contents:

Unit I - Statistical Concepts Normal distribution; chi-square, t and F-distributions; estimation of parameters; properties of estimators; testing of hypotheses: defining statistical hypotheses; distributions of test statistics; testing hypotheses related to population parameters; Type I and Type II errors; power of a test; tests for comparing parameters from two samples.

Unit II- Simple Linear Regression Model: Two Variable Case Estimation of model by method of ordinary least squares; properties of estimators; goodness of fit; tests of hypotheses; scaling and units of measurement; confidence intervals; Gauss-Markov theorem; forecasting.

Unit III -Multiple Linear Regression Model Estimation of parameters; properties of OLS estimators; goodness of fit - R2 and adjusted R2 ; partial regression coefficients; testing hypotheses – individual and joint; functional forms of regression models; qualitative (dummy) independent variables.

Unit IV-Violations of Classical Assumptions: Consequences, Detection and Remedies Multicollinearity; heteroscedasticity; serial correlation. Specification Analysis Omission of a relevant variable; inclusion of irrelevant variable; tests of specification errors.

Course Learning Outcomes(CLOs) :

CLO-1**:** Learn Statistical Concepts and different types of distribution.
CLO-2:Understand the Simple Linear Regression Model
CLO-3 : Learn Multiple Linear Regression Model and Estimation of parameters.
CLO-4 : Understand Multicollinearity and heteroscedasticity

Text books :

1. Christopher Dougherty, Introduction to Econometrics, Oxford University Press, 3rd Ed., Indian edition, 2007.

Reference books :

1. Jay L. Devore, Probability and Statistics for Engineers, Cengage Learning, 2010.
2. John E. Freund, Mathematical Statistics, Prentice Hall, 1992.
3. Richard J. Larsen and Morris L. Marx, An Introduction to Mathematical Statistics and its Applications, Prentice Hall, 2011.

Online links for study & reference materials :

https://youtu.be/dQNpSa-bq4M

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

	L	T	P
	2	**0**	**0**

Course Code: STUGM – GE 41
Course Name: Applications of Algebra
Course Credit Hour: 2hr
Total Contact Hour: 35hr

Course Objective:

The main Objective of Algebra is to develop fluency in working with linear equations. Students will extend their experiences with tables, graphs, and equations and solve linear equations and inequalities and systems of linear equations and inequalities.

Course Description:

This course includes Balanced incomplete block designs (BIBD), Special types of matrices And Applications of linear transformations.

Course Contents:

Unit I - Balanced incomplete block designs (BIBD): definitions and results, incidence matrix of a BIBD, construction of BIBD from difference sets, construction of BIBD using quadratic residues, difference set families, construction of BIBD from finite fields.

Unit II- Special types of matrices: idempotent, nilpotent, involution, and projection tri diagonal matrices, circulant matrices, Vandermonde matrices, Hadamard matrices, permutation and doubly stochastic matrices, Frobenius- König theorem, Birkhoff theorem. Positive Semi-definite matrices: positive semi-definite matrices, square root of apositive semi-definite matrix, a pair of positive semi-definite matrices, and their simultaneous diagonalization. Symmetric matrices and quadratic forms: diagonalization of symmetric matrices, quadratic forms, constrained optimization, singular value decomposition, and applications to image processing and statistics.

Unit III -Applications of linear transformations: Fibonacci numbers, incidence models, and differential equations. Least squares methods: Approximate solutions of system of linear equations, approximate inverse of an m×n matrix, solving a matrix equation using its normal equation, finding functions that approximate data. Linear algorithms: LDU factorization, the row reduction algorithm and its inverse, backward and forward substitution, approximate inverse and projection algorithms.

Course Learning Outcomes(CLOs) :

CLO-1**:** Understand the Balanced incomplete block designs (BIBD).
CLO-2: Learn the Special types of matrices
CLO-3 : Understand Applications of linear transformations

Text books :

1. David C. Lay, Linear Algebra and its Applications. 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.

Reference books :

1. I. N. Herstein and D. J. Winter, Primer on Linear Algebra, Macmillan Publishing Company, New York, 1990.
2. S. R. Nagpaul and S. K. Jain, Topics in Applied Abstract Algebra, Thomson Brooks and Cole, Belmont, 2005.

Online links for study & reference materials :

https://youtu.be/y9ame4BGEvE

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code : STUGM – GE 42 **Course Name :**Combinatorial Mathematics
Course Credit Hour : 2hr **Total Contact Hour :** 35hr

Course Objective :

Combinatorial Mathematics, is the field of mathematics concerned with problems of selection, arrangement, and operation within a finite or discrete system. Its objective is: How to count without counting. Therefore, One of the basic problems of combinatorics is to determine the number of possible configurations of objects of a given type.

Course Description :

This course includes Basic counting principles, Permutations and Combinations, Generating functions, Integer partitions, Polya theory of counting: Necklace problem and Burnside's lemma.

Course Contents :

Unit I - Basic counting principles, Permutations and Combinations (with and without repetitions), Binomial theorem, Multinomial theorem, Counting subsets, Set-partitions, Stirling numbers Principle of Inclusion and Exclusion, Derangements, Inversion formulae.

Unit II- Generating functions: Algebra of formal power series, Generating function models, Calculating generating functions, Exponential generating functions. Recurrence relations: Recurrence relation models, Divide and conquer relations, Solution of recurrence relations, Solutions by generating functions.

Unit III -Integer partitions, Systems of distinct representatives. Polya theory of counting: Necklace problem and Burnside's lemma, Cyclic index of a permutation group, Polya's theorems and their immediate applications. Latin squares, Hadamard matrices, Combinatorial designs: t designs, BIBDs, Symmetric designs.

Course Learning Outcomes(CLOs) :

CLO-1**:** Understand theBasic counting principles, Permutations and Combinations
CLO-2: Learn about the Generating functions.
CLO-3 : Understand Polya theory of counting: Necklace problem and Burnside's lemma.

Text books :

1. S.S. Sane, Combinatorial Techniques, Hindustan Book Agency, 2013.
2. V. Krishnamurthy, Combinatorics, Theory and Application, Affiliated East-West Press1985.

Reference books :

1. P.J. Cameron, Combinatorics, Topics, Techniques, Algorithms, Cambridge University Press, 1995.
2. M. Jr. Hall, Combinatorial Theory, 2nd Ed., John Wiley & Sons, 1986.

Online links for study & reference materials :

https://youtu.be/qnVM27nKH4Q
https://youtu.be/WLPqom-EcMw

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
5	1	0

Course Code: STUGM – GE
Course Name: Introduction to Operating System
Course Credit Hour: 6hr
Total Contact Hour: 72hr

Course Objective:

The objective of Introduction to operating system to learn about design principles of operating systems and To do a case study of Operating System

Course Description:

This course includes Basic counting principles, Permutations and Combinations, Generating functions, Integer partitions, Polya theory of counting: Necklace problem and Burnside's lemma.

Course Contents:

Unit I –
Fundamentals of Operating system: Introduction to Operating System, its need and Operating System services, Early systems, Structures - Simple Batch, Multi programmed, timeshared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems. Process Management: Process concept, Operation on processes, Cooperating Processes, Threads, and Inter-process Communication..

Unit II –
CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms : FCFS, SJF,Round Robin & Queue Algorithms. Deadlocks: Deadlock characterization, Methods for handling deadlocks, Banker's Algorithm.

Unit III -
Memory Management: Logical versus Physical address space, Swapping, Contiguousallocation, Paging, Segmentation. Virtual Memory: Demand paging, Performance of demand paging, Page replacement, Page replacement algorithms, Thrashing

Unit-IV-
File management: File system Structure, Allocation methods: Contiguous allocation, Linked allocation, Indexed allocation, Free space management: Bit vector, Linked list, Grouping, Counting.

Unit-V-
Device Management: Disk structure, Disk scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK.

Course Learning Outcomes(CLOs) :

CLO-1**:** Analyze the structure of OS and basic architectural components involved in OS design.
CLO-2: Analyze and design the applications to run in parallel either using process or thread models of different OS
CLO-3 : Demonstrate the various device and resource management techniques for timesharing and distributed systems.
CLO-4 : Understand the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
CLO-5**:** Interpret the mechanisms adopted for file sharing in distributed.

Text books :

1. EktaWalia, "Operating Systems Concepts", Khanna Publishes, New Delhi, 2002.

Reference books :

1. Abraham Silberschatz, Peter B. Galvin, " Operating System Concepts", Addison-Wesley publishing. Co., 7th. Ed., 2004.
2. Nutt Gary, "Operating Systems", Addison Wesley Publication, 2000.
3. Andrew S. Tannenbaum, "Modern Operating Systems", Pearson Education Asia, Second Edition, 2001.
4. William Stallings, "Operating Systems, "Internals and Design Principles", 4th Edition, PH, 2001.

Online links for study & reference materials :

https://youtu.be/RozoeWzT7IM

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
2	0	0

Course Code: STUGM – AECC 01 **Course Name: ENVIRONMENTAL** SCIENCES
Course Credit Hour: 2hr **Total Contact Hour:** 35hr

Course Objective:

Creating the awareness about environmental problems among people.Imparting basic knowledge about the environment and its allied problems.Developing an attitude of concern for the environment. Motivating public to participate in environment protection and environment improvement

Course Description:

This course includes Natural Resources, Ecosystems, Biodiversity and its conservation, Environmental Pollution and Environmental Policies &.

Course Contents:

Unit I- : Natural Resources**:** Forest resources: Use and over-exploitation, deforestation, case studies. Timberextraction, mining, dams and their effects on forests and tribal people, (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water,dams-benefits and problems. (c) Mineral resources: Use and exploitation, environmentaleffects of extracting and using mineral resources, case studies. (d) Food resources: Worldfood problems, changes caused by agriculture and overgrazing, effects of modernagriculture, fertilizer-pesticide problems, water logging salinity, case studies. (e) Energyresources: Growing energy needs, renewable and non- renewable energy sources, use ofalternate energy sources (f) Land resources: Land as a resource, landdegradation, man induced landslides, soil erosion and desertification. Role of an individualin conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit II - Ecosystems**:** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumersand decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, foodwebs and ecological pyramids, Introduction, types, characteristic features, structure andfunction of the following ecosystem :- (a) Forest ecosystem, (b) Grassland ecosystem, (c)Desert ecosystem, (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III - Biodiversity and its conservationIntroduction – Definition: genetic, species and ecosystem diversity, Biogeographicalclassification of India, Value of biodiversity : consumptive use, productive use, socialethical, aesthetic and option values, Biodiversity at global, National and local levels, Indiaas a mega diversity nation, Hot-spots of biodiversity, Threats to biodiversity : habitat loss,poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India,Conservation of biodiversity : In-situ and Ex situ conservation of biodiversity.

Unit IV -Environmental Pollution: Definition, Causes, effects and control measures of: (a) Air pollution, (b) Water pollution, (c) Soil pollution, (d) Marine pollution (e) Noise pollution, (f) Thermal pollution, (g) Nuclear hazards. Human health risks; Solid waste management: Control measures of urban and industrial waste. Pollution case studies.

Unit V -Environmental Policies & Practices: Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act.; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Course Learning Outcomes(CLOs) :

CLO-1**:** Understand the Natural Resources.
CLO-2: Learn about Ecosystems.
CLO-3 : Understand Biodiversity and its conservation.
CLO-4 : Learn about the Environmental Pollution.
CLO-5 : Understand Environmental Policies & Practices

Text books :

1. Bharucha, E. 2003, Textbook for Environmental Studies, University Grants Commission, New Delhi and BharatiVidyapeeth Institute of Environmental Education and Research, Pune. 361.

Reference books :

1. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
2. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic press, 2011.

Online links for study & reference materials :

https://youtu.be/_mgvsPnCYj4

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF PHYSICS

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

UNDERGRADUATE PROGRAMME

Choice Based Credit System (CBCS)

(Academic Year 2019-20)

CURRICLUM DEVELOPMENT COMMITTEE

1.	Dr. Lomas Tomar Associate Professor & Director School of Sciences, NIU Greater Noida	Chairperson
2.	Dr. B K Das Associate Professor & Head Department of Physics, NIU Greater Noida	Member Secretary
3.	Dr. Rajneesh Tripathi Associate Professor Galgotia College of Engineering and Technology, Greater Noida	Member
4.	Dr. Tanveer Ahmad Wani Assistant Professor Department of Physics, NIU Greater Noida	Member

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So, it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point

Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
   - **2.1 Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
   - **2.2 Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
   - **2.3 Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.
     P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
   - **3.1** AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
   - **3.2** AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

PROGRAM LEARNING OUTCOMES

The student graduating with the Degree B. Sc Physics (Hons) should be able to

- Acquire (i) a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics like Astrophysics, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics, Mathematical Physics, Analytical dynamics, Space science, and its linkages with related disciplinary areas/subjects like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology; (ii) procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research and development, teaching and government/public service; (iii) skills in areas related to one's specialization area within the disciplinary/subject area of Physics and current and emerging developments in the field of Physics.

- Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles and methodologies to solve a wide range of problems associated with Physics.

- Recognize the importance of mathematical modeling simulation and computing, and the role of approximation and mathematical approaches to describing the physical world.

- Plan and execute Physics-related experiments or investigations, analyze and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and purpose-written packages, and report accurately the findings of the experiment/investigations while relating the conclusions/findings to relevant theories of Physics.

- Demonstrate relevant generic skills and global competencies such as (i) problem-solving skills that are required to solve different types of Physics-related problems with well-defined solutions, and tackle open-ended problems that belong to the disciplinary area boundaries; (ii) investigative skills, including skills of independent investigation of Physics-related issues and problems; (iii) communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences of technical or popular nature; (iv) analytical skills involving paying attention to detail and ability to construct logical arguments using correct technical language related to Physics and ability to translate them with popular language when needed; (v) ICT skills; (vi) personal skills such as the ability to work both independently and in a group.

- Demonstrate professional behavior such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behavior such as fabricating, falsifying or misrepresenting data or committing plagiarism; (ii) the ability to identify the potential ethical issues in work-related situations; (iii) appreciation of intellectual property, environmental and sustainability issues; and (iv) promoting safe learning and working environment.

Course Structure

Details of courses under B.Sc. Physics (Hons)

Course	*Credits Theory+ Practical	Theory + Tutorial
I. Core Course		
(14 Papers)	14X4= 56	14X5=70
Core Course Practical / Tutorial*		
(14 Papers)	14X2=28	14X1=14
II. Elective Course		
(8 Papers)		
A.1. Discipline Specific Elective	4X4=16	4X5=20
(4 Papers)		
A.2. Discipline Specific Elective Practical/Tutorial*	4 X 2=8	4X1=4
(4 Papers)		
B.1. Generic Elective/ Interdisciplinary	4X4=16	4X5=20
(4 Papers)		
B.2. Generic Elective Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		

- **Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6th Semester**

III. Ability Enhancement Courses		
1. **Ability Enhancement Compulsory**		
(2 Papers of 2 credit each)	2 X 2=4	2X 2=4
Environmental Science		
English/MIL Communication		
2. **Ability Enhancement Elective** (Skill Based)		
(Minimum 2)	2 X 2=4	2 X 2=4
(2 Papers of 2 credit each)		
Total credit	**140**	**140**

*** Wherever there is a practical there will be no tutorial and vice-versa**

SCHEME FOR CHOICE BASED CREDIT SYSTEM IN BSc Physics (Hons)

Semester	Core Course (14)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (2)	Elective: Discipline Specific (DSE) (4)	Elective: Generic (GE) (4)
I	Mathematical Physics I	AECC-1 Environmental Science			GE-1
	Mechanics				
II	Electricity& Magnetism	AECC-2 Communicative Alternative English			GE-2
	Waves and Optics				
III	Mathematical Physics II		AEEC-1/SEC-1		GE-3
	Thermal Physics				
	Digital Systems and Applications				
IV	Mathematical Physics III		AEEC-2/SEC-2		GE-4
	Elements of Modern Physics				
	Analog Systems and Applications				
V	Quantum Mechanics and Applications			DSE-1	
	Solid State Physics			DSE-2	
VI	Electromagnetic Theory			DSE-3	
	Statistical Mechanics			DSE-4	

SEM	COURSE OPTED	COURSE NAME	Credits
I	Ability Enhancement Compulsory Course- I	Communicative English	2
	Core Course-I	Mathematical Physics-I	4
	Core Course-I Practical/Tutorial	Mathematical Physics-I Lab	2
	Core course-II	Mechanics	4
	Core Course-II Practical/Tutorial	Mechanics Lab	2
	Generic Elective -1	GE-1	4/5
	Generic Elective -1 Practical/Tutorial		2/1
II	Ability Enhancement Compulsory Course- II	Environmental Science	2
	Core course-III	Electricity and Magnetism	4
	Core Course-III Practical/Tutorial	Electricity and Magnetism Lab	2
	Core course-IV	Waves and Optics	4
	Core Course-IV Practical/Tutorial	Waves and Optics Lab	2
	Generic Elective -2	GE-2	4/5
	Generic Elective -2 Practical/Tutorial		2/1
III	Core course-V	Mathematical Physics-II	4
	Core Course-V Practical/Tutorial	Mathematical Physics-II Lab	2
	Core course-VI	Thermal Physics	4
	Core Course-VI Practical/Tutorial	Thermal Physics Lab	2
	Core course-VII	Digital Systems and Applications	4
	Core Course-VII Practical/Tutorial	Digital Systems and Applications Lab	2
	Skill Enhancement Course -1/Ability Enhancement Elective Course-1	SEC-1/AEEC-1	2
	Generic Elective -3	GE-3	4/5
	Generic Elective -3 Practical/Tutorial		2/1
IV	Core course-VIII	Mathematical Physics III	4
	Course-VIII Practical/Tutorial	Mathematical Physics-III Lab	2
	Core course-IX	Elements of Modern Physics	4
	Course-IX Practical/Tutorial	Elements of Modern Physics Lab	2
	Core course-X	Analog Systems and Applications	4
	Course- X Practical/Tutorial	Analog Systems and Applications Lab	2
	Skill Enhancement Course -2/Ability Enhancement Elective Course-2	SEC -2/AEEC-2	2
	Generic Elective -4	GE-4	4/5
	Generic Elective -4 Practical/Tutorial		2/1
V	Core course-XI	Quantum Mechanics and Applications	4
	Core Course-XI Practical/Tutorial	Quantum Mechanics and	2

		Applications Lab	
	Core course-XII	**Solid State Physics**	**4**
	Core Course-XII Practical/Tutorial	**Solid State Physics Lab**	**2**
	Discipline Specific Elective -1	**DSE-1**	**4/5**
	Discipline Specific Elective -1 Practical/Tutorial	**DSE-1 Lab**	**2/1**
	Discipline Specific Elective -2	**DSE-2**	**4/5**
	Discipline Specific Elective- 2 Practical/Tutorial	**DSE-2 Lab**	**2/1**
VI	**Core course-XIII**	**Electro-magnetic Theory**	**4**
	Core Course-XIII Practical/Tutorial	**Electro-magnetic Theory Lab**	**2**
	Core course-XIV	**Statistical Mechanics**	**4**
	Core Course-XIV Practical/Tutorial	**Statistical Mechanics Lab**	**2**
	Discipline Specific Elective -3	**DSE-3**	**4/5**
	Discipline Specific Elective -3 Practical/Tutorial	**DSE-3 Lab**	**2/1**
	Discipline Specific Elective-4	**DSE-4**	**4/5**
	Discipline Specific Elective -4 Practical/Tutorial	**DSE-4 Lab**	**2/1**
Total Credits			**140**

Core Papers (C): (Credit: 06 each) (1 period/week for tutorials or 4 periods/week for practical)

1. Mathematical Physics-I
2. Mechanics
3. Electricity and Magnetism
4. Waves and Optics
5. Mathematical Physics–II
6. Thermal Physics
7. Digital Systems and Applications
8. Mathematical Physics III
9. Elements of Modern Physics
10. Analog Systems and Applications
11. Quantum Mechanics and Applications
12. Solid State Physics
13. Electromagnetic Theory
14. Statistical Mechanics

Discipline Specific Elective Papers: (Credit: 06 each) (4 papers to be selected) - DSE 1-4

1. Classical Dynamics + Tut
2. Nuclear and Particle Physics + Tut
3. Astronomy and Astrophysics + Tut
4. Physics of the Earth + Tut
5. Physics of Devices and Communication + Lab
6. Nano Materials and Applications + Lab
7. Experimental Techniques + Lab

Other Discipline - GE 1 to GE 4

1. Mathematics + Tut
2. Chemistry + Lab
3. Computer Science + Lab
4. Electronics + Lab
5. Statistics + Tut

(Relevant subject to be decided upon by the BOS in Physics from time to time)

Skill Enhancement Courses (02 to 04 papers) (Credit: 02 each) - SEC1 to SEC4

1. Applied Optics
2. Physics Workshop Skills
3. Basic Instrumentation Skills
4. Renewable Energy and Energy harvesting

5. Electrical circuits and Network Skills
6. Technical Drawing
7. Radiation Safety
8. Weather Forecasting

Generic Elective Papers (GE) for other Departments/Disciplines: (Credit: 06 each)

1. Mechanics + Lab
2. Electricity and Magnetism + Lab
3. Thermal Physics + Lab
4. Waves and Optics + Lab

NOIDA INTERNATIONAL UNIVERSITY

SCHOOL OF SCIENCES

Study & Evaluation Scheme for B.Sc. Physics (Hons)
Effective from the Session: 2019-20

SEMESTER-I

S. No	Course Name	Course Code	Course Type	Period			Evaluation Scheme				Subject Total	Credit
				L	T	P	CA	TA	Total	External Exam		
1	Mathematical Physics I	STUGP/C01	Core	4	0	0	20	20	40	60	100	4
2	Mechanics	STUGP/C02	Core	4	0	0	20	20	40	60	100	4
3	Fundamentals of Computer Applications	STUGP/GE01	GE	4	0	0	20	20	40	60	100	4
4	Environmental Sciences	STUGP/AECC01	AECC	2	0	0	20	20	40	60	100	2
Practical												
1	Mathematical Physics I Lab	SPUGP/C01	Core	0	0	2	-	-	25	25	50	2
2	Mechanics Lab	SPUGP/C02	Core	0	0	2	-	-	25	25	50	2
3	Fundamentals of Computer Applications Lab	SPUGP/GE01	GE	0	0	2	-	-	25	25	50	2
Total											**550**	**20**

SEMESTER-II

S. No	Course Name	Course Code	Course Type	Period			Evaluation Scheme				Subject Total	Credit
				L	T	P	CA	TA	Total	External Exam		
1	Electricity& Magnetism	STUGP/C03	Core	4	0	0	20	20	40	60	100	4
2	Waves and Optics	STUGP/C04	Core	4	0	0	20	20	40	60	100	4
3	Operating System	STUGCS/C03	GE	4	0	0	20	20	40	60	100	4
4	Technical Communication	STUGP/AECC02	AECC	2	0	0	20	20	40	60	100	2
Practical												
1	Electricity& Magnetism Lab	SPUGP/C03	Core	0	0	2	-	-	25	25	50	2
2	Waves and Optics Lab	SPUGP/C04	Core	0	0	2	-	-	25	25	50	2
3	Operating System Lab	SPUGCS/C03	GE	0	0	2	-	-	25	25	50	2
Total											**550**	**20**

SEMESTER-III

S. No	Course Name	Course Code	Course Type	Period			Evaluation Scheme				Subject Total	Credit
										External Exam		
				L	T	P	CA	TA	Total			
1	Mathematical Physics II	STUGP/C05	Core	4	0	0	20	20	40	60	100	4
2	Thermal Physics	STUGP/C06	Core	4	0	0	20	20	40	60	100	4
3	Digital Systems and Applications	STUGP/C07	Core	4	0	0	20	20	40	60	100	4
4	Environmental Chemistry	STUGC/C07	GE	4	0	0	20	20	40	60	100	4
5	✓Applied Optics ✓Physics Workshop Skills ✓Basic Instrumentation Skills ✓Renewable Energy and Energy harvesting (Any One to be Opted)	STUGP/AEEC01 STUGP/AEEC02 STUGP/AEEC03 STUGP/AEEC04	AEEC	2	0	0	20	20	40	60	100	2
Practical												
1	Mathematical Physics II Lab	SPUGP/C05	Core	0	0	2	-	-	25	25	50	2
2	Thermal Physics Lab	SPUGP/C06	Core	0	0	2	-	--	25	25	50	2
3	Digital Systems and Applications Lab	SPUGP/C07	Core	0	0	2	-	-	25	25	50	2
4	Environmental Chemistry Lab	SPUGC/C07	GE	0	0	2	--	-	25	25	50	2
Total											**700**	**26**

SEMESTER-IV

S. No	Course Name	Course Code	Course Type	Period			Evaluation Scheme				Subject Total	Credit
										External Exam		
				L	T	P	CA	TA	Total			
1	Mathematical Physics III	STUGP/C08	Core	4	0	0	20	20	40	60	100	4
2	Elements of Modern Physics	STUGP/C09	Core	4	0	0	20	20	40	60	100	4
3	Analog Systems and Applications	STUGP/C10	Core	4	0	0	20	20	40	60	100	4
4	Green Chemistry	STUGC/C10	GE	4	0	0	20	20	40	60	100	4
5	✓Electrical circuits and Network Skills ✓Technical Drawing ✓Radiation Safety ✓Weather Forecasting (Any One to be Opted)	STUGP/AEEC05 STUGP/AEEC06 STUGP/AEEC07 STUGP/AEEC08	AEEC	2	0	0	20	20	40	60	100	2
Practical												
1	Mathematical Physics III Lab	SPUGP/C08	Core	0	0	2	-	-	25	25	50	2
2	Elements of Modern Physics Lab	SPUGP/C09	Core	0	0	2	-	-	25	25	50	2
3	Analog Systems and Applications Lab	SPUGP/C10	Core	0	0	2	-	-	25	25	50	2
4	Green Chemistry Lab	SPUGC/C10	GE	0	0	2	-	-	25	25	50	2
Total											**700**	**26**

SEMESTER-V

S. No	Course Name	Course Code	Course Type	Period			Evaluation Scheme				Subject Total	Credit
										External Exam		
				L	T	P	CA	TA	Total			
1	Quantum Mechanics and Applications	STUGP/C11	Core	4	0	0	20	20	40	60	100	4
2	Solid State Physics	STUGP/C12	Core	4	0	0	20	20	40	60	100	4
3	✓ Classical Dynamics ✓ Nuclear and Particle Physics ✓ Astronomy and Astrophysics ✓ Physics of the Earth (Any two to be Opted)	STUGP/DSE01 STUGP/DSE02 STUGP/DSE03 STUGP/DSE04	DSE	5	1	0	20	20	40	60	100*2	6*2
Practical												
1	Quantum Mechanics and Applications Lab	SPUGP/C11	Core	0	0	2	-	-	25	25	50	2
2	Solid State Physics Lab	SPUGP/C12	Core	0	0	2	-	-	25	25	50	2
Total											**600**	**24**

SEMESTER-VI

S. No	Course Name	Course Code	Course Type	Period			Evaluation Scheme				Subject Total	Credit
										External Exam		
				L	T	P	CA	TA	Total			
1	Electromagnetic Theory	STUGP/C13	Core	4	0	0	20	20	40	60	100	4
2	Statistical Mechanics	STUGP/C14	Core	4	0	0	20	20	40	60	100	4
3	✓ Physics of Devices and Communication ✓ Nano Materials and Applications ✓ Experimental Techniques (Any two to be Opted)	STUGP/DSE05 STUGP/DSE06 STUGP/DSE07	DSE	4	0	0	20	20	40	60	100*2	4*2
						Practical						
1	Electromagnetic Theory Lab	SPUGP/C13	Core	0	0	2	-	-	25	25	50	2
2	Statistical Mechanics Lab	SPUGP/C14	Core	0	0	2	-	-	25	25	50	2
3	✓ Physics of Devices and Communication Lab ✓ Nano Materials and Applications Lab ✓ Experimental Techniques Lab (Any two to be Opted)	SPUGP/DSE05 SPUGP/DSE06 SPUGP/DSE07	DSE	0	0	2	-	-	25	25	50*2	2*2
Total											**600**	**24**

Semester I

Course Code: S T U G P / C 0 1

Course Title: MATHEMATICAL PHYSICS – I

Nature of the Course: CORE

Total Credits assigned: 06

Distribution of credit: Theory – 04, Practicals-02

Course Objectives: At the completion of this course, a student will be able to

1. Write a problem in Physics in the language of Mathematics.
2. Identify a range of diverse mathematical techniques to formulate and solve a problem in basic Physics.
3. Analyze some of the basic mathematical concepts and methods.
4. Apply the knowledge and understanding of these mathematical methods to solve problems in a number of elementary branches of Physics like mechanics, electromagnetic theory, statistical Physics, thermal Physics etc.
5. Learn computer programming and numerical analysis and know its role in solving problems in Physics.
6. Construct a problem in Physics computationally.

MATHEMATICAL PHYSICS-I (THEORY)

60 Lectures, 60 Marks

Calculus:

Recapitulation: Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only).

(2 Lectures, 2 Marks)

First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems. Particular Integral.

(13 Lectures, 13 Marks)

Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers.

(6 Lectures, 6 Marks)

Vector Calculus:

Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields.

(5 Lectures, 5 Marks)

Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators.

Vector identities
(8 Lectures, 8 Marks)

Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs).
(14 Lectures, 14 Marks)

Orthogonal Curvilinear Coordinates:
Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems
(6 Lectures, 6 Marks)

Introduction to probability:
Independent random variables: Probability distribution functions; binomial, Gaussian, and Poisson, with examples. Mean and variance.
Dependent events: Conditional Probability. Bayes' Theorem and the idea of hypothesis testing.
(4 Lectures, 4 Marks)

Dirac Delta function and its properties:
Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function.
(2 Lectures, 2 Marks)

Recommended readings:

- Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier.
- An introduction to ordinary differential equations, E.A. Coddington, 2009, PHI learning
- Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
- Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jones and Bartlett Learning
- Mathematical Physics, Goswami, 1st edition, Cengage Learning
- Engineering Mathematics, S. Pal and S.C. Bhunia, 2015, Oxford University Press
- Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
- Essential Mathematical Methods, K.F. Riley & M.P. Hobson, 2011, Cambridge Univ. Press

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

MATHEMATICAL PHYSICS-I (LAB)

60 Lectures

The course will consist of lectures (both theory and practical) in the Lab. Evaluation is to be done not on the programming but on the basis of formulating the problem. Students can use any one operating system: Linux or Microsoft Windows .

Topics	**Description with Applications**
Introduction and Overview	Computer architecture and organization, memory and Input/output devices
Basics of scientific computing	Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow &overflow emphasize the importance of making equations in terms of dimensionless variables, Iterative methods
Errors and error Analysis	Truncation and round off errors, Absolute and relative errors, Floating point computations
Review of C & C++ Programming Fundamentals	Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (*If-statement. If-else Statement. Nested if Structure. Else-if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops*), Arrays (*1D & 2D*) and strings, user defined functions, Structures and Unions, Idea of classes and objects
Programs	Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending descending order, Binary search
Random number generation	Area of circle, area of square, volume of sphere, value of Pi (π)
Solution of algebraic and transcendental equation by Bisection, Newton Raphson and Secant methods	Solution of linear and quadratic equation,

Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation	Evaluation of trigonometric functions e.g., *sin θ, cos θ, tan θ, etc*
Numerical differentiation (Forward and backward interpolation formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method	Given Position with equidistant time data to calculate velocity and acceleration and vice versa. Find the area of B-H Hysteresis loop

Recommended readings:

- Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
- Schaum's Outline of Programming with C++. J. Hubbard, 2000, McGraw-Hill Pub.
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal, 3rd Edn., 2007, Cambridge University Press.
- A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning.
- Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn., 2007, Wiley India Edition.
- Numerical Methods for Scientists & Engineers, R.W. Hamming, 1973, Courier Dover Pub.
- An Introduction to computational Physics, T. Pang, 2nd Edn., 2006, Cambridge Univ. Press
- Computational Physics, Darren Walker, 1st Edn.,2015, Scientific International Pvt. Ltd

Mode of Assessment/ Assessment Tools (%)

Internal: **50**

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.: 25

Written Test for theory and/or Viva Voce for Laboratory: 25

Final (End Semester): **50**

Written Test for theory and/or Laboratory experiments: 50

Expected Learner Outcomes: This course will

1. Develop the requisite mathematical skills of a student to understand the fundamental topics in Physics.
2. Develop the ability of a student to critically analyze a topic.
3. Prepare a student for more advanced topics in Physics by providing a solid grip over the fundamental concepts in Physics.
4. Demonstrate the use and importance of computational methods in Physics and enable a student to construct a Physics problem computationally.

Course code: **STUGP/C02**
Course title: MECHANICS
Nature of the course: Core
Total Credit assigned: 06
Distribution of credit: Theory – 04, Practicals-02

Objective of the course: At the completion of this course, a student will be able to

1. Understand the basic concepts and ideas in mechanics- e.g., motion, force and torque, mass and moment of inertia, linear and angular momentum, kinetic energy and potential energy etc. by parallel studies of linear dynamics and rotational dynamics.
2. Understand the basic conservation laws by studying them in various mechanical systems including collisions, oscillations, gravitational systems etc.
3. Analyze simple harmonic oscillator in detail
4. Study planetary motions as a central force problem.
5. Understand the concept of frame of reference, importance of relative transformations and invariance of laws of Physics.
6. Realize the consequences of non-inertial frame in our real physical world.
7. Know about the peculiar phenomena of special relativity which are not seen in Newtonian relativity and to understand the concept of space-time.

MECHANICS (THEORY)
60 Lectures, 60 Marks

Fundamentals of Dynamics:
Reference frames. Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Momentum of variable-mass system: motion of rocket. Motion of a projectile in Uniform gravitational field Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse.
(6 Lectures, 6 Marks)

Work and Energy:

Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy.

(4 Lectures, 4 Marks)

Collisions:

Elastic and inelastic collisions between particles. Centre of Mass and laboratory frame

(3 Lectures, 3 Marks)

Rotational Dynamics:

Angular momentum of particles and system of particles, Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation.

(12 Lectures, 12 Marks)

Elasticity:

Relation between Elastic constants. Twisting torque on a Cylinder or Wire.

(2 Lectures, 2 Marks)

Fluid Motion:

Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube.

(3 Lectures, 3 Marks)

Gravitation and Central Force Motion:

Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere.

Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).

(9 Lectures, 9 Marks)

Oscillations:

SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor.

(7 Lectures, 7 Marks)

Non-Inertial Systems:

Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems.

(4 Lectures, 4 Marks)

Special Theory of Relativity:

Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of Energy and Momentum.

(10 Lectures, 10 Marks)

Recommended readings:

- An introduction to Mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
- Mechanics, Berkeley Physics, vol.1, C. Kittel, W. Knight, et.al. 2007, Tata McGraw-Hill.
- Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
- Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.
- Feynman Lectures, Vol. I, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education
- Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Additional Recommended readings:

- Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
- University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley
- Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serway, 2010, Cengage Learning.
- Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

MECHANICS (LAB)
60 Lectures

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To determine the height of a building using a Sextant.
4. To study the Motion of Spring and calculate (a) Spring constant, (b) **g** and (c) Modulus of rigidity.
5. To determine the Moment of Inertia of a Flywheel.
6. To determine **g** and velocity for a freely falling body using Digital Timing Technique
7. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
8. To determine the Young's Modulus of a Wire by Optical Lever Method.
9. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
10. To determine the elastic Constants of a wire by Searle's method.
11. To determine the value of **g** using Bar Pendulum.
12. To determine the value of **g** using Kater's Pendulum.

Recommended readings:

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal
- Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
- Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected learner outcome: This course will

1. Introduce the students to the basic concepts of mechanics.
2. Enable the students to understand conservation laws as they are the fundamental laws of nature and will help them in realizing a crucial phenomenon of nature- symmetry.
3. Enable the students to understand simple harmonic oscillator as it is a unique mechanical problem and will help them to understand the advanced treatment in quantum mechanics and

modern Physics.

4. Develop knowledge of special relativity to understand relativistic formulation of modern theories.

5. Develop knowledge of mechanics which will help students in their everyday life.

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Semester II

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Course code: STUGP/C03
Course title: ELECTRICITY AND MAGNETISM
Nature of the course: Core
Total Credit assigned: 06
Distribution of credit: Theory -04, Practical-02

Course Objective: At the completion of this course, a student will be able to:

1. Gain basic knowledge of electricity and magnetism.
2. Understand the electrical and magnetic properties of matter in brief.
3. Understand the effect of electric field on magnetic field and the effect of magnetic field on current.
4. Understand the basic principle of the electrical circuit (AC) circuit and electrical networking.
5. Acquire the basic theoretical as well as experimental skill on electrical networking.

PHYSICS-C III: ELECTRICITY AND MAGNETISM (THEORY)
60 Lectures, 60 Marks

Electric Field and Electric Potential
Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry.
(6 Lectures, 6 Marks)

Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole.
(6 Lectures, 6 Marks)

Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to (1) Plane Infinite Sheet and (2) Sphere.
(10 Lectures, 10 Marks)

Dielectric Properties of Matter:
Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector **D**. Relations between **E**, **P** and **D**. Gauss' Law in dielectrics.
(8 Lectures, 8 Marks)

Magnetic Field:

Magnetic force between current elements and definition of Magnetic Field **B**. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of **B**: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic, Field.

(9 Lectures, 9 Marks)

Magnetic Properties of Matter:

Magnetization vector (**M). ** Magnetic Intensity**(H).** Magnetic Susceptibility and permeability. Relation between **B, H, M**. Ferromagnetism. B-H curve and hysteresis.

(4 Lectures, 4 Marks)

Electromagnetic Induction:

Faraday's Law. Lenz's Law. Self-Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current.

(6 Lectures, 6 Marks)

Electrical Circuits:

AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit.

(4 Lectures, 4 Marks)

Network theorems:

Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem. Applications to dc circuits.

(4 Lectures, 4 Marks)

Ballistic Galvanometer:

Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping. CDR.

(3 Lectures, 3 Marks)

Recommended readings:

- Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw
- Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education
- Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
- Feynman Lectures Vol.2, R.P. Feynman, R.B. Leighton, M. Sands, 2008, Pearson Education

- Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
- Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press

Mode of Assessment/ Assessment Tools (%)

Internal: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc: 20

Written Test for theory and/or Viva Voce for Laboratory: 20

Final (End Semester): 60

Written Test for theory and/or Laboratory experiments: 60

ELECTRICITY AND MAGNETISM LAB
60 Lectures

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series RC Circuit.
3. To determine an unknown Low Resistance using Potentiometer.
4. To determine an unknown Low Resistance using Carey Foster's Bridge.
5. To compare capacitances using De'Sauty's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
7. To verify the Thevenin and Norton theorems.
8. To verify the Superposition, and Maximum power transfer theorems.
9. To determine self-inductance of a coil by Anderson's bridge.
10. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
11. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
12. Measurement of charge and current sensitivity and CDR of Ballistic Galvanometer
13. Determine a high resistance by leakage method using Ballistic Galvanometer.
14. To determine self-inductance of a coil by Rayleigh's method.
15. To determine the mutual inductance of two coils by Absolute method.

Recommended readings:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- Engineering Practical Physics, S. Panigrahi and B. Mallick, 2015, Cengage Learning.
- A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub.

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected learner outcome: This course will:

1. Develop the basic theoretical knowledge as well as experimental skills of the students on electrical networking.
2. Train the students to handle and repair instruments based on electric and magnetic field effects.

Course code: STUGP/C04
Course title: WAVES AND OPTICS
Nature of the course: Core
Total Credit assigned: 06
Distribution of credit: Theory -04, Practical-02

Course Objective: At the completion of this course, a student will be able to

1. Learn the basics of wave motion.
2. Know about the behavior of light due to its wave nature.
3. Identify and understand different phenomena due to the interaction of light with light and matter.
4. Analyze some of the fundamental laws and principles of light which is used in many important optical instruments.

WAVES AND OPTICS (THEORY)
60 Lectures, 60 Marks

Wave Optics: Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence.
(5 Lectures, 10 Marks)

Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings:
Measurement of wavelength and refractive index.
(15 Lectures, 15 Marks)

Interferometer: Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer.
(10 Lectures, 10 Marks)

Diffraction:
Fraunhofer diffraction: Single slit. Rectangular and Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating.
(15 Lectures, 10 Marks)

Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Cornu`s spiral and its applications. Straight edge, a slit and a wire.
(15, Lectures, 15 Marks)

Recommended readings:

- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill.
- Principles of Optics, Max Born and Emil Wolf, 7^{th} Edn., 1999, Pergamon Press.
- Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
- The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
- The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
- Fundamental of Optics, A. Kumar, H.R. Gulati and D.R. Khanna, 2011, R. Chand Publications.

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:		20
Written Test for theory and/or Viva Voce for Laboratory:		20
Final (End Semester):	**60**	
Written Test for theory and/or Laboratory experiments:		60

WAVES AND OPTICS (LAB)
60 Lectures

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify λ^2 –T law.
2. To investigate the motion of coupled oscillators.
3. To study Lissajous Figures.
4. Familiarization with: Schuster`s focusing; determination of angle of prism.
5. To determine refractive index of the Material of a prism using sodium source.
6. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
7. To determine the wavelength of sodium source using Michelson's interferometer.
8. To determine wavelength of sodium light using Fresnel Biprism.
9. To determine wavelength of sodium light using Newton's Rings.
10. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
11. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
12. To determine dispersive power and resolving power of a plane diffraction grating.

Recommended readings:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub.

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected learner outcome: This course will

1. Enable the students to analyze different phenomena due to the interaction of light with light and matter.
2. Train the students to use different optical instruments.
3. Help the students to understand various natural phenomena using different apparatus in the laboratory.

Semester III

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Course Code: S T U G P / C 0 5
Course Title: MATHEMATICAL PHYSICS – II
Nature of the Course: Core
Total Credits assigned: 06
Distribution of credit: Theory – 04, Practicals-02

Course Objectives: At the completion of this course, a student will be able to

1. Write a problem in Physics (slightly more advanced than those in Mathematical Physics I) in the language of Mathematics.
2. Identify a range of diverse mathematical techniques to formulate and solve a problem in basic Physics.
3. Analyze some of the useful mathematical methods.
4. Apply the knowledge and understanding of these mathematical methods to solve problems in a number of fundamental topics in Physics.
5. Construct a problem in Physics computationally.

MATHEMATICAL PHYSICS-II (THEORY)
60 Lectures, 60 Marks

Fourier Series:
Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity.
(12 Lectures, 12 Marks)

Frobenius Method and Special Functions:
Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions (Jo(x) and J1(x)) and Orthogonality.
(24 Lectures, 24 Marks)

Some Special Integrals:
Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma

Functions. Error Function (Probability Integral).
(4 Lectures, 4 Marks)

Theory of Errors:
Systematic and Random Errors. Propagation of Errors. Normal Law of Errors. Standard and Probable Error. Least-squares fit. Error on the slope and intercept of a fitted line.
(6 Lectures, 6 Marks)

Partial Differential Equations:
Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes. Diffusion Equation.
(14 Lectures, 14 Marks)

Recommended readings:

- Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier.
- Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
- Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
- Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
- Partial Differential Equations for Scientists & Engineers, S.J. Farlow, 1993, Dover Pub.
- Engineering Mathematics, S. Pal and S.C. Bhunia, 2015, Oxford University Press
- Mathematical methods for Scientists & Engineers, D.A. McQuarrie, 2003, Viva Books

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:		20
Written Test for theory and/or Viva Voce for Laboratory:		20
Final (End Semester):	**60**	
Written Test for theory and/or Laboratory experiments:		60

MATHEMATICAL PHYSICS-II (LAB)
60 Lectures

This course will consist of lectures (both theory and practical) in the Lab. Evaluation is to be done not on the programming but on the basis of formulating the problems

Topics	Description with application
Introduction to Numerical computation software SCILAB	Introduction to Scilab, Advantages and disadvantages, Scilab environment, Command window, Figure window, Edit window, Variables and arrays, Initialising variables in Scilab, Multidimensional arrays, Sub array, Special values, Displaying output data, data file, Scalar and array operations, Hierarchy of operations, Built in Scilab functions, Introduction to plotting, 2D and 3D plotting (2), Branching Statements and program design, Relational & logical operators, the while loop, for loop, details of loop operations, break & continue statements, nested loops, logical arrays and vectorization (2) User defined functions, Introduction to Scilab functions, Variable passing in Scilab, optional arguments, preserving data between calls to a function, Complex and Character data, string function, Multidimensional arrays (2) an introduction to Scilab file processing, file opening and closing, Binary I/O functions, comparing binary and formatted functions, Numerical methods and developing the skills of writing a program (2).
Curve fitting, Least square fit, Goodness of fit, standard deviation	Ohms law to calculate R, Hooke's law to calculate spring constant
Solutions of linear systems of equations by Gauss elimination method and Gauss Seidal method, Diagonalization of matrices, Inverse of matrix, Eigen vectors, eigen value problem	Solution of mesh equation of electric circuits (3 meshes) Solution of coupled spring mass systems (3 masses)

Recommended readings:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3^{rd} ed., 2006, Cambridge University Press
- Complex Variables, A.S. Fokas & M.J. Ablowitz, 8^{th} Ed., 2011, Cambridge Univ. Press
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett
- Computational Physics, D. Walker, 1^{st} Edn., 2015, Scientific International Pvt. Ltd.
- A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3^{rd} Edn., Cambridge University Press
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A.V. Wouwer, P. Saucez, C.V. Fernández. 2014 Springer
- Scilab by example: M. Affouf 2012, ISBN: 978-1479203444
- Scilab (A free software to Matlab): H. Ramchandran, A.S. Nair. 2011 S. Chand & Company
- Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing
- www.**scilab**.in/textbook_companion/generate_book/291

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected learner Outcomes: This course will:

1. Develop the requisite mathematical skills to understand some of the fundamental topics (slightly more advanced than those in Mathematical Physics I) in Physics.
2. Develop the ability of a student to critically analyze a topic.
3. Prepare a student for more advanced topics in Physics by providing a solid grip over the fundamental concepts in Physics.
4. Enable a student to understand the use and importance of computational / numerical methods in Physics and enable a student to construct a Physics problem computationally.

Course Code: STUGP/C06

Course Title: THERMAL PHYSICS
Nature of the Course: Core
Total Credits assigned: 06
Distribution of credit: Theory – 04, Practicals-02

Course Objectives: At the completion of this course, a student will be able to

1. Develop knowledge on the classical laws of thermodynamics and their application
2. Use the knowledge of thermodynamics in various applications in allied fields like Materials science, Condensed matter Physics, Atmospheric Physics, Solar Physics, etc.
3. Probe questions in varied fields of Physics, chemistry and biology based on principles of Thermal Physics.
4. Use the concept of thermodynamics in real world experiences
5. Develop critical and analytical thinking of the student on thermodynamics and allied disciplines

THERMAL PHYSICS (THEORY)
60 Lectures, 60 Marks

Introduction to Thermodynamics

Zeroth and First Law of Thermodynamics: Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient.
(8 Lectures, 8 Marks)

Second Law of Thermodynamics:
Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, 2^{nd} Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale.
(10Lectures, 10 Marks)

Entropy:
Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature–Entropy

diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero.
(7 Lectures, 7 Marks)

Thermodynamic Potentials:
Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Surface Films and Variation of Surface Tension with Temperature. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations
(7 Lectures, 7 Marks)

Maxwell's Thermodynamic Relations:
Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of C_p-C_v, (3) TdS Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process.
(7 Lectures, 7 Marks)

Kinetic Theory of Gases

Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases.
(7Lectures, 7 Marks)

Molecular Collisions:
Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance
(4 Lectures, 4 Marks)

Real Gases:
Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO_2 Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. P-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule- Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion. Joule- Thomson Cooling.
(10 Lectures, 10 Marks)

Recommended readings:

- Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1958, Indian Press
- Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
- Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
- Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University Press

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:		20
Written Test for theory and/or Viva Voce for Laboratory:		20
Final (End Semester):	**60**	
Written Test for theory and/or Laboratory experiments:		60

THERMAL PHYSICS (LAB)
60 Lectures

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
7. To calibrate a thermocouple to measure temperature in a specified Range using (1) Null Method, (2) Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature.

Recommended readings:

- Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced Level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal,1985, Vani Pub.

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected Learner Outcomes: This course will enable the students to

1. Apply the laws of thermodynamics in real world problems.
2. Conduct scientific problems and experiments on thermodynamics and allied disciplines.
3. Demonstrate a working knowledge of the physical principles in Thermal Physics.

Course Code: S T U G P / C 0 7
Course Title: DIGITAL SYSTEMS AND APPLICATIONS
Nature of the Course: Core
Total Credits assigned: 06
Distribution of credit: Theory – 04, Practicals-02

Course objectives: At the completion of this course, a student will be able to:

1. Know about the basic laboratory equipment electronics**.**
2. Understand basic digital electronics concepts and devices**.**
3. Analyze digital circuits.

DIGITAL SYSTEMS AND APPLICATIONS (THEORY)
60 Lectures, 60 Marks

Introduction to CRO:
Block Diagram of CRO. Electron Gun, Deflection System and Time Base. Deflection Sensitivity. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference.
(3 Lectures, 3 Marks)

Integrated Circuits
(Qualitative treatment only): Active & Passive components. Discrete components. Wafer. Chip. Advantages and drawbacks of ICs. Scale of integration: SSI, MSI, LSI and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and Digital ICs.
(3 Lectures, 3 Marks)

Digital Circuits:
Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application as Parity Checkers.
(6 Lectures, 6 Marks)

Boolean algebra:
De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.
(6 Lectures, 6 Marks)

Data processing circuits:
Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders.
(4 Lectures, 4 Marks)

Arithmetic Circuits:
Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor.
(5 Lectures, 5 Marks)

Sequential Circuits:
SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop.
(6 Lectures, 6 Marks)

Timers:
IC 555: block diagram and applications: A stable multivibrator and Monostable multivibrator.
(3 Lectures, 3 Marks)

Shift registers:
Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).
(2 Lectures, 2 Marks)

Counters (4 bits):
Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.
(4 Lectures, 4 Marks)

Computer Organization:
Input/Output Devices. Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map.
(6 Lectures, 6 Marks)

Intel 8085 Microprocessor Architecture:
Main features of 8085. Block diagram. Components. Pin-out diagram. Buses. Registers. ALU. Memory. Stack memory. Timing & Control circuitry. Timing states. Instruction cycle, Timing diagram of MOV and MVI.
(8 Lectures, 8 Marks)

Introduction to Assembly Language: 1 byte, 2 byte & 3-byte instruction
(4 Lectures, 4 Marks)

Recommended readings:

- Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Ed., 2011, Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Digital Electronics G K Kharate ,2010, Oxford University Press

- Digital Systems: Principles & Applications, R.J. Tocci, N.S. Widmer, 2001, PHI Learning
- Logic circuit design, Shimon P. Vingron, 2012, Springer.
- Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
- Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill
- Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

LAB
60 Lectures

1. To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO.
2. To test a Diode and Transistor using a Multimeter.
3. To design a switch (NOT gate) using a transistor.
4. To verify and design AND, OR, NOT and XOR gates using NAND gates.
5. To design a combinational logic system for a specified Truth Table.
6. To convert a Boolean expression into logic circuit and design it using logic gate ICs.
7. To minimize a given logic circuit.
8. Half Adder, Full Adder and 4-bit binary Adder.
9. Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.
10. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
11. To build JK Master-slave flip-flop using Flip-Flop ICs
12. To build a 4-bit Counter using D-type/JK Flip-Flop ICs and study timing diagram.
13. To make a 4-bit Shift Register (serial and parallel) using D-type/JK Flip-Flop, IC
14. To design an astable multivibrator of given specifications using 555 Timer.
15. To design a monostable multivibrator of given specifications using 555 Timer.
16. Write the following programs using 8085 Microprocessor
    a) Addition and subtraction of numbers using direct addressing mode
    b) Addition and subtraction of numbers using indirect addressing mode
    c) Multiplication by repeated addition.
    d) Division by repeated subtraction.
    e) Handling of 16-bit Numbers.
    f) Use of CALL and RETURN Instruction.
    g) Block data handling.
    h) Other programs (e.g., Parity Check, using interrupts, etc.).

Recommended readings:

- Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill.
- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Microprocessor Architecture Programming and applications with 8085, R.S. Goankar, 2002, Prentice Hall.
- Microprocessor 8085: Architecture, Programming and interfacing, A. Wadhwa, 2010, PHI Learning.

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Semester IV

- -

Course Code: S T U G P / C 0 8
Course Title: MATHEMATICAL PHYSICS-III
Nature of the Course: Core
Total Credits assigned: 06
Distribution of credits: Theory – 04, Practicals-02

Course Objectives: At the completion of this course, a student will be able to

1. Write a problem in Physics (slightly more advanced than those in Mathematical Physics I and II) in the language of mathematics.
2. Identify a range of diverse mathematical techniques/ideas to formulate, simplify and solve some problems in Physics.
3. Analyze some of the useful mathematical ideas and techniques.
4. Apply the knowledge and understanding of these mathematical methods to solve problems in a number of fundamental topics in Physics.
5. Construct a problem in Physics computationally and use simulations to design an experiment.

MATHEMATICAL PHYSICS-III (THEORY)
60 Lectures, 60 Marks

Complex Analysis:
Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy’s Integral formula. Simply and multiply connected region. Laurent and Taylor’s expansion. Residues and Residue Theorem. Application in solving Definite Integrals.
(30 Lectures, 30 Marks)

Integrals Transforms:
Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.). Three dimensional Fourier transforms with examples. Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations.
(15 Lectures, 15 Marks)

Laplace Transforms:
Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of 1st and 2nd order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution

Theorem. Inverse LT. Application of Laplace Transforms to 2nd order Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits, Coupled differential equations of 1st order. Solution of heat flow along infinite bar using Laplace transform.

(15 Lectures, 15 Marks)

Recommended readings:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications
- Complex Variables, A.S. Fokas & M.J. Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
- Complex Variables, A.K. Kapoor, 2014, Cambridge Univ. Press
- Complex Variables and Applications, J.W. Brown & R.V. Churchill, 7th Ed. 2003, Tata McGraw-Hill
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:		20
Written Test for theory and/or Viva Voce for Laboratory:		20
Final (End Semester):	**60**	
Written Test for theory and/or Laboratory experiments:		60

MATHEMATICAL PHYSICS-III (LAB)

60 Lectures

Scilab/C++ based simulations experiments based on Mathematical Physics problems like:

1. Calculation of error for each data point of observations recorded in experiments done in previous semesters (choose any two).
2. Calculation of least square fitting manually without giving weightage to error. Confirmation of least square fitting of data through computer program.
3. Evaluation of trigonometric functions e.g., $\sin\theta$, Given Bessel's function at N points find its value at an intermediate point. Complex analysis: Integrate $1/(x^2+2)$ numerically and check with computer integration.
4. Compute the n^{th} roots of unity for $n = 2, 3,$ and 4.
5. Find the two square roots of $-5+12j$.
6. Solve Kirchoff's Current law for any node of an arbitrary circuit using Laplace's transform.
7. Solve Kirchoff's Voltage law for any loop of an arbitrary circuit using Laplace's transform.
8. Perform circuit analysis of a general LCR circuit using Laplace's transform.

Recommended readings:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J. Bence, 3rd ed., 2006, Cambridge University Press
- Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications
- Complex Variables, A.S. Fokas & M.J. Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
- Complex Variables, A.K. Kapoor, 2014, Cambridge Univ. Press
- Complex Variables and Applications, J.W. Brown & R.V. Churchill, 7th Ed. 2003, Tata McGraw-Hill
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan, 1940, Jones & Bartlett

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	25
Written Test for theory and/or Viva Voce for Laboratory:	25
Final (End Semester):	**50**
Written Test for theory and/or Laboratory experiments:	50

Expected learner Outcomes: This course will

1. Develop mathematical skills of a student to understand some of the fundamental topics (slightly more advanced than those in Mathematical Physics I and II).
2. Develop the ability of a student to critically analyze a topic.

3. Prepare a student for more advanced topics in Physics by providing a solid grip over the fundamental concepts in Physics.
4. Enable a student to understand the use and importance of computational/ numerical methods in Physics and to construct a problem computationally.
5. Help a student to pursue advanced studies in Physics.

Course Code: S T U G P / C 0 9
Course Title: ELEMENTS OF MODERN PHYSICS
Nature of the Course: Core
Total Credits Assigned: 06
Distribution of credits: Theory – 04, Practicals-02

Course Objectives: At the completion of this course, a student will be able to

1. Understand the theoretical basis for the understanding of quantum Physics as the basis for dealing with microscopic phenomena.
2. Apply concepts of 20^{th} Century Modern Physics to deduce the structure of atoms.
3. Explain the wave-particle duality of the photon.
4. Analyze the structure of matter at its most fundamental.
5. Develop insight into the key principles and applications of Nuclear Physics

ELEMENTS OF MODERN PHYSICS (THEORY)
60 Lectures, 60 Marks

Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude and wave functions.
(14 Lectures, 14 Marks)
Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle- application to virtual particles and range of an interaction.
(5 Lectures, 5 Marks)

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension.
(10 Lectures, 10 Marks)

One dimensional infinitely rigid box- energy eigen values and eigen functions, normalization; Quantum dot as example; Quantum mechanical scattering and tunneling in one dimension-across a step potential & rectangular potential barrier.
(10 Lectures, 10 Marks)

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers.

(6 Lectures, 6 Marks)

Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay; Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation: electron-positron pair creation by gamma photons in the vicinity of a nucleus.

(8 Lectures, 8 Marks)

Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions driving stellar energy (brief qualitative discussions).

(3 Lectures, 3 Marks)

Lasers:

Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser. Basic lasing.

(4 Lectures, 4 Marks)

Recommended Readings:

- Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
- Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
  Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
- Physics for scientists and Engineers with Modern Physics, Jewett and Serway, 2010, Cengage Learning.
- Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill
- Quantum Mechanics: Theory & Applications, A.K. Ghatak & S. Loganathan, 2004, Macmillan

Additional recommended readings:

- Modern Physics, J.R. Taylor, C.D. Zafiratos, M.A. Dubson, 2004, PHI Learning.
- Theory and Problems of Modern Physics, Schaum`s outline, R. Gautreau and W. Savin, 2nd Edn, Tata McGraw-Hill Publishing Co. Ltd.
- Quantum Physics, Berkeley Physics, Vol.4. E.H. Wichman, 1971, Tata McGraw-Hill Co
- Basic ideas and concepts in Nuclear Physics, K. Heyde, 3rd Edn., Institute of Physics Pub.
- Six Ideas that Shaped Physics: Particle Behave like Waves, T.A. Moore, 2003, McGraw Hill

Mode of Assessment/ Assessment Tools (%)

Internal: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc: 20

Written Test for theory and/or Viva Voce for Laboratory: 20

Final (End Semester): 60

Written Test for theory and/or Laboratory experiments: 60

ELEMENTS OF MODERN PHYSICS (LAB)
60 Lectures

1. Measurement of Planck's constant using black body radiation and photo-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
3. To determine work function of material of filament of directly heated vacuum diode.
4. To determine the Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the ionization potential of mercury.
7. To determine the absorption lines in the rotational spectrum of Iodine vapour.
8. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To show the tunneling effect in tunnel diode using I-V characteristics.
11. To determine the wavelength of laser source using diffraction of single slit.
12. To determine the wavelength of laser source using diffraction of double slits.
13. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating.

Mode of Assessment/ Assessment Tools (%)

Internal: 50
Assignment /Presentation/ attendance/ Class room interaction/quiz etc: 25
Written Test for theory and/or Viva Voce for Laboratory: 25
Final (End Semester): 50
Written Test for theory and/or Laboratory experiments: 50

Expected learner outcome: This course will enable the students to**:**

1. Understand and appreciate the theory of modern physics
2. Develop the ability to apply it in solving simple problems in Quantum Mechanics (QM), structure of atoms, Laser, and Nuclear Physics.

Course Code: S T U G P / C 1 0
Course Title: ANALOG SYSTEMS AND APPLICATIONS
Nature of the Course: Core
Total credits assigned: 06
Distribution of credits: Theory – 04, Practicals-02

Course Objectives: At the completion of this course, a student will be able to

1. Know about the basics of semiconductor PN junction, its various types and its application to different electronic circuits.
2. Understand bipolar junction transistor and its applications as amplifier and oscillators.
3. Familiarize with operational amplifiers, its applications and analysis.
4. Develop knowledge about analog to digital and digital to analog conversion techniques

ANALOG SYSTEMS AND APPLICATIONS (THEORY)
60 Lectures, 60 Marks

Semiconductor Diodes:
P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity. PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode. Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width and Current for Step Junction. Current Flow Mechanism in Forward and Reverse Biased Diode.
(10 Lectures, 10 Marks)

Two-terminal Devices and their Applications:
(1) Rectifier Diode: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, C-filter (2) Zener Diode and Voltage Regulation. Principle and structure of (1) LEDs, (2) Photodiode and (3) Solar Cell.
(6 Lectures, 6 Marks)

Bipolar Junction transistors:
n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β Relations between α and β. Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and Saturation Regions.
(6 Lectures, 6 Marks)

Amplifiers:
Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers.
(10 Lectures, 10 Marks)

Coupled amplifiers:

Two stage RC coupled Amplifier and its frequency response.

(4 Lectures, 4 Marks)

Feedback in Amplifiers:

Effect of positive and negative feedback on Input impedence, Output impedence, Gain, Stability, Distortion and noise.

(4 Lectures, 4 Marks)

Sinusoidal Oscillators:

Barkhausen's Criterion for self-sustained oscillations. RC Phase shift oscillator, determination of Frequency. Hartley & Colpitts oscillators.

(4 Lectures, 4 Marks)

Operational Amplifiers (Black Box approach):

Characteristics of an Ideal and Practical Op-Amp. (IC 741) Open-loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and concept of Virtual ground.

(4 Lectures, 4 Marks)

Applications of Op-Amps:

(1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Log amplifier, (7) Zero crossing detector (8) Wein bridge oscillator.

(9 Lectures, 9 Marks)

Conversion:

Resistive network (Weighted and R-2R Ladder). Accuracy and Resolution. A/D Conversion (successive approximation)

(3 Lectures, 3 Marks)

Recommended readings:

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
- Solid State Electronic Devices, B.G. Streetman & S.K. Banerjee, 6th Edn.,2009, PHI Learning
- Electronic Devices & circuits, S. Salivahanan & N.S. Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
- Electronic circuits: Handbook of design & applications, U. Tietze, C. Schenk, 2008, Springer
- Semiconductor Devices: Physics and Technology, S.M. Sze, 2nd Ed., 2002, Wiley India
- Microelectronic Circuits, M.H. Rashid, 2nd Edition, Cengage Learning
- Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

Mode of Assessment/ Assessment Tools (%)

Internal: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc: 20

Written Test for theory and/or Viva Voce for Laboratory: 20

Final (End Semester): 60

Written Test for theory and/or Laboratory experiments: 60

ANALOG SYSTEMS AND APPLICATIONS (LAB)

60 Lectures

1. To study V-I characteristics of PN junction diode, and Light emitting diode.
2. To study the V-I characteristics of a Zener diode and its use as voltage regulator.
3. Study of V-I & power curves of solar cells, and find maximum power point & efficiency.
4. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
5. To study the various biasing configurations of BJT for normal class A operation.
6. To design a CE transistor amplifier of a given gain (mid-gain) using voltage divider bias.
7. To study the frequency response of voltage gain of a RC-coupled transistor amplifier.
8. To design a Wien bridge oscillator for given frequency using an op-amp.
9. To design a phase shift oscillator of given specifications using BJT.
10. To study the Colpitt`s oscillator.
11. To design a digital to analog converter (DAC) of given specifications.
12. To study the analog to digital convertor (ADC) IC.
13. To design an inverting amplifier using Op-amp (741,351) for dc voltage of given gain
14. To design inverting amplifier using Op-amp (741,351) and study its frequency response
15. To design non-inverting amplifier using Op-amp (741,351) & study its frequency response
16. To study the zero-crossing detector and comparator
17. To add two dc voltages using Op-amp in inverting and non-inverting mode
18. To design a precision Differential amplifier of given I/O specification using Op-amp.
19. To investigate the use of an op-amp as an Integrator.
20. To investigate the use of an op-amp as a Differentiator.
21. To design a circuit to simulate the solution of a $1^{st}/2^{nd}$ order differential equation.

Recommended readings:

- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4^{th} edition, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.
  Electronic Devices & circuit Theory, R.L. Boylestad & L.D. Nashelsky, 2009, Pearson

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected Learner Outcomes: This course will enable the students to

1. Learn the foundation knowledge of analog electronic systems.
2. Learn the working and applications of PN junction and bipolar junction transistors (BJT).
3. Learn to analyze circuits containing PN junction and BJT along with the application of BJT as amplifiers and oscillators.
4. Develop basic knowledge of operational amplifier and its applications

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Semester V

Course Code: S T U G P / C 1 1
Course Title: QUANTUM MECHANICS AND APPLICATIONS
Nature of the Course: Core
Total credits assigned: 06
Distribution of credits: Theory – 04, Practicals-02

Course Objectives: At the completion of this course, a student will be able to

1. Know about the development of modern Physics and the theoretical formulation of quantum mechanics.
2. Know the applications of quantum mechanics in solving physical problems.

QUANTUM MECHANICS AND APPLICATIONS (THEORY)
60 Lectures, 60 Marks

Time dependent Schrodinger equation:
Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle.
(6 Lectures, 6 Marks)

Time independent Schrodinger equation-
Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to spread of Gaussian wave-packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle.
(10 Lectures, 10 Marks)

General discussion of bound states in an arbitrary potential-
continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem-square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigen functions using Frobenius method; Hermite polynomials; ground state, zero-point energy & uncertainty principle.
(12 Lectures, 12 Marks)

Quantum theory of hydrogen-like atoms:

time independent Schrodinger equation in spherical polar coordinates; separation of variables for second order partial differential equation; angular momentum operator & quantum numbers; Radial wave functions from Frobenius method; shapes of the probability densities for ground & first excited states; Orbital angular momentum quantum numbers l and m; s, p, d... shells.

(10 Lectures, 10 Marks)

Atoms in Electric & Magnetic Fields:

Electron angular momentum. Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton.

(8 Lectures, 8 Marks)

Atoms in External Magnetic Fields: -

Normal and Anomalous Zeeman Effect. Paschen Back and Stark Effect (Qualitative Discussion only).

(4 Lectures, 4 Marks)

Many electron atoms:

Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total angular momentum. Vector Model. Spin-orbit coupling in atoms-L-S and J-J couplings. Hund's Rule. Term symbols. Spectra of Hydrogen and Alkali atoms (Na etc.)

(10 Lectures, 10 Marks)

Recommended readings:

- A Text book of Quantum Mechanics, P.M. Mathews and K. Venkatesan, 2nd Ed., 2010, McGraw Hill
- Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002, Wiley.
- Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGraw Hill.
- Quantum Mechanics, G. Aruldhas, 2nd Edn. 2002, PHI Learning of India.
- Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
- Quantum Mechanics: Foundations & Applications, Arno Bohm, 3rd Edn., 1993, Springer
- Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press

Additional recommended readings:

- Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
- Introduction to Quantum Mechanics, D.J. Griffith, 2nd Ed. 2005, Pearson Education
- Quantum Mechanics, Walter Greiner, 4th Edn., 2001, Springe

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:		20
Written Test for theory and/or Viva Voce for Laboratory:		20
Final (End Semester):	**60**	
Written Test for theory and/or Laboratory experiments:		60

QUANTUM MECHANICS AND APPLICATIONS (LAB)
60 Lectures

Laboratory based experiments:

1. Study of Electron spin resonance- determine magnetic field as a function of the resonance frequency
2. Study of Zeeman effect: with external magnetic field; Hyperfine splitting
3. To show the tunneling effect in tunnel diode using I-V characteristics.
4. Quantum efficiency of CCDs

Recommended readings:

- Schaum's outline of Programming with C++. J. Hubbard, 2000, McGraw-Hill Publication
- Numerical Recipes in C: The Art of Scientific Computing, W.H. Pressetal., 3rd Edn., 2007, Cambridge University Press.
- An introduction to computational Physics, T. Pang, 2nd Edn.,2006, Cambridge Univ. Press
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific & Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández.2014 Springer.
- Scilab (A Free Software to Matlab): H. Ramchandran, A.S. Nair. 2011 S. Chand & Co.
- A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd Edn., Cambridge University Press
- Scilab Image Processing: L.M. Surhone.2010 Betascript Publishing ISBN:978-6133459274

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected Learner Outcomes: This course will enable students to

1. Learn how to apply quantum mechanics to solve physical systems in different areas of science.
2. Know about the physical behavior of materials.
3. Learn how the scientific behavior of materials can be used for human applications.

Course Code: STUGP/C12
Course Title: SOLID STATE PHYSICS
Nature of the Course: Core
Total credits assigned: 06
Distribution of credits: Theory – 04, Practicals-02

Course Objectives: At the completion of this course, a student will be able to

1. Familiarize with fundamentals of Solid-State Physics.
2. Know about the structural, electronic and lattice vibration dependent behavior of solids.
3. Learn the basic concepts in hands on mode through laboratory experiments associated with the course.

SOLID STATE PHYSICS (THEORY)
60 Lectures, 60 Marks

Crystal Structure:
Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor. **(12 Lectures, 12 Marks)**

Elementary Lattice Dynamics:
Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law
(10 Lectures, 10 Marks)

Magnetic Properties of Matter:
Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia– and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss. **(8 Lectures, 8 Marks)**

Dielectric Properties of Materials:
Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric

Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons, TO modes.

(8 Lectures, 8 Marks)

Ferroelectric Properties of Materials:

Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.

(6 Lectures, 6 Marks)

Elementary band theory:

Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient.

(10 Lectures, 10 Marks)

Superconductivity:

Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation)

(6 Lectures, 6 Marks)

Recommended readings:

- Introduction to Solid State Physics, Charles Kittel, 8th Edition, 2004, Wiley India Pvt. Ltd.
- Elements of Solid-State Physics, J.P. Srivastava, 4th Edition, 2015, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, N.W. Ashcroft and N.D. Mermin, 1976, Cengage Learning
- Solid-state Physics, H. Ibach and H. Luth, 2009, Springer
- Solid State Physics, Rita John, 2014, McGraw Hill
- Elementary Solid-State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:		20
Written Test for theory and/or Viva Voce for Laboratory:		20
Final (End Semester):	**60**	
Written Test for theory and/or Laboratory experiments:		60

SOLID STATE PHYSICS (LAB)
60 Lectures

1. Measurement of susceptibility of paramagnetic solution (Quinck`s Tube Method)
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency
5. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)
6. To determine the refractive index of a dielectric layer using SPR
7. To study the PE Hysteresis loop of a Ferroelectric Crystal.
8. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.
9. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150 ^{o}C) and to determine its band gap.
10. To determine the Hall coefficient of a semiconductor sample.
11. To determine the band gap of semiconductor by P-N junction method.

Recommended readings:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Elements of Solid-State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India.

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	25
Written Test for theory and/or Viva Voce for Laboratory:	25
Final (End Semester):	**50**
Written Test for theory and/or Laboratory experiments:	50

Expected Learner Outcome: The course will

1. Equip a student with basic concepts of solid-state Physics so that the knowledge can be applied for further development of the subject.
2. Enable a student to work in both theoretical and experimental aspects of solid-state Physics.
3. Help the students in thorough learning of the concepts associated to the course through the laboratory experiments.

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Semester VI

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Course Code: S T U G P / C 1 3
Course Title: ELECTROMAGNETIC THEORY
Nature of the Course: Core
Total credits assigned: 06
Distribution of credits: Theory – 04, Practicals-02

Course Objectives: At the completion of this course, a student will be able to

1. Understand the physical and mathematical principles to provide in-depth analysis of the behavior of electricity and magnetism in matter.
2. Apply Maxwell's equations to explain the properties of the electromagnetic wave and its interaction with matter.
3. Analyze the principles and processes related to polarization, interference, and diffraction along with their applications to the development of wave-guide and optical fibers.

ELECTROMAGNETIC THEORY (THEORY)
60 Lectures, 60 Marks

Maxwell Equations:
Review of Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Boundary Conditions at Interface between Different Media. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density.
(12 Lectures, 12 Marks)

EM Wave Propagation in Unbounded Media:
Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth. Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth, application to propagation through ionosphere.
(10 Lectures, 10 Marks)

EM Wave in Bounded Media:
Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law. Reflection & Transmission coefficients. Total internal reflection, evanescent waves. Metallic reflection (normal Incidence)
(10 Lectures, 10 Marks)

Polarization of Electromagnetic Waves:

Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Symmetric Nature of Dielectric Tensor. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Babinet Compensator and its Uses. Analysis of Polarized Light

(12 Lectures, 12 Marks)

Rotatory Polarization: Optical Rotation. Biot's Laws for Rotatory Polarization. Fresnel's Theory of optical rotation. Calculation of angle of rotation. Experimental verification of Fresnel's theory.

Specific rotation. Laurent's half-shade polarimeter.

(5 Lectures, 5 Marks)

Wave Guides:

Planar optical wave guides. Planar dielectric wave guide. Condition of continuity at interface. Phase shift on total reflection. Eigenvalue equations. Phase and group velocity of guided waves, Field energy and power transmission.

(8 Lectures, 8 Marks)

Optical Fibres:

Numerical aperture, Step and Graded Indices (Definitions only), Single and Multimode fibres (Concepts and Definition Only).

(3 Lectures, 3 Marks)

Recommended readings:

- Introduction to Electrodynamics, D.J. Griffiths, 3rd Ed., 1998, Benjamin Cummings.
- Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
- Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning
- Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill
- Electromagnetic field Theory, R.S. Kshetrimayun, 2012, Cengage Learning
- Engineering Electromagnetic, Willian H. Hayt, 8th Edition, 2012, McGraw Hill.
- Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer

Additional recommended readings:

- Electromagnetic Fields & Waves, P. Lorrain & D. Corson, 1970, W.H. Freeman & Co.
- Electromagnetics, J.A. Edminster, Schaum Series, 2006, Tata McGraw Hill.
- Electromagnetic field theory fundamentals, B. Guru and H. Hiziroglu, 2004, Cambridge University Press

Mode of Assessment/ Assessment Tools (%)

Internal: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc: 20

Written Test for theory and/or Viva Voce for Laboratory: 20

Final (End Semester): 60

Written Test for theory and/or Laboratory experiments: 60

ELECTROMAGNETIC THEORY (LAB)

60 Lectures

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of sugar solution using Polarimeter.
3. To analyze elliptically polarized Light by using a Babinet's compensator.
4. To study dependence of radiation on angle for a simple Dipole antenna.
5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonic grating.
6. To study the reflection, refraction of microwaves
7. To study Polarization and double slit interference in microwaves.
8. To determine the refractive index of liquid by total internal reflection using Wollaston's air-film.
9. To determine the refractive Index of (1) glass and (2) a liquid by total internal reflection using a Gaussian eyepiece.
10. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
11. To verify the Stefan`s law of radiation and to determine Stefan's constant.
12. To determine the Boltzmann constant using V-I characteristics of PN junction diode.

Recommended readings:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected learner Outcomes: This course will enable a student to

1. Solve problems relevant to interfaces between media with defined boundary conditions.
2. Use Maxwell's equations to describe the behaviour of electromagnetic waves in vacuum as well as medium.
3. Describe states and methods of polarization and analyze the polarization state of a light source.

Course Code: S T U G P / C 1 4
Course Title: STATISTICAL MECHANICS
Nature of the Course: Core
Total credits assigned: 06
Distribution of credits: Theory – 04, Practicals-02

Course objectives:

The Statistical Mechanics is one of the most important branches of Physics which is required to understand the properties of matter in bulk on the basis of the dynamical behaviors of its microscopic constituents. As such the objectives of this course are to

1. Introduce the basic concepts of Statistical Mechanics so that students will be able to cope-up with higher level of such course in future.
2. Develop the critically thinking ability of students to understand the diverse physical phenomena.
3. Develop the interest and ability among students to solved challenging physical problems by the application of techniques of Statistical Mechanics in future.

STATISTICAL MECHANICS (THEORY)
60 Lectures, 60 Marks

Classical Statistics:

Macrostate & Microstate, Elementary Concept of Ensemble, Phase Space, Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Partition Function, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, Gibbs Paradox, Sackur Tetrode equation, Law of Equipartition of Energy (with proof) – Applications to Specific Heat and its Limitations, Thermodynamic Functions of a Two-Energy Levels System, Negative Temperature. **(18 Lectures, 18 Marks)**

Classical Theory of Radiation:

Properties of Thermal Radiation. Blackbody Radiation. Pure temperature dependence. Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation Pressure. Wien's Displacement law. Wien's Distribution Law. Saha's Ionization Formula. Rayleigh-Jean's Law. Ultraviolet Catastrophe. **(9 Lectures, 9 Marks)**

Quantum Theory of Radiation:

Spectral Distribution of Black Body Radiation. Planck's Quantum Postulates. Planck's Law of Blackbody Radiation: Experimental Verification. Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law, (4) Wien's Displacement law from Planck's law. **(5 Lectures, 5 Marks)**

Bose-Einstein Statistics:

B-E distribution law, Thermodynamic functions of a strongly Degenerate Bose Gas, Bose Einstein condensation, properties of liquid He (qualitative description), Radiation as a photon gas and

Thermodynamic functions of photon gas. Bose derivation of Planck's law.
(13 Lectures, 13 Marks)

Fermi-Dirac Statistics:
Fermi-Dirac Distribution Law, Thermodynamic functions of a Completely and strongly Degenerate Fermi Gas, Fermi Energy, Electron gas in a Metal, Specific Heat of Metals, Relativistic Fermi gas, White Dwarf Stars, Chandrasekhar Mass Limit.
(15 Lectures, 15 Marks)

Recommended readings:

- Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.
- Statistical Physics, Berkeley Physics Course, F. Reif, 2008, Tata McGraw-Hill
- Statistical and Thermal Physics, S. Lokanathan and R.S. Gambhir. 1991, Prentice Hall
- Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
- An Introduction to Statistical Mechanics & Thermodynamics, R.H. Swendsen, 2012, Oxford Univ. Press

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:		20
Written Test for theory and/or Viva Voce for Laboratory:		20
Final (End Semester):	**60**	
Written Test for theory and/or Laboratory experiments:		60

STATISTICAL MECHANICS (LAB)
60 Lectures

Use C/C^{++}/Scilab/other numerical simulations for solving the problems based on Statistical Mechanics like

1. Computational analysis of the behavior of a collection of particles in a box that satisfy Newtonian mechanics and interact via the Lenard-Jones potential, varying the total number of particles N and the initial conditions:

    a) Study of local number density in the equilibrium state (i) average; (ii) fluctuations
    b) Study of transient behavior of the system (approach to equilibrium)
    c) Relationship of large N and the arrow of time
    d) Computation of the velocity distribution of particles for the system and comparison with the Maxwell velocity distribution
    e) Computation and study of mean molecular speed and its dependence on particle mass
    f) Computation of fraction of molecules in an ideal gas having speed near the most probable speed

2. Computation of the partition function $Z(\beta)$ for examples of systems with a finite number of single particle levels (e.g., 2 level, 3 level, etc.) and a finite number of non-interacting particles N under Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics:
    a) Study of how $Z(\beta)$, average energy $< E >$, energy fluctuation ΔE, specific heat at constant volume C_v, depend upon the temperature, total number of particles N and the spectrum of single particle states.
    b) Ratios of occupation numbers of various states for the systems considered above
    c) Computation of physical quantities at large and small temperature T and comparison of various statistics at large and small temperature T.

3. Plot Planck's law for Black Body radiation and compare it with Raleigh-Jeans Law at high temperature and low temperature.

4. Plot Specific Heat of Solids (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature and low temperature and compare them for these two cases.

5. Plot the following functions with energy at different temperatures

    a) Maxwell-Boltzmann distribution
    b) Fermi-Dirac distribution
    c) Bose-Einstein distribution

Recommended readings:

- Elementary Numerical Analysis, K.E. Atkinson, 3rd Edn. 2007, Wiley India Edition
- Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford University Press.
- Introduction to Modern Statistical Mechanics, D. Chandler, Oxford University Press, 1987
- Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
- Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
- Statistical and Thermal Physics with computer applications, Harvey Gould and Jan Tobochnik, Princeton University Press, 2010.
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V. Fernández. 2014 Springer ISBN: 978-3319067896
- Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
- Scilab Image Processing: L.M. Surhone. 2010, Betascript Pub., ISBN: 978- 6133459274

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected Learner Outcome: This course will

1. Equip the students with basic knowledge of the Statistical Mechanics and hence will be able to look critically for analyzing any physical phenomena.
2. Create interest to the subject to pursue further higher study in future.
3. Enable the students to solve any challenging physical problem in statistical mechanics

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DISCIPLINE SPECIFIC ELECTIVES (DSE)

Semester V

Course code: STUGP/DSE01

Course title: CLASSICAL DYNAMICS

Nature of the course: DSE

Total credit assigned: 06

Distribution of credits: Theory – 05, Tutorials-01

Course objective: After completing the course, a student will be able to

1. Understand the underlying facts in the development of classical mechanics and the advantages of its formulation over Newtonian mechanics.
2. Describe mechanics of a system in terms of equation of motion.
3. Understand Lagrangian formulation and Hamiltonian formulation of mechanics and their applications in mechanical problems.
4. Study the theoretical analysis of systems oscillating with small amplitudes.
5. Observe the peculiar phenomena when transformed from Newtonian relativity to special relativity and to understand the concept of space-time.

CLASSICAL DYNAMICS (THEORY)

75 Lectures, 60 Marks

Classical Mechanics of Point Particles:

Review of Newtonian Mechanics; Application to the motion of a charge particle in external electric and magnetic fields- motion in uniform electric field, magnetic field- gyroradius and gyrofrequency, motion in crossed electric and magnetic fields. Generalized coordinates and velocities, Hamilton's principle, Lagrangian and the Euler-Lagrange equations, one-dimensional examples of the Euler-Lagrange equations- one-dimensional Simple Harmonic Oscillations and falling body in uniform gravity; applications to simple systems such as coupled oscillators Canonical momenta & Hamiltonian. Hamilton's equations of motion.

Applications: Hamiltonian for a harmonic oscillator, solution of Hamilton's equation for Simple Harmonic Oscillations; particle in a central force field- conservation of angular momentum and energy.

(22 Lectures, 20 Marks)

Small Amplitude Oscillations:

Minima of potential energy and points of stable equilibrium, expansion of the potential energy around a minimum, small amplitude oscillations about the minimum, normal modes of oscillations example of N identical masses connected in a linear fashion to (N -1) - identical springs.

(10 Lectures, 10 Marks)

Special Theory of Relativity:

Postulates of Special Theory of Relativity. Lorentz Transformations. Minkowski space. The invariant interval, light cone and world lines. Space-time diagrams. Time -dilation, length contraction and twin paradox. Four-vectors: space-like, time-like and light-like. Four-velocity and acceleration. Metric and alternating tensors. Four-momentum and energy-momentum relation. Doppler effect from a four-vector perspective. Concept of four-force. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle.

(33 Lectures, 20 Marks)

Fluid Dynamics:

Density ρ and pressure P in a fluid, an element of fluid and its velocity, continuity equation and mass conservation, stream-lined motion, laminar flow, Poiseuille's equation for flow of a liquid through a pipe, Navier-Stokes equation, qualitative description of turbulence, Reynolds number.

(10 Lectures, 10 Marks)

Recommended readings:

- Classical Mechanics, H. Goldstein, C.P. Poole, J.L. Safko, 3rd Edn. 2002, Pearson Education.
- Mechanics, L. D. Landau and E. M. Lifshitz, 1976, Pergamon.
- Classical Electrodynamics, J.D. Jackson, 3rd Edn., 1998, Wiley.
- The Classical Theory of Fields, L.D Landau, E.M Lifshitz, 4th Edn., 2003, Elsevier.
- Introduction to Electrodynamics, D.J. Griffiths, 2012, Pearson Education.
- Classical Mechanics, P.S. Joag, N.C. Rana, 1st Edn., McGraw Hall.
- Classical Mechanics, R. Douglas Gregory, 2015, Cambridge University Press.
- Classical Mechanics: An introduction, Dieter Strauch, 2009, Springer.
- Solved Problems in classical Mechanics, O.L. Delange and J. Pierrus, 2010, Oxford Press

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

Expected learner outcome: This course will enable the students to

1. Prepare for the study of modern Physics.
2. Develop basic theoretical ingredients necessary to study advanced theoretical courses like quantum mechanics.
3. Learn a number of mathematical techniques applicable to Physics problems in different areas.
4. Develop knowledge of special relativity which is essential to understand the relativistic formulation of modern theories.

Course code: STUGP/DSE02
Course title: NUCLEAR AND PARTICLE PHYSICS
Nature of the course: DSE
Total credit assigned: 06
Distribution of credits: Theory – 05, Tutorial -01

Course Objective: After the end of the course, a student will be able to

1. Understand various concepts in Nuclear Physics.
2. Emphasize on the existing connections with other domains of Physics, in particular Quantum Mechanics, Mathematical Physics and Particle Physics.

NUCLEAR AND PARTICLE PHYSICS (THEORY)
75 Lectures, 60 Marks

General Properties of Nuclei:
Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.
(10 Lectures, 10 Marks)

Nuclear Models:
Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.
(12 Lectures, 10 Marks)

Radioactivity decay:
(a) Alpha decay: basics of α-decay processes, theory of α-emission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays' emission & kinematics, internal conversion.
(**10 Lectures, 10 Marks**)

Nuclear Reactions:
Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction, Coulomb scattering (Rutherford scattering).
(8 Lectures, 5 Marks)
Interaction of Nuclear Radiation with matter:
Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation.
Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production,

neutron interaction with matter.

(8 Lectures, 5 Marks)

Detector for Nuclear Radiations:

Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector.

(8 Lectures, 5 Marks)

Particle Accelerators:

Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

(5 Lectures, 5 Marks)

Particle Physics:

Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

(14 Lectures, 10 Marks)

Recommended readings:

- Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
- Concepts of nuclear Physics by Bernard L. Cohen. (Tata McGraw Hill, 1998).
- Introduction to the Physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
- Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press
- Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
- Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
- Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP-Institute of Physics Publishing, 2004).
- Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
- Physics and Engineering of Radiation Detection, Syed Naeem Ahmed (Academic Press, Elsevier, 2007).
- Theoretical Nuclear Physics, J.M. Blatt & V.F. Weisskopf (Dover Pub.Inc., 1991)

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		20
Written Test for theory and/or Viva Voce for Laboratory:		20
Final (End Semester):	**60**	
Written Test for theory and/or Laboratory experiments:		60

Expected learner outcome: This course will enable the students to

1. Develop knowledge regarding nuclear and elementary particle as well as properties and phenomena related to them.
2. Successfully apply the same knowledge in solving problems in the field of nuclear and particle Physics.

Course code: STUGP/DSE03
Course title: ASTRONOMY AND ASTROPHYSICS
Nature of the course: DSE
Total credit assigned: 06
Distribution of credits: Theory – 05, Tutorials-01

Course Objectives: Astrophysics (and Astronomy) is the most fascinating and rapidly growing field of Physics at present. In fact, Astronomy is the oldest science among all physical sciences. Although in recent years due to sophistication of theoretical as well as observational techniques this field of Physics grows unprecedentedly, still there are lots of regions of this field which are remained unexplored till now.
Thus, the objectives of offering this course are to

1. Introduce the fundamental concepts of Astrophysics to the interested students.
2. Motivate students to pursue the further study in future in these challenging, fascinating and important fields of Physics.

ASTRONOMY & ASTROPHYSICS (THEORY)
75 Lectures, 60 Marks

Astronomical Scales:
Astronomical Distance, Mass and Time, Scales, Brightness, Radiant Flux and Luminosity, Measurement of Astronomical Quantities Astronomical Distances, Stellar Radii, Masses of Stars, Stellar Temperature.
(4 Lectures, 2 Marks)

Basic concepts of positional astronomy:
Celestial Sphere, Geometry of a Sphere, Spherical Triangle Astronomical Coordinate Systems, Geographical Coordinate Systems, Horizon System, Equatorial System, Diurnal Motion of the Stars, Conversion of Coordinates. Measurement of Time, Sidereal Time, Apparent Solar Time, Mean Solar Time, Equation of Time, Calendar. Basic Parameters of Stars: Determination of Distance by Parallax Method; Brightness, Radiant Flux and Luminosity, Apparent and Absolute magnitude scale, Distance Modulus; Determination of Temperature and Radius of a star; Determination of Masses from Binary orbits; Stellar Spectral Classification, Hertzsprung-Russell Diagram.
(20 Lectures, 20 Marks)

Astronomical techniques:
Basic Optical Definitions for Astronomy (Magnification Light Gathering Power, Resolving Power and Diffraction Limit, Atmospheric Windows), Optical Telescopes (Types of Reflecting Telescopes, Telescope Mountings, Space Telescopes, Detectors and Their Use with Telescopes (Types of Detectors, detection Limits with Telescopes).
(6 Lectures, 5 Marks)

Physical principles: Gravitation in Astrophysics (Virial Theorem, Newton versus Einstein), Systems in Thermodynamic Equilibrium.

(3 Lectures, 3 Marks)

The sun

(Solar Parameters, Solar Photosphere, Solar Atmosphere, Chromosphere. Corona, Solar Activity, Basics of Solar Magneto-hydrodynamics. Helioseismology).

The solar family (Solar System: Facts and Figures, Origin of the Solar System: The Nebular Model, Tidal Forces and Planetary Rings, Extra- Solar Planets.

(6 Lectures, 5 Marks)

Stellar spectra and classification Structure (Atomic Spectra Revisited, Stellar Spectra, Spectral Types and Their Temperature Dependence, Black Body Approximation, H R Diagram, Luminosity Classification)

(5 Lectures, 2 Marks)

The milky way:

Basic Structure and Properties of the Milky Way, Nature of Rotation of the Milky Way (Differential Rotation of the Galaxy and Oort Constant, Rotation Curve of the Galaxy and the Dark Matter, Nature of the Spiral Arms), Stars and Star Clusters of the Milky Way, Properties of and around the Galactic Nucleus.

(14 Lectures, 10 Marks)

Galaxies:

Galaxy Morphology, Hubble's Classification of Galaxies, Elliptical Galaxies (The Intrinsic Shapes of Elliptical, de Vaucouleurs Law, Stars and Gas). Spiral and Lenticular Galaxies (Bulges, Disks, Galactic Halo) The Milky Way Galaxy, Gas and Dust in the Galaxy, Spiral Arms.

(7 Lectures, 8 Marks)

Large scale structure & expanding universe:

Cosmic Distance Ladder (An Example from Terrestrial Physics, Distance Measurement using Cepheid Variables), Hubble's Law (Distance- Velocity Relation), Clusters of Galaxies (Virial theorem and Dark Matter).

(10 Lectures, 5 Marks)

Recommended readings:

- Modern Astrophysics, B.W. Carroll & D.A. Ostlie, Addison-Wesley Publishing Co.
- Introductory Astronomy and Astrophysics, M. Zeilik and S.A. Gregory, 4^{th} Edition, Saunders College Publishing.
- The Physical universe: An introduction to astronomy, F. Shu, Mill Valley: University Science Books.
- Fundamental of Astronomy (Fourth Edition), H. Karttunen et al. Springer
- K.S. Krishnasamy, 'Astrophysics a modern perspective,' Reprint, New Age International

(p) Ltd, New Delhi,2002.

- Baidyanath Basu, ‘An introduction to Astrophysics’, Second printing, Prentice - Hall of India Private limited, New Delhi,2001.
- Textbook of Astronomy and Astrophysics with elements of cosmology, V.B. Bhatia, Narosa Publication.

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		20
Written Test for theory and/or Viva Voce for Laboratory:		20
Final (End Semester):	**60**	
Written Test for theory and/or Laboratory experiments:		60

Expected Learner Outcome: This course will:

1. Equip the students with basic knowledge of the Astrophysics.
2. Create interest to the subjects of Astrophysics and to pursue further higher studies in the subject concerned in future.
3. Develop the critically analyzing ability, which may motivate the students to solve any challenging physical problem in future.

Course code: STUGP/DSE04
Course title: PHYSICS OF EARTH
Nature of the course: DSE
Total credit assigned: 06
Distribution of credits: Theory – 05, Tutorial -01

Course Objectives: After the completion of the course, a student will be able to

1. Acquire knowledge on origin and evolution of the Earth and Universe
2. Acquire knowledge on structure, composition and dynamics of the Earth from crust up to space.
3. Understand the interaction among different components of the Earth.
4. Get familiar with the weather and climate systems, climate change.
5. Increase people awareness of the scientific process of the Earth and its role in the exploration of the Universe.

PHYSICS OF EARTH (THEORY)
75 Lectures, 60 Marks

1. **The Earth and the Universe**:

(a) Origin of universe, creation of elements and earth. A Holistic understanding of our dynamic planet through Astronomy, Geology, Meteorology and Oceanography. Introduction to various branches of Earth Sciences.

(b) General characteristics and origin of the Universe. The Milky Way galaxy, solar system, Earth's orbit and spin, the Moon's orbit and spin. The terrestrial and Jovian planets. Meteorites & Asteroids. Earth in the Solar system, origin, size, shape, mass, density, rotational and revolution parameters and its age.

(c) Energy and particle fluxes incident on the Earth.
(d) The Cosmic Microwave Background.
(17 Lectures, 14 Marks)

2. **Structure**:

(a) The Solid Earth: Mass, dimensions, shape and topography, internal structure, magnetic field, geothermal energy. How do we learn about Earth's interior?

(b) The Hydrosphere: The oceans, their extent, depth, volume, chemical composition. River systems.

(c) The Atmosphere: variation of temperature, density and composition with altitude, clouds.

(d) The Cryosphere: Polar caps and ice sheets. Mountain glaciers.

(e) The Biosphere: Plants and animals. Chemical composition, mass. Marine and land organisms.
(18 Lectures, 15 Marks)

3. **Dynamical Processes**:

a) The Solid Earth: Origin of the magnetic field. Source of geothermal energy. Convection in Earth's core and production of its magnetic field. Mechanical layering of the Earth. Introduction to geophysical methods of earth investigations. Concept of plate tectonics; sea-floor spreading and continental drift. Geodynamic elements of Earth: Mid Oceanic Ridges, trenches, transform faults and island arcs. Origin of oceans, continents, mountains and rift valleys. Earthquake and earthquake belts. Volcanoes: types products and distribution.

b) The Hydrosphere: Ocean circulations. Oceanic current system and effect of coriolis forces. Concepts of eustasy, tend – air-sea interaction; wave erosion and beach processes. Tides. Tsunamis.

c) The Atmosphere: Atmospheric circulation. Weather and climatic changes. Earth's heat budget. Cyclones.

Climate:

i. Earth's temperature and greenhouse effect.
ii. Paleoclimate and recent climate changes.
iii. The Indian monsoon system.

(b) Biosphere: Water cycle, Carbon cycle, Nitrogen cycle, Phosphorous cycle. The role of cycles in maintaining a steady state.

(18 Lectures, 14 Marks)

4. **Evolution:**

Nature of stratigraphic records, Standard stratigraphic time scale and introduction to the concept of time in geological studies. Introduction to geochronological methods in their application in geological studies. History of development in concepts of uniformitarianism, catastrophism and neptunism. Law of superposition and faunal succession. Introduction to the geology and geomorphology of Indian subcontinent.

1. Time line of major geological and biological events.
2. Origin of life on Earth.
3. Role of the biosphere in shaping the environment.
4. Future of evolution of the Earth and solar system: Death of the Earth.

(18 Lectures, 14 Marks)

5. **Disturbing the Earth – Contemporary dilemmas**

(a) Human population growth.
(b) Atmosphere: Greenhouse gas emissions, climate change, air pollution.
(c) Hydrosphere: Fresh water depletion.

(d)Geosphere: Chemical effluents, nuclear waste.

(e) Biosphere: Biodiversity loss. Deforestation. Robustness and fragility of ecosystem

(4 Lectures, 3 Marks)

Recommended readings:

- Planetary Surface Processes, H. Jay Melosh, Cambridge University Press, 2011.
- Consider a Spherical Cow: A course in environmental problem solving, John Harte. University Science Books
- Holme's Principles of Physical Geology. 1992. Chapman & Hall.
- Emiliani, C, 1992. Planet Earth, Cosmology, Geology and the Evolution of Life and Environment. Cambridge University Press.

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		20
Written Test for theory and/or Viva Voce for Laboratory:		20
Final (End Semester):	**60**	
Written Test for theory and/or Laboratory experiments:		60

Expected learner Outcomes: This course will enable the students to:

1. Develop critical and quantitative thinking of scientific issues related to the study of cosmology and Earth Sciences.
2. Understand the basic principles of various processes of the Earth.
3. Apply the acquired knowledge on the study of the Universe
4. Pursue career in Earth Sciences, Cosmology etc.
5. Understand the contemporary dilemmas on Earth and Environmental issues like climate change, air pollution, deforestation etc.

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Semester VI

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Course code: STUGP/DSE05
Course title: PHYSICS OF DEVICES AND INSTRUMENTS
Nature of the course: DSE
Total credit assigned: 06
Distribution of credits: Theory-04, Practicals-02

Course Objectives: After completing this course, a student will be able to:

1. Know about various devices like UJT, FET, MOSFET, CMOS etc. and its application to different electronic circuits.
2. Design rectifiers, passive and active filters, multivibrators etc.
3. Familiarize with the IC fabrication techniques.
4. Learn about digital data communication standards and also about communication systems.

PHYSICS OF DEVICES AND INSTRUMENTS (THEORY)
60 Lectures, 60 Marks

Devices: Characteristic and small signal equivalent circuits of UJT and JFET. Metal-semiconductor Junction. Metal oxide semiconductor (MOS) device. Ideal MOS and Flat Band voltage. SiO2-Si based MOS. MOSFET– their frequency limits. Enhancement and Depletion Mode MOSFETS, CMOS. Charge coupled devices. Tunnel diode.
(14 Lectures, 14 Marks)

Power supply and Filters: Block Diagram of a Power Supply, Qualitative idea of C and L Filters. IC Regulators, Line and load regulation, short circuit protection.
Active and Passive Filters, Low Pass, High Pass, Band Pass and band Reject Filters.
Multivibrators: As table and Monostable Multivibrators using transistors.
(9 Lectures, 9 Marks)

Phase Locked Loop (PLL): Basic Principles, Phase detector (XOR & edge triggered), Voltage Controlled Oscillator (Basics, varactor). Loop Filter– Function, Loop Filter Circuits, transient response, lock and capture. Basic idea of PLL IC (565 or 4046).
(5 Lectures, 5 Marks)

Processing of Devices:
Basic process flow for IC fabrication, Electronic grade silicon. Crystal plane and orientation. Defects in the lattice. Oxide layer. Oxidation Technique for Si. Metallization technique. Positive and Negative Masks. Optical lithography. Electron lithography. Feature size control and wet anisotropic etching. Lift off Technique. Diffusion and implantation.
(12Lectures, 12 Marks)

Digital Data Communication Standards:
Serial Communications: RS232, Handshaking, Implementation of RS232 on PC.
Universal Serial Bus (USB): USB standards, Types and elements of USB transfers. Devices (Basic idea of UART).
(2 Lectures, 2 Marks)

Parallel Communications: General Purpose Interface Bus (GPIB), GPIB signals and lines, Handshaking and interface management, Implementation of a GPIB on a PC. Basic idea of sending data through a COM port.
(3 Lectures, 3 Marks)

Introduction to communication systems: Block diagram of electronic communication system, Need for modulation. Amplitude modulation. Modulation Index. Analysis of Amplitude Modulated wave. Sideband frequencies in AM wave. CE Amplitude Modulator. Demodulation of AM wave using Diode Detector. basic idea of Frequency, Phase, Pulse and Digital Modulation including ASK, PSK, FSK.
(15 Lectures, 15 Marks)

Recommended readings:

- Physics of Semiconductor Devices, S.M. Sze & K.K. Ng, 3rd Ed.2008, John Wiley & Sons
- Electronic devices and integrated circuits, A.K. Singh, 2011, PHI Learning Pvt. Ltd.
- Op-Amps & Linear Integrated Circuits, R.A. Gayakwad,4 Ed. 2000, PHI Learning Pvt. Ltd
- Electronic Devices and Circuits, A. Mottershead, 1998, PHI Learning Pvt. Ltd.
- Electronic Communication systems, G. Kennedy, 1999, Tata McGraw Hill.
- Introduction to Measurements & Instrumentation, A.K. Ghosh, 3rd Ed., 2009, PHI Learning Pvt. Ltd.
- Semiconductor Physics and Devices, D.A. Neamen, 2011, 4th Edition, McGraw Hill
- PC based instrumentation; Concepts & Practice, N. Mathivanan, 2007, Prentice-Hall of India

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

PHYSICS OF DEVICES AND INSTRUMENTS (LAB)
60 Lectures

Experiments from both Section A and Section B:

Section-A

1. To design a power supply using bridge rectifier and study effect of C-filter.
2. To design the active Low pass and High pass filters of given specification.
3. To design the active filter (wide band pass and band reject) of given specification.
4. To study the output and transfer characteristics of a JFET.
5. To design a common source JFET Amplifier and study its frequency response.
6. To study the output characteristics of a MOSFET.
7. To study the characteristics of a UJT and design a simple Relaxation Oscillator.
8. To design an Amplitude Modulator using Transistor.
9. To design PWM, PPM, PAM and Pulse code modulation using ICs.
10. To design an Astable multivibrator of given specifications using transistor.
11. To study a PLL IC (Lock and capture range).
12. To study envelope detector for demodulation of AM signal.
13. Study of ASK and FSK modulator.
14. Glow an LED via USB port of PC.
15. Sense the input voltage at a pin of USB port and subsequently glow the LED connected with another pin of USB port.

Section-B:

SPICE/MULTISIM simulations for electrical networks and electronic circuits

1. To verify the Thevenin and Norton Theorems.
2. Design and analyze the series and parallel LCR circuits
3. Design the inverting and non-inverting amplifier using an Op-Amp of given gain
4. Design and Verification of op-amp as integrator and differentiator
5. Design the 1^{st} order active low pass and high pass filters of given cutoff frequency
6. Design a Wein`s Bridge oscillator of given frequency.
7. Design clocked SR and JK Flip-Flop`s using NAND Gates
8. Design 4-bit asynchronous counter using Flip-Flop ICs
9. Design the CE amplifier of a given gain and its frequency response.
10. Design an Astable multivibrator using IC555 of given duty cycle.

Recommended readings:

- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill
- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4^{th} edn., 2000, Prentice Hall.
- Introduction to PSPICE using ORCAD for circuits & Electronics, M.H. Rashid, 2003, PHI Learning.
- PC based instrumentation; Concepts & Practice, N. Mathivanan, 2007, Prentice-Hall of India

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected learner outcome: This course will enable the students to:

1. Develop knowledge about various devices like UJT, FET etc. and to use these devices for different applications.
2. Design and analyse filter circuits, power supply FET amplifiers etc.
3. Develop the basic knowledge of IC fabrications, data communication standards and communication systems.

Course code: STUGP/DSE06

Course title: NANO MATERIALS AND APPLICATION

Nature of the course: DSE

Total credit assigned: 06

Distribution of credits: Theory – 04, Practical -02

Course Objective: The aim of the course is to

1. Provide a systematic coverage and insight into the promising area of nano materials in order to facilitate the understanding of the nature and prospects for the field.
2. Provide information about various synthesis and characterization techniques of nano materials.
3. Discuss optical and electronic transport properties of nano materials.
4. Discuss applications of nano materials.

NANO MATERIALS AND APPLICATIONS (THEORY)

60 Lectures, 60 Marks

Nanoscale systems:

Length scales in Physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences.

(10 Lectures, 10 Marks)

Synthesis of nanostructure materials:

Top down and Bottom-up approach, Photolithography. Ball milling. Gas phase condensation. Vacuum deposition. Physical vapor deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD). Sol-Gel. Electro deposition. Spray pyrolysis. Hydrothermal synthesis. Preparation through colloidal methods. MBE growth of quantum dot

(8 Lectures, 8 Marks)

Characterization:

X- ray diffraction, Optical Microscopy, scanning electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy, Scanning Tunneling Microscopy

(8 Lectures, 8 Marks)

Optical properties:

Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect band gap semiconductor nanocrystals. Quantitative treatment of quasi-particles and excitons, charging effects. Radiative Processes: General formalization-absorption, emission and luminescence, Optical properties of hetero structures and nano structures.

(14 Lectures, 14 Marks)

Electron transport:

Carrier transport in nanostrcutures. Coulomb blockade effect, thermionic emission, tunneling and hoping conductivity. Defects and impurities: Deep level and surface defects.

(6 Lectures, 6 Marks)

Applications:

Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron transfer devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS)

(14 Lectures, 14 Marks)

Recommended readings:

- C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
- S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company)
- K.K. Chattopadhyay and A. N. Banerjee, Introduction to Nanoscience and Technology (PHI Learning Private Limited).
- Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).
- M. Hosokawa, K. Nogi, M. Naita, T. Yokoyama, Nanoparticle Technology Handbook (Elsevier, 2007).
- Introduction to Nanoelectronics, V.V. Mitin, V.A. Kochelap and M.A. Stroscio, 2011, Cambridge University Press.
- Bharat Bhushan, Springer Handbook of Nanotechnology (Springer-Verlag, Berlin

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

NANO MATERIALS AND APPLICATIONS (LAB)
60 Lectures

1. Synthesis of metal nano particles by chemical route.
2. Synthesis of semiconductor nano particles.
3. Surface Plasmon study of metal nano particles by UV-Visible spectrophotometer.
4. XRD pattern of nano materials and estimation of particle size.
5. To study the effect of size on color of nano materials.
6. To prepare composite of CNTs with other materials.
7. Growth of quantum dots by thermal evaporation.
8. Prepare a disc of ceramic of a compound using ball milling, pressing and sintering, and study its XRD.
9. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and study transmittance spectra in UV-Visible region.
10. Prepare a thin film capacitor and measure capacitance as a function of temperature or frequency.
11. Fabricate a PN diode by diffusing Al over the surface of N-type Si and study its V-I characteristic.

Recommended readings:

- C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
- S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publishing Company).
- K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience & Technology (PHI Learning Private Limited).
- Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected learner outcome: This course will enable the students to

1. Gather sufficient knowledge about the fascinating behaviour of nanomaterials and tuning of such properties for different applications.
2. Obtain information on experimental methodologies with necessary theoretical background, which may be useful for pursuing further study on the areas of nanoscience and technology.

Course code: STUGP/DSE07
Course title: EXPERIMENTAL TECHNIQUES
Nature of the course: DSE
Total credit assigned: 06
Distribution of credits: Theory – 04, Practicals -02

Course objective: After completing this course, a student will be able to

1. Enhance experimental knowledge.
2. Develop the theoretical as well as experimental knowledge of different instruments and instrumentation.
3. Enhance the knowledge of some measurement techniques and data and error analysis technique.

EXPERIMENTAL TECHNIQUES (THEORY)
60 Lectures, 60 Marks

Measurements:
Accuracy and precision. Significant figures. Error and uncertainty analysis. Types of errors: Gross error, systematic error, random error. Statistical analysis of data (Arithmetic mean, deviation from mean, average deviation, standard deviation, chi-square) and curve fitting. Guassian distribution.
(7 Lectures, 7 Marks)

Signals and Systems:
Periodic and aperiodic signals. Impulse response, transfer function and frequency response of first and second order systems. Fluctuations and Noise in measurement system. S/N ratio and Noise figure. Noise in frequency domain. Sources of Noise: Inherent fluctuations, Thermal noise, Shot noise, 1/f noise
(7 Lectures, 7 Marks)

Shielding and Grounding:
Methods of safety grounding. Energy coupling. Grounding. Shielding: Electrostatic shielding. Electromagnetic Interference.
(4 Lectures, 4 Marks)

Transducers & industrial instrumentation (working principle, efficiency, applications):
Static and dynamic characteristics of measurement Systems. Generalized performance of systems, zero order first order, second order and higher order systems. Electrical, Thermal and Mechanical systems. Calibration. Transducers and sensors. Characteristics of Transducers. Transducers as electrical element and their signal conditioning. Temperature transducers: RTD, Thermistor, Thermocouples, Semiconductor type temperature sensors (AD590, LM35, LM75) and signal conditioning. Linear Position transducer: Strain gauge, Piezoelectric. Inductance change transducer: Linear variable differential transformer (LVDT), Capacitance change transducers. Radiation Sensors: Principle of Gas filled detector, ionization chamber, scintillation detector.
(21 Lectures, 21 Marks)

Digital Multimeter:

Comparison of analog and digital instruments. Block diagram of digital multimeter, principle of measurement of I, V, C. Accuracy and resolution of measurement.

(5 Lectures, 5 Marks)

Impedance Bridges and Q-meter:

Block diagram and working principles of RLC bridge. Q-meter and its working operation. Digital LCR bridge.

(4 Lectures, 4 Marks)

Vacuum Systems:

Characteristics of vacuum: Gas law, Mean free path. Application of vacuum. Vacuum system- Chamber, Mechanical pumps, Diffusion pump & Turbo Modular pump, pumping speed, Pressure gauges (Pirani, Penning, ionization).

(12 Lectures, 12 Marks)

Recommended readings:

- Measurement, Instrumentation and Experiment Design in Physics and Engineering, M. Sayer and A. Mansingh, PHI Learning Pvt. Ltd.
- Experimental Methods for Engineers, J.P. Holman, McGraw Hill
- Introduction to Measurements and Instrumentation, A.K. Ghosh, 3rd Edition, PHI Learning Pvt. Ltd.
- Transducers and Instrumentation, D.V.S. Murty, 2nd Edition, PHI Learning Pvt. Ltd.
- Instrumentation Devices and Systems, C.S. Rangan, G.R. Sarma, V.S.V. Mani, Tata McGraw Hill
- Principles of Electronic Instrumentation, D. Patranabis, PHI Learning Pvt. Ltd.
- Electronic circuits: Handbook of design & applications, U. Tietze, Ch. Schenk, Springer

Mode of Assessment/ Assessment Tools (%)

Internal:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

EXPERIMENTAL TECHNIQUES (LAB)
60 Lectures

1. Determine output characteristics of a LVDT & measure displacement using LVDT
2. Measurement of Strain using Strain Gauge.
3. Measurement of level using capacitive transducer.
4. To study the characteristics of a Thermostat and determine its parameters
5. Study of distance measurement using ultrasonic transducer.
6. Calibrate Semiconductor type temperature sensor (AD590, LM35, or LM75)
7. To measure the change in temperature of ambient using Resistance Temperature Device (RTD).
8. Create vacuum in a small chamber using a mechanical (rotary) pump and measure the chamber pressure using a pressure gauge.
9. Comparison of pickup of noise in cables of different types (co-axial, single shielded, double shielded, without shielding) of 2m length, understanding of importance of grounding using function generator of mV level & an oscilloscope.
10. To design and study the Sample and Hold Circuit.
11. Design and analyze the Clippers and Clampers circuits using junction diode
12. To plot the frequency response of a microphone.
13. To measure Q of a coil and influence of frequency, using a Q-meter.

Recommended readings:

- Electronic circuits: Handbook of design and applications, U. Tietze and C. Schenk, 2008, Springer
- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1990, Mc-Graw Hill
- Measurement, Instrumentation and Experiment Design in Physics & Engineering, M. Sayer and A. Mansingh, 2005, PHI Learning

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected learner outcome: This course will enable the students to

1. Develop the theoretical as well as experimental knowledge on different instruments and instrumentation.
2. Develop the knowledge of some measurement techniques and data and error analysis technique, which is very essential for a Physics student.
3. Handle different electrical network-based instruments.

ABILITY ENHANCEMENT ELECTIVE COURSE (AEEC)

Semester III

Course code: STUGP/AEEC01
Course title: APPLIED OPTICS
Nature of the course: AEEC
Total credit assigned: 02
Course Objectives: After completing this course, a student will be able to:

1. Learn about various optical devices, components and systems.
2. Familiarize with experiments related to optoelectronic devices.
3. Learn about Fourier transform spectroscopy, holography and various aspects of fibre optics.

PHYSICS AEEC-1: APPLIED OPTICS (THEORY)
30 Lectures, 60 Marks

(i) Sources and Detectors

Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.
(9 Lectures, 20 Marks)

Experiments on Lasers:

a. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid-state laser.
b. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid-state laser.
c. To find the polarization angle of laser light using polarizer and analyzer
d. Thermal expansion of quartz using laser

Experiments on Semiconductor Sources and Detectors:

a) V-I characteristics of LED
b) Study the characteristic of solid-state laser
c) Study the characteristics of LDR
d) Photovoltaic cell
e) Characteristic of IR sensor

(ii) Fourier optics

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens
(6 Lectures, 15 Marks)

Experiments on Fourier Optics:

a. Fourier optic and image processing

1. Optical image addition/subtraction
2. Optical image differentiation
3. Fourier optical filtering
4. Construction of an optical 4f system

Fourier Transform Spectroscopy

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science.

Experiment:

To study the interference pattern from a Michelson interferometer as a function of mirror separation in the interferometer. The resulting interferogram is the Fourier transform of the power spectrum of the source. Analysis of experimental interferograms allows one to determine the transmission

(iii) Holography

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy, interferometry, and character recognition
(6 Lectures, 10 Marks)

Experiments on Holography and interferometry:

1. Recording and reconstructing holograms
2. Constructing a Michelson interferometer or a Fabry Perot interferometer
3. Measuring the refractive index of air
4. Constructing a Sagnac interferometer
5. Constructing a Mach-Zehnder interferometer
6. White light Hologram

(iv) Photonics: Fibre optics

Optical fibres and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres, Fibre optic sensors: Fibre Bragg Grating.

(9 Lectures, 15 Marks)

Experiments on Photonics: Fibre Optics

a. To measure the numerical aperture of an optical fibre
b. To study the variation of the bending loss in a multimode fibre
c. To determine the mode field diameter (MFD) of fundamental mode in a single-mode fibre by measurements of its far field Gaussian pattern
d. To measure the near field intensity profile of a fibre and study its refractive index profile
e. To determine the power loss at a splice between two multimode fibres

Recommended readings:

- Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.
- LASERS: Fundamentals & applications, K. Thyagrajan & A.K. Ghatak, 2010, Tata McGraw Hill
- Fibre optics through experiments, M.R. Shenoy, S.K. Khijwania, et.al. 2009, Viva Books
- Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.
- Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.
- Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
- Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
- Optical Physics, A. Lipson, S.G. Lipson, H. Lipson, 4th Edn., 1996, Cambridge Univ. Press

Mode of Assessment/ Assessment Tools

Internal:	**40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:		20
Written Test for theory and/or Viva Voce for Laboratory:		20
Final (End Semester):	**60**	
Written Test for theory and/or Laboratory experiments:		60

Expected learner outcome: This course will enable the students to:

1. Acquire knowledge about various optoelectronic devices and their applications.
2. Understand the basics of Laser and their uses.
3. Understand about Fourier transform spectroscopy and will learn to use this technique for various purposes.
4. Learn the use of optical fibres and related information.

Semester IV

Course code: STUGP/AEEC05

Course title: ELECTRICAL CIRCUITS AND NETWORK SKILLS
Nature of the course: AEEC
Total credit assigned: 02

Course Objectives: After the completion of this course, a student will be able to

1. Design and trouble shoot the electrical circuits, networks and appliances through hands on mode.
2. Build the basic foundation for learning electrical wirings and repairing of other house hold equipments.

ELECTRICAL CIRCUITS AND NETWORK SKILLS (THEORY)
30 Lectures, 60 Marks

Basic Electricity Principles:
Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC, Electricity. Familiarization with multimeter, voltmeter and ammeter.
(3 Lectures, 5 Marks)

Understanding Electrical Circuits:
Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.
(4 Lectures, 10 Marks)

Electrical Drawing and Symbols:
Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop.
(4 Lectures, 10 Marks)

Generators and Transformers:
DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers.
(3 Lectures, 5 Marks)

Electric Motors:
Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heater and motors, speed and power of ac motor
(4 lectures, 5 Marks)

Solid state devices:
Resistors, inductors and capacitors, Diode and rectifiers, Components in series or in shunt, Response of Inductors and capacitors with AC or DC sources.
(3 Lectures, 5 Marks)

Electrical Protections:
Relays, fuses and disconnect switches, Circuit breakers, Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device)
(4 Lectures, 10 Marks)

Electrical Wiring:
Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drops and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board.
(5 Lectures, 10 Marks)

Recommended readings:

- A text book in Electrical Technology - B L Theraja - S Chand & Co.
- A text book of Electrical Technology - A K Theraja
- Performance and design of AC machines - M G Say ELBS Edn.

Mode of Assessment/ Assessment Tools

Internal:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

Expected learner outcome: This course will enable the students to

1. Design and troubleshoot certain electrical circuits and domestic appliances along with the understanding of the working of those appliances.
2. Do electrical wiring and repairing. This knowledge will develop the skill of the students for various electrical repairing and servicing purposes.

GENERIC ELECTIVE

Semester I

Course Code: STUGP/GE01

Course Title: MECHANICS
Nature of the Course: GENERIC ELECTIVE
Total Credits assigned: 06
Distribution of credits: Theory – 04, Practicals-02

Course Objective: At the completion of this course, a student will be able to

1. Understand the basics of vector algebra and the techniques of solving ordinary differential equations.
2. Understand the basic components of mechanics- e.g., motion, force and torque, mass and moment of inertia, linear and angular momenta, kinetic energy and potential energy etc. and the conservation theorems.
3. Study the mechanics of gravitational systems and simple harmonic motion.
4. Study the elastic behaviour of materials.
5. Realize the idea of frame of reference and its implications in the study of special relativity.

PHYSICS-GE-1: MECHANICS (THEORY)
60 Lectures, 60 Marks

Vectors:
Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter.
(3 Lectures, 3 Marks)

Ordinary Differential Equations:
1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.
(7 Lectures, 7 Marks)

Laws of Motion:
Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass.
(10 Lectures, 10 Marks)

Momentum and Energy:
Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets.
(6 Lectures, 6 Marks)

Rotational Motion:
Angular velocity and angular momentum. Torque. Conservation of angular momentum.
(5 Lectures, 5 Marks)

Gravitation:

Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Basic idea of global positioning system (GPS). Weightlessness. Physiological effects on astronauts.

(8 Lectures, 8 Marks)

Oscillations:

Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations.

(6 Lectures, 6 Marks)

Elasticity:

Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion–Torsional pendulum-Determination of Rigidity modulus and moment of inertia- q, η and σ by Searles method.

(8 Lectures, 8 Marks)

Special Theory of Relativity:

Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.

(7 Lectures, 7 Marks)

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Recommended readings:

- University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley
- Mechanics Berkeley Physics, v.1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
- Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
- Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Mode of Assessment/ Assessment Tools

(%) Internal	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

MECHANICS (LAB)
60 Lectures

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To determine g and velocity for a freely falling body using Digital Timing Technique
10. To study the Motion of a Spring and calculate (a) Spring Constant, (b) g.

Recommended readings:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- Engineering Practical Physics, S. Panigrahi & B. Mallick,2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**50**
Written Test for theory and/or Laboratory experiments:	50

Expected learner outcome: This course will enable the students to

1. Develop basic knowledge of mechanics as it is helpful to study any other course in science discipline.
2. Develop knowledge of vector algebra and differential equations which will help students in the study of theoretical courses in science.
3. Acquire useful knowledge about material science.
4. Explain the abstract idea of 4-dimensional world to students which are not from physics discipline.

Semester II

Course Code: S T U G P / G E 0 2
Course Title: ELECTRICITY AND MAGNETISM
Nature of the Course: GENERIC ELECTIVE
Total Credits assigned: 06
Distribution of credits: Theory – 04, Practicals-02

Course Objectives: At the completion of this course, a student will be able to:

1. Understand basic knowledge of electricity and magnetism.
2. Understand basic knowledge of electrical and magnetic properties of matter in brief.
3. Understand the basic knowledge of the effect of electric field on magnetic field and the effect of magnetic field on current.
4. Understand the basic principle of the electrical circuit (AC) circuit and electrical networking.
5. Develop the basic theoretical as well as experimental skill on electrical networking.

ELECTRICITY AND MAGNETISM (THEORY)
60 Lectures, 60 Marks

Vector Analysis:
Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).
(12 Lectures, 12 Marks)

Electrostatics:
Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.
(22 Lectures, 22 Marks)

Magnetism:
Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferro-magnetic materials.
(10 Lectures, 10 Marks)

Electromagnetic Induction:
Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.
(6 Lectures, 6 Marks)

Maxwell`s equations and Electromagnetic wave propagation:
Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.
(10 Lectures, 10 Marks)

Recommended readings:

- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education
- Electricity & Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

Mode of Assessment/ Assessment Tools

(%) Internal:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

ELECTRICITY AND MAGNETISM (LAB)
60 Lectures

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer:
   (i) Measurement of charge and current sensitivity
   (ii) Measurement of CDR
   (iii) Determine a high resistance by Leakage Method
   (iv) To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De'Sauty's bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx)
5. To study the Characteristics of a Series RC Circuit.
6. To study a series LCR circuit LCR circuit and determine its (a) Resonant frequency, (b) Quality factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorems
10. To verify the Superposition, and Maximum Power Transfer Theorems

Recommended readings:

- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4^{th} Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11^{th} Ed.2011, Kitab Mahal
- Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:		25
Written Test for theory and/or Viva Voce for Laboratory:		25
Final (End Semester):	**50**	
Written Test for theory and/or Laboratory experiments:		50

Expected learner outcome:

This course will enable the students to

1. Perform quantitative analyses of basic problems in Electrostatics and Magneto dynamics.
2. Apply Gauss's Law, Ampere's Law, and Biot-Savart Law to solving practical problems in electricity and magnetism.
3. Apply the fundamental laws of electromagnetism to solve problems of electrostatics, magnetostatics, and electromagnetic induction

4. Explain and analyze the behaviour of alternating currents in LCR circuits.
5. Perform and interpret the results of simple experiments and demonstrations of physical principles.
6. Solve problems relevant to interfaces between media with defined boundary conditions.

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Semester III

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Course Code: S T U G P / G E 0 3
Course Title: THERMAL PHYSICS AND STATISTICAL MECHANICS
Nature of the Course: GENERIC ELECTIVE
Total Credits assigned: 06
Distribution of credits: Theory – 04, Practicals-02

Course objectives: At the completion of this course, a student will be able to

1. Develop the working knowledge of the laws and methods of thermodynamics and elementary statistical mechanics.
2. Provide insight to the postulates of Statistical Mechanics and statistical interpretation of thermodynamics
3. Understand the laws of radiation and acquire knowledge for their applications in various disciplines in Physics, Chemistry, Biology, Earth and Atmospheric Sciences.
4. Develop application-oriented knowledge on laws of statistical mechanics in selected problems
5. Use the methodologies, conventions and tools of thermal and statistical physics to test and communicate ideas and explanation

THERMAL PHYSICS AND STATISTICAL MECHANICS (THEORY)
(60 Lectures, 60 Marks)

Laws of Thermodynamics:
Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.
(22 Lectures, 22 Marks)

Thermodynamic Potentials:
Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations.
(10 Lectures, 10 Marks)

Kinetic Theory of Gases:
Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-

atomic and diatomic gases.

(10 Lectures, 10 Marks)

Theory of Radiation:

Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

(6 Lectures, 6 Marks)

Statistical Mechanics:

Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.

(12 Lectures, 12 Marks)

Recommended readings:

- Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Heat and Thermodynamics, M.W. Zemasky and R. Dittman, 1981, McGraw Hill
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W. Sears and G.L. Salinger. 1988, Narosa
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications.

Mode of Assessment/ Assessment Tools

(%) Internal:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

THERMAL PHYSICS AND STATISTICAL MECHANICS (LAB)
60 Lectures

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of a hot object as a function of time using a thermocouple and suitable data acquisition system
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

Recommended readings:

- Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal,
- 1985, Vani Publication.

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	25
Written Test for theory and/or Viva Voce for Laboratory:	25
Final (End Semester):	**50**
Written Test for theory and/or Laboratory experiments:	50

Expected learner Outcomes: This course will enable the students to

1. Apply laws of thermodynamics and statistical mechanics to a range of situations in real world problems.
2. Conduct scientific problems and experiments on thermodynamics and allied disciplines.
3. Demonstrate a working knowledge of the physical principles describing the thermal physics.
4. Explain thermal physics as logical consequences of the postulates of statistical mechanics

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Semester IV

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Course Code: STUGP/GE04

Course Title: WAVES AND OPTICS
Nature of the Course: GENERIC ELECTIVE
Total Credits assigned: 06
Distribution of credits: Theory – 04, Practicals-02

Course objectives: At the completion of this course, a student will be able to

1. Learn the basic ideas of the behaviour of light based on its wave nature.
2. Develop the knowledge of the different phenomena due to the interaction of light among them and with mater.
3. Learn about some fundamental principles of light which is used in different optical instrument which very essential for Physics student.

WAVES AND OPTICS (THEORY)
60 Lectures, 60 Marks

Superposition of Two Collinear Harmonic oscillations:
Linearity & Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).
Superposition of Two Perpendicular Harmonic Oscillations:
Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses.
(6 Lectures, 6 Marks)

Waves Motion- General:
Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity.,
(7 Lectures, 7 Marks)

Sound:
Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria.
(10 Lectures, 10 Marks)

Wave Optics:
Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle.
(3 Lectures, 3 Marks)

Interference:
Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in

Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index.

Michelson's Interferometer:

Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference, Refractive index, and Visibility of fringes.

(15 Lectures, 15 Marks)

Diffraction:

Fraunhofer diffraction- Single slit; Double Slit. Multiple slits and Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.

(14 Lectures, 14 Marks)

Polarization:

Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.

(5 Lectures, 5 Marks)

Recommended readings:

- Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill
- Principles of Optics, B.K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publications
- University Physics. F.W. Sears, M.W. Zemansky and H.D. Young. 13/e, 1986. Addison-Wesley

Mode of Assessment/ Assessment Tools

(%) Internal:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc:	20
Written Test for theory and/or Viva Voce for Laboratory:	20
Final (End Semester):	**60**
Written Test for theory and/or Laboratory experiments:	60

WAVES AND OPTICS (LAB)
60 Lectures

1. To investigate the motion of coupled oscillators
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law.
3. To study Lissajous Figures
4. Familiarization with Schuster`s focusing; determination of angle of prism.
5. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. To determine the Refractive Index of the Material of a Prism using Sodium Light.
7. To determine Dispersive Power of the Material of a Prism using Mercury Light
8. To determine the value of Cauchy Constants.
9. To determine the Resolving Power of a Prism.
10. To determine wavelength of sodium light using Fresnel Biprism.
11. To determine wavelength of sodium light using Newton's Rings.
12. To determine the wavelength of Laser light using Diffraction of Single Slit.
13. To determine wavelength of (1) Sodium and (2) Spectral lines of the Mercury light using plane diffraction Grating
14. To determine the Resolving Power of a Plane Diffraction Grating.
15. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

Recommended readings:

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Mode of Assessment/ Assessment Tools (%)

Internal:	**50**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	25
Written Test for theory and/or Viva Voce for Laboratory:	25
Final (End Semester):	**50**
Written Test for theory and/or Laboratory experiments:	50

Expected learner Outcomes: This course will enable the students to

1. Justify different phenomena due to light and the interaction of light among them and with matter.
2. Use different optical instruments.
3. Produce different natural phenomena using different apparatus in the laboratory.

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF BIOTECHNOLOGY & MICROBIOLOGY

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

UNDERGRADUATE PROGRAMME (MICROBIOLOGY)

Choice Based Credit System (CBCS)

(w.e.f. academic session 2019-20)

UNDERGRADUATE PROGRAMME (MICROBIOLOGY)

Curriculum Drafting Committee

1.	Dr. Lomas Tomar, Director, School of Sciences, NIU	Chairperson
2.	Dr. Varun Kumar Sharma, Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member Secretary
3.	Dr. Namrata Dudha Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
4.	Dr. Kashish Gupta Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
5.	Dr. Garima Sharma Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
6.	Dr. Navroop Kaur Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So, it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point
Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
   - **2.1 Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
   - **2.2 Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
   - **2.3 Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

     P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
   - **3.1** AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
   - **3.2** AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of courses

	Theory+ Practical	Theory + Tutorial
I. Core Course		
(14 Papers)	14X4= 56	14X5=70
Core Course Practical / Tutorial*		
(14 Papers)	14X2=28	14X1=14
II. Elective Course		
(8 Papers)		
A.1. Discipline Specific Elective	4X4=16	4X5=20
(4 Papers)		
A.2. Discipline Specific Elective Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		
B.1. Generic Elective/ Interdisciplinary	4X4=16	4X5=20
(4 Papers)		
B.2. Generic Elective Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		

- **Optional Dissertation or project work in place of one Discipline Specific** Elective **paper (6 credits) in 6th Semester**

III. <u>Ability Enhancement Courses</u>

1. **Ability Enhancement Compulsory**		
(2 Papers of 2 credit each)	2 X 2=4	2 X 2=4
Environmental Science		
English/MIL Communication		
2. **Ability Enhancement Elective** (Skill Based)		
(Minimum 2)	2 X 2=4	2 X 2=4
(2 Papers of 2 credit each)		
Total credit	**140**	**140**

* wherever there is a practical there will be no tutorial and vice-versa

B.Sc. (Hons) Microbiology

Core Papers (C): (Credit: 06 each) (1 period/week for tutorials or 4 periods/week for practical)

1. STUGMB/C01: Bio instrumentation (4 + 4)
2. STUGMB/C02: Elementary Cell Biology (4 + 4)
3. STUGMB/C03: Fundamentals of Biochemistry (4 + 4)
4. STUGMB/C04: Basics of Immunology (4 + 4)
5. STUGMB/C05: Microbial Genetics (4 + 4)
6. STUGMB/C06: Bacteriology & Virology (4 + 4)
7. STUGMB/C07: Environmental Biotechnology (4 + 4)
8. STUGMB/C08: Microbiology (4 + 4)
9. STUGMB/C09: Food technology & Bioprocess technology (4 + 4)
10. STUGMB/C10: Basics of Genetic Engineering (4 + 4)
11. STUGMB/C11: Principle of Genomics and Proteomics (4 + 4)
12. STUGMB/C12: Elementary Molecular Biology (4 + 4)
13. STUGMB/C13: Medical Microbiology (4 + 4)
14. STUGMB/C14: Entrepreneurship (4 + 4)

Discipline Specific Elective Papers: (Credit: 06 each) - DSE 1-4

(4 papers to be selected: 02 each for Odd semester and Even semester as listed below)

1. STUGMB/DSE01: Microbial Biotechnology (4) + Lab (4)
2. STUGMB/DSE02: Animal Biotechnology (4) + Lab (4)
3. STUGMB/DSE04: Industrial Microbiology (4) + Lab (2)
4. STUGMB/DSE05: Parasitology (4) + Lab (4)
5. STUGMB/DSE06: Clinical Research (4) + Lab (4)
6. STUGMB/DSE07: Host Pathogen interaction (4) + Lab (4)
7. STUGMB/DSE08: Biological physics (4) + Lab (4)
8. STUGMB/DSE09: Bio-pesticide & Bio-fertilizer (5) + Tutorial (1)
9. STUGMB/DSE12: Dissertation

Skill Enhancement Courses (02 to 04 papers) (Credit: 02 each)- SEC1 to SEC4

1. STUGMB/SEC01: Molecular Diagnostics
2. STUGMB/SEC02: Enzymology
3. STUGMB/SEC03: Industrial Fermentations
4. STUGMB/SEC04: Basic Instrumentation Skills
5. STUGMB/SEC05: Fermentation technology
6. STUGMB/SEC06: Drug Designing
7. STUGMB/SEC07: Basics of Forensic Science
8. STUGMB/SEC08: Food technology
9. STUGMB/SEC09: Bioprocess technology

Generic Elective Papers (GE): (Credit: 06 each)

1. STUGMB/GE01: Fund. of Computer Applications (4) + Lab (4)
2. STUGMB/GE02: Operating system (4) + Lab (4)
3. STUGMB/GE03: Chemistry-1 (4) + Lab (4)
4. STUGMB/GE04: Bioinformatics (4) + Lab (4)
5. STUGMB/GE05: Recombinant DNA Technology (4) + Lab (4)
6. STUGMB/GE06: Bioethics, Biosafety and IPR (4) + Lab (4)
7. STUGMB/GE07: Plant Pathology (4) + Lab (4)

Assessment method:

Assessment method	**Theory**					**Practical**	
	Internal assessment	Mid-term examination	End-term examination	Maximum Mark		Practical examination	Maximum Mark
Mark	20	20	60	100		50 Mark	50 Mark
%	20%	20%	60%	100%		100%	100%

PEOs, POs & PSOs of B.Sc. Microbiology Programme

Programme Educational Objectives (PEOs):

PEO1: To provide an insight on the fundamentals of Microbiology and microbes as a major component of the ecosystem.

PEO2: Use current microbial technologies and methods for the drug design and implementation of solution in pharmaceutical industry.

PEO3: Practice continuous learning to maintain and achieve personal excellence.

Programme Outcomes / Programme Specific Outcomes are attributes i.e. what students are expected to know or will be able to do when they graduate from a programme.

Programme Outcomes (POs): The POs of BSc Microbiology are as follows:

PO1: Understand the impact of the professional microbiological solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO2: Apply ethical principles and commit to professional ethics and responsibilities and norms of the science practice.

PO3: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PO4: An ability to meet desired needs within realistic constraints adapt to sustainability.

PO5: An understanding of professional and ethical responsibility.

PO6: Can become independent researchers and make impactful contributions to the field of Food Microbiology.

PO7: Can take up the jobs of Quality control in various organisations besides research and academics. Instead of becoming job seekers, they are trained to become job providers.

PO8: Students learn to integrate science with society for the overall development of the nation. Are equipped to train manpower, think independently, honesty in research and community service quality inculcated in them will help them in taking up higher studies, set up small scale industries, and develop confidence to take up challenging tasks of research in the field of Microbiology.

Programme Specific Outcomes (PSOs):

PSO1: Understand fundamental principles involved in Microbiology

PSO2: Acquire detail knowledge of microorganisms, their types and significance

PSO3: Understand metabolic and structural significance of bio-molecules

PSO4: Acquaint with concepts of Immunity, Antigen, Antibody and Immune system

PSO5: Understand importance and applications of various enzymes in replication transcription and translations

PSO6: Acquire detail knowledge of industrial production of enzymes, antibiotics and vitamins

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for B.Sc. (Microbiology)

B.Sc. Microbiology) 1st Year
SEMESTER-I

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total	External Exam			
1	STUGMB1 /C01	Bio instrumentation	4	0	0	20	20	40	60	100	4	C1
2	STUGMB1 /C02	Elementary Cell Biology	4	0	0	20	20	40	60	100	4	C2
3	STUGMB1 /GE1	Fundamentals of Computer Applications	4	0	0	20	20	40	60	100	4	GE1
4	STUGMB1 /AECC1	Environmental Sciences	2	0	0	20	20	40	60	100	2	AECC 1
Practical												
1	SPUGMB1 /C01	Bio instrumentation Practical	0	0	2			25	25	50	2	C1
2	SPUGMB1 /C02	Elementary Cell Biology Practical	0	0	2			25	25	50	2	C2
3	SPUGMB1 /GE1	Fundamentals of Computer Applications Practical	0	0	2			25	25	50	2	GE1
Total										**550**	**20**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Microbiology 1st Year
SEMESTER-II

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGMB2/ C03	Fundamentals of Biochemistry	4	0	0	20	20	40	60	100	4	C3
2	STUGMB2/ C04	Basics of Immunology	4	0	0	20	20	40	60	100	4	C4
5	STUGMB2/ GE02	Bioinformatics	4	0	0	20	20	40	60	100	4	GE2
6	STUGMB2/ AECC2	Technical Communication	2	0	0	20	20	40	60	100	2	AECC 2
Practical												
1	SPUGMB2/ C03	Fundamentals of Biochemistry Practical	0	0	2			25	25	50	2	C3
2	SPUGMB2/ C04	Basics of Immunology Practical	0	0	2			25	25	50	2	C4
3	SPUGMB2/ GE02	Bioinformatics Practical	0	0	2			25	25	50	2	AECC 2
Total										**550**	**20**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Microbiology 2nd Year
SEMESTER-III

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGMB3 /C05	Genetics	4	0	0	20	20	40	60	100	4	C5
2	STUGMB3 /C06	Bacteriology & Virology	4	0	0	20	20	40	60	100	4	C6
3	STUGMB3 /C07	Environmental Biotechnology	4	0	0	20	20	40	60	100	4	C7
4	STUGMB3 /SEEC1	Fermentation Technology	2	0	0	20	20	40	60	100	2	SEC1
5	STUGMB3 /GE3	Bioethics, Biosafety and IPR	4	0	0	20	20	40	60	100	4	GE3
Practical												
1	SPUGMB3 /C05	Genetics Practical	0	0	2			25	25	50	2	C5
2	SPUGMB3 /C06	Bacteriology & Microbiology Practical	0	0	2			25	25	50	2	C6
3	SPUGMB3 /C07	Environmental Biotechnology Practical	0	0	2			25	25	50	2	C7
4	SPUGMB3 /GE3	Bioethics, Biosafety and IPR Seminar	0	2	0			25	25	50	2	GE3
Total										**700**	**26**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Microbiology 2nd Year
SEMESTER-IV

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGMB4 /C08	Microbiology	4	0	0	20	20	40	60	100	4	C8
2	STUGMB4 /C09	Food Technology & Bioprocess technology	4	0	0	20	20	40	60	100	4	C9
3	STUGMB4 /C10	Basics of Genetic Engineering	4	0	0	20	20	40	60	100	4	C10
4	STUGMB4 /SEEC2	Basics of forensic science	2	0	0	20	20	40	60	100	2	SEC2
5	STUGMB4 /GE4	Plant Pathology	4	0	0	20	20	40	60	100	4	GE4
Practical												
1	SPUGMB4 /C08	Microbiology Practical	0	0	2			25	25	50	2	C8
2	SPUGMB4 /C09	Food technology & Bioprocess technology Practical	0	0	2			25	25	50	2	C9
3	SPUGMB4 /C10	Basics of Genetic Engineering Practical	0	0	2			25	25	50	2	C10
4	SPUGMB4 /GE4	Plant Pathology Practical	0	0	2			25	25	50	2	GE4
Total										**700**	**26**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Microbiology 3rd Year
SEMESTER-V

S. No	Course Code	Subject	Period			Evaluation Scheme			External Exam	Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total				
1	STUGMB5 /C11	Principle of Genomics And Proteomics	4	0	0	20	20	40	60	100	4	C11
2	STUGMB5 /C12	Elementary Molecular Biology	4	0	0	20	20	40	60	100	4	C12
3	STUGMB5 /DSC1	Medical Microbiology	4	0	0	20	20	40	60	100	4	DSC1
4	STUGMB5 /DSC2	Industrial Microbiology	4	0	0	20	20	40	60	100	4	DSC2
Practical												
1	SPUGMB5 /C11	Principle of Genomics and Proteomics Seminar	0	2	0			25	25	50	2	C11
2	SPUGMB5 /C12	Elementary Molecular Biology Practical	0	0	2			25	25	50	2	C12
3	SPUGMB5 /DSC1	Medical Microbiology Practical	0	0	2			25	25	50	2	DSC1
4	SPUGMB5 /DSC2	Industrial Microbiology Practical	0	0	2			25	25	50	2	DSC2
Total										**600**	**24**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

B.Sc. Microbiology 3rd Year
SEMESTER-VI

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	STUGMB 6/C11	Mycology	4	0	0	20	20	40	60	100	4	C13
2	STUGMB 6/C12	Entrepreneurship	4	0	0	20	20	40	60	100	4	C14
3	STUGMB 6/DSC3	Parasitology/ Transcriptomics and Metabolomics	4	0	0	20	20	40	60	100	4	DSC3
4	STUGMB 6/DSC4	Clinical Research	4	0	0	20	20	40	60	100	4	DSC4
Practical												
1	SPUGMB 6/C11	Mycology Practical	0	0	2			25	25	50	2	C13
2	SPUGMB 6/C12	Entrepreneurship Seminar	0	2	0			25	25	50	2	C14
3	SPUGMB 6/DSC3	Parasitology/ Transcriptomics and Metabolomics Seminar	0	2	0			25	25	50	2	DSC3
4	SPUGMB 6/DSC4	Clinical Research Seminar	0	2	0			25	25	50	2	DSC4
Total										**600**	**24**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

OVERALL CREDIT SCHEME

S. No.	SEMESTER	Theory Total	Practical Total	Subject Total	Total Credit
1	I	400	150	550	20
2	II	400	150	550	20
3	III	500	200	700	26
4	IV	500	200	700	26
5	V	400	200	600	24
6	VI	400	200	600	24
			Grand Total	**3700**	**140**

B.Sc. (H) Microbiology 1st Year
SEMESTER-I

BIO INSTRUMENTATION (STUGMB1/C01)

L	T	P
4	0	2

Course Name: Bio Instrumentation **Course Code:** STUGMB1/C01
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The students learn the physical principles of structure-function relationships in biological macromolecules such as proteins and nucleic acids, as well as the various approaches, techniques and instrumentation associated with structural biology.

Course Description:

This course presents the principles and applications of Biotechnology explaining the biomolecules and applications of biophysical methods. Students will be able to justify the need for buffers, describe how buffers are prepared, and calculate the amount of buffering agent needed when making a particular bufferOn successful completion of the course the students will be aware of Microscopic techniques, Electro physiological methods, Biomolecules structure determination using X-Ray diffraction.

Course Contents:

Unit I: General Biophysical methods: Measurement of pH, pOH, Buffer action, Isoelectric focusing.

Unit II: Separation & Identification of Materials: Concept of Chromatography (Partition Chromatography, Paper Chromatography, Adsorption Chromatography, TLC, GLC, Ion Exchange Chromatography, Gel Chromatography, HPLC, Affinity Chromatography); Electrophoresis (Gel Electrophoresis, Paper Electrophoresis).

Unit III: Centrifugation: Basic Principle of Centrifugation, Instrumentation of Ultracentrifuge (Preparative, Analytical), Factors affecting Sedimentation velocity, Standard Sedimentation Coefficient, Centrifugation of associating systems, Rate-Zonal centrifugation, sedimentation equilibrium Centrifugation.

Unit IV: Microscopy: Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, TEM, SEM.

Unit V: X-Ray Crystallography: X-ray diffraction, Bragg equation, Reciprocal lattice, Miller indices & Unit cell, Concept of different crystal structure, determination of crystal structure (concept of rotating crystal method, powder method). **Spectroscopy:** Basic concepts, principle, working, care & maintenance and applications of Raman Spectroscopy, NMR Spectroscopy and Absorption Spectroscopy.

Course Learning Outcomes (CLOs):
CLO-1: Enable the student to get sufficient knowledge in principles and applications of bio instruments.
CLO-2. To enable the students to learn the immuno techniques and radio labelling techniques.
CLO-3. To differentiate and analyze the biomedical signal sources.
CLO4. Describe the Basic concept of microscopic techniques such as Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, TEM, SEM.
CLO5. Explain the basic principle and application of X-Ray Crystallography and spectroscopy.

Text Books:

- Cromwell, L. and Weibell, F.J. and Pfeiffer, E.A., Biomedical Instrumentation and Measurement, Dorling Kingsley (2006) 2nd ed.
- Carr, J.J. and Brown, J.M., Introduction to Biomedical Equipment Technology, Prentice Hall (2000) 4th ed.
- Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.

Reference Books:

- Geddes, L.A., and Baker, L.E., Principles of Applied Biomedical Instrumentation, Wiley InterScience (1989) 3rd ed.
- Khandpur, R.S., Handbook of Biomedical Instrumentation, McGraw Hill (2003) 2nd ed.
- Webster, J.G., Medical Instrumentation Application and Design, John Wiley (2007) 3rd ed.
- Biophysical Techniques By Iain Campbell • 2012, 9780199642144, 0199642141, QUP Oxford.

Online links for study & reference materials:
https://microbenotes.com/category/instrumentation/
https://lecturenotes.in/download/material/18824-note-of-bioinstrumentation-by-nithya-biotech.
http://biomedikal.in/2009/12/lecture-notes-on-biomedical-instrumentation/

B.Sc. (H) Microbiology 1st Year
SEMESTER-I

ELEMENTARY CELL BIOLOGY (STUGMB1/C02)

L	T	P
4	0	2

Course Name: Elementary Cell Biology
Course Code: STUGMB1/C02
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

To provide students the knowledge about cellular content, organization, structures and functions. To impart basic understanding of development biology and interaction of cell with environment.

Course Description:
It is an introductory cell biology course. Topics include the structure of the cell and cell components, both eukaryotic and prokaryotic. The processes of DNA replication and gene expression including protein processing and routing. Photosynthesis, respiration, and chemotrophy as means of energy production. The cell cycle and its regulation. These topics will be covered in one semester having four-hour lectures and one two-hour laboratory work per week.

Course Contents:

Unit I: Basics of Cell Biology (Structure & Function): Discovery of cell and Cell Theory; Comparison between plant and animal cells; Cell wall; Plasma membrane; Modification of plasma membrane and intracellular junctions; Cytoskeleton; Protoplasm; Mitochondria; Chloroplast; ER; Golgi complex; Lysosome, endosome and microbodies; Ribosome; Centriole; Nucleus; Chemical components of a cell; Catalysis and use of energy by cells.

Unit II: Biogenesis of Cellular organelles: Biosynthesis of mitochondria, chloroplast, ER, Golgi complex; Biosynthetic process in ER and Golgi apparatus; Protein synthesis and folding in the cytoplasm; Degradation of cellular components.

Unit III: Chromosomes: Chemical composition, structural organization of chromatids, centromeres, telomeres, chromatin, nucleosome organization, eu- and heterochromatin, special chromosomes (e.g. polytene and lampbrush chromosomes), banding patterns in human chromosomes.

Unit IV: Membrane Structure & Transport: Models of membrane structure, Membrane lipids, proteins and carbohydrates; Solute transport by Simple diffusion, Facilitated diffusion and Active transport; Cell adhesion

Unit V: Cell Cycle: An overview of cell cycle; Mitosis and meiosis; Components of cell cycle control system; Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer, Viral disease (AIDS) & Organ transplant.

Course Learning Outcomes (CLOs):
After completion of the course, students will have a basic understanding of cell biology and will be able to demonstrate/explain:

CLO 1: To differentiate between animal as well as plant cells, to recognize and identify the function(s) of the following: centrioles, chromatin, Golgi apparatus, lysosome, microfilaments, microtubules, mitochondrion, nucleus, peroxisome, plasma membrane, rough and smooth endoplasmic reticulum, and ribosomes. An understanding of the ability of enzymes to facilitate chemical reactions. Explain how catalysts, including enzymes, affect and are affected by the chemical reactions in which they participate.

CLO 2: Protein sorting and transport of protein. Understanding of the biochemical processes of photosynthesis, glycolysis, citric acid cycle, and oxidative phosphorylation. Define cellular respiration and identify the cellular locations of the various stages of cellular respiration. Distinguish between the light reactions and the Calvin cycle of photosynthesis.

CLO 3: Chemical composition of nucleic acids (DNA/RNA). Structural Organization of DNA, chromatids, chromosome. Describe the various types of chromosomes on the basis of centromeric position. Chromosomal banding patterns and its application.

CLO 4: Cellular membrane structure and function. Various models of cellular membrane. Composition of cellular membranes. Transport across membrane by simple diffusion, facilitated diffusion and Active transport. Interaction between cells through cell adhesion molecules.

CLO 5: An understanding of how cells grow and divide. Describe the major events of each of the stages of the cell cycle (interphase, G1, G2, S, mitosis, prophase, prometaphase, metaphase, anaphase, telophase, mitotic phase, and cytokinesis). Cell Death and various process associated with cell death.

Text Books:

- Jeff Hardin, Gregory Bertoni, Lewis J. Kleinsmith, Wayne M. Becker. Becker's World of the Cell, 8th edition, Benajmin Cummings, 9780321689634, 0321689631, (2012).
- EDP De Robertis and EMF De Robertis. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, 9780781734936, 0781734932, (2006)

Reference Books:

- Gerald Karp, Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc, 9780470483374, 0470483377 (2010)
- G.M. Cooper, and R.E. Hausman. The Cell: A Molecular Approach. 5^{th} Edition. ASM Press 780878931064, 0878931066 (2009)

Online links for study and reference materials:

- http://www.open2study.com/cellbiology
- https://nptel.ac.in/courses/102103012/
- Cell Biology - Course (swayam2.ac.in)

B.Sc. (H) Microbiology 1st Year
SEMESTER-I

FUNDAMENTALS OF COMPUTER APPLICATION (STUGMB1/GE1)

L	T	P
4	0	2

Course Name: Fundamentals of Computer Application **Course Code:** STUGMB1/GE1
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of computer application. This course will introduce the students with fundamentals of hardware, software and programming.

Course Contents:

Unit-I: Fundamental: H/W and S/W part of computer system, Computer Block Diagram, online processing, time sharing system, real time system, batch system, multiprogramming, multiprocessing, SPOOLING, distributed data processing. Element of computer file, types of files, file processing activities, file design factors, access methods, pros and cons of file organization.

Unit-II: MS office I: Introduction to MS Office; Introduction to MSWord; Features & area of use. Working with MS Word.; Menus & Commands; Toolbars & Buttons; Shortcut Menus, Wizards & Templates; Creating a New Document; Different Page Views and layouts;

Unit-III: MS office II: Applying various Text Enhancements; Working with – Styles, Text Attributes; Paragraph and Page Formatting; Text Editing using various features ; Bullets, Numbering, Auto formatting, Printing & various print options.

Unit-IV: MS Excel: Introduction and area of use; Working with MS Excel.; concepts of Workbook & Worksheets; Using Wizards; Various Data Types; Using different features with Data, Cell and Texts; Inserting, Removing & Resizing of Columns & Rows

Unit-V: Working with Data & Ranges; Column Freezing, Labels, Hiding, Splitting etc.; Using different features with Data and Text; Use of Formulas, Calculations & Functions; Cell Formatting including Borders & Shading; Working with Different Chart Types; Printing of Workbook.

Course Learning Outcomes (CLOs):

CLO1: Problem solving through computer programming,
CLO2: Familiarity of programming environment in Linux operating system.
CLO3: Ability to use different memory allocation methods.
CLO4: Ability to deal with different input/output methods.
CLO-5: Ability to use different data structures.

Text Books:
- Joe Habraken, Microsoft Office 2000, 8 in 1 by, Prentice Hall of India
- Deitel & Deitel: C How to Program (Prentice Hall), 1996.
- Yashwant Kanetker, Let us C, BPB Publications.

Reference Books:

- R. B. Patel, Fundamental of Computers and Programming in C, Khanna Book Publishing Company PVT.LTD. Delhi, India, 1st edition, 2008, ISBN: 13: 978-81-906988-7-0, pp. 1-962.
- Gottfried, Programming with C, Tata McGraw Hill. Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd Ed. Prentice Hall of India.

Online links for study & reference materials:
https://lecturenotes.in/download/note/18532-note-for-cprogramming-by-anshuman

B.Sc. (H) Microbiology 1st Year
SEMESTER-I

ENVIRONMENTAL SCIENCES- EVS (STUGMB1/AECC1)

L	T	P
2	0	0

Course Name: Environmental Sciences **Course Code:** STUGMB1/AECC1
Course Credit Hour: 2 hrs **Total Contact hour:** 30 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of Environmental Sciences. People working in industries or elsewhere essentially require the knowledge of environmental science to enable them to work and produce the most efficient, economical and eco-friendly finished products.

Course Contents:

Unit I: Natural Resources: Forest resources: Use and over-exploitation, deforestation, case studies. Timberextraction, mining, dams and their effects on forests and tribal people, (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water,dams-benefits and problems. (c) Mineral resources: Use and exploitation, environmentaleffects of extracting and using mineral resources, case studies. (d) Food resources: Worldfood problems, changes caused by agriculture and overgrazing, effects of modernagriculture, fertilizer-pesticide problems, water logging salinity, case studies. (e) Energyresources: Growing energy needs, renewable and non- renewable energy sources, use ofalternate energy sources (f) Land resources: Land as a resource, landdegradation, man induced landslides, soil erosion and desertification.

Unit II: Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumersand decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, foodwebs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem :- (a) Forest ecosystem, (b) Grassland ecosystem, (c)Desert ecosystem, (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III: Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and option values. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity : In-situ and Ex situ conservation of biodiversity.

Unit VI: Environmental Pollution: Definition, Causes, effects and control measures of: (a) Air pollution, (b) Water pollution,(c) Soil pollution, (d) Marine pollution (e) Noise pollution, (f) Thermal pollution, (g) Nuclearhazards. Human health risks; Solid waste management: Control measures of urban and industrial waste. Pollution case studies.

Unit V: Environmental Policies & Practices: Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air and Water Wildlife Protection Act; Forest Conservation Act.; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept immune system and its importance.
CLO2. Discuss Structure, Functions and Properties of different type of Immune Cells and immune organs.
CLO3. Describe the Basic characteristics of an antigen and Structure, Types, Functions and Properties of antibodies.
CLO4. Explain the Major Histocompatibility Complex I & II molecules, basics of Components of the Complement system.
CLO5. Discuss the basic concept of Generation of Immune Response, in particular Generation of Humoral Immune and Cell Mediated Immune Response.

Text Books:

- S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi.
- C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011
- Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099
- Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.

Reference Books:

- O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi
- Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.
- Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic press, 2011.

Online links for study & reference materials:
www.cpcp.nic.in
www.cpcp.gov.in
www.conserve-energy-future.com

B.Sc. Microbiology 1st Year
SEMESTER-II

FUNDAMENTALS OF BIOCHEMISTRY (STUGMB2/C03)

L	T	P
4	0	2

Course Name: Fundamentals of Biochemistry
Course Code: STUGMB2/C03
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

The **course aims** to provide an advanced understanding of the core principles and topics of **Biochemistry** and their experimental basis, and to enable students to acquire a specialised knowledge and understanding of selected aspects by means of a stem/branch lecture series and a research project.

Course Description:
This course introduces students to the general families of biomolecules that comprise the science of biochemistry and to the principles that integrate biochemistry with other chemical and biological disciplines. They acquire knowledge in the quantitative and qualitative estimation of biomolecules.

Course Contents:

Unit 1: Classification and Study of macromolecules: Introduction and classification of Carbohydrate. Lipids, amino acids and Nucleic acid. Interaction between protein-protein, protein-nucleic acid and nucleic acid- nucleic acid. Biochemistry and its scope. Structure, general properties and function of cellular macromolecules.

Unit 2: Carbohydrate metabolism: Glucose Metabolism: Glycolysis; fermentation; anaerobic fate of pyruvate; control of glycolysis; metabolism of hexoses other than glucose; pentose phosphate pathway. **Citric Acid Cycle**: Synthesis of acetyl-coenzyme A; enzymes of the citric acid cycle; regulation of the citric acid cycle; glyoxylate pathway; electron transport and oxidative phosphorylation. Glycogen Metabolism and Gluconeogenesis: Glycogen breakdown; glycogen synthesis; control of glycogen metabolism. Starch Metabolism: Starch synthesis; storage and degradation; abnormal carbohydrate metabolism.

Unit 3: Lipid Metabolism: Digestion; absorption and transport; fatty acid oxidation; ketone bodies; regulation of fatty acid metabolism; cholesterol biosynthesis; fatty acid biosynthesis.

Unit 4: Nitrogen Metabolism: Amino acid biosynthesis (L-Serine, L-Asparagine, L-Alanine, L-Tyrosine, L-Methionine); Nitrogen fixation in plants and microorganisms; nitrate reduction; inborn errors of L-Phenylalanine and L-Tyrosine metabolism; essential amino acids; glucogenic &ketogenic amino acids.

Unit 5: Nitrogen Excretion: The urea cycle; inborn errors involving urea synthesis; catabolism of purine and pyrimidine nucleotides; disorders involving purine metabolism.

Course Learning Outcomes:

C01: Understanding of Biochemistry as a discipline and milestone discoveries in life sciences that led to establishment of Biochemistry as separate discipline

C02: Fundamental properties of elements, their role in formation of biomolecules and in chemical reactions within living organisms

C03: Understanding of the concepts of mole, mole fraction, molarity, etc. and to apply them in preparations of solutions of desired strengths

C04: Unique property of water as a universal solvent and its importance in biological system

C05: Understanding of concepts of acids, bases, indicators, pKa values, etc. Acquiring skill to determine pKa value of amino acids.

Text Books:

- A.L., Lehninger, PRINCIPLES OF BIOCHEMISTRY (1982), Worth Publishers, Inc. New York, ISBN: 9780716743392, 0716743396
- L. Stryer, BIOCHEMISTRY (1995) W.H. Freeman Press, San Francisco, USA, ISBN: 9781319248086, 131924808X

Reference Books:

- Voet, D. and Voet, J.G., Biochemistry, (2004). 3rd Edition, John Wiley & Sons, Inc.USA,
- U. Sathyanarayana, Biochemistry by Books and Allied (P) Ltd. Kolkata, ISBN 0-87893-214-3, (2014), ISBN: 9788187134800, 8187134801

Online links for study & reference materials:

https://www.khanacademy.org/test-prep/mcat/biomolecules
https://nptel.ac.in/courses/104/105/104105076/

B.Sc. Microbiology 1st Year
SEMESTER-II

BASICS OF IMMUNOLOGY (STUGMB2/C04)

L	T	P
4	0	2

Course Name: Basics of Immunology
Course Code: STUGMB2/C04
Course Credit Hour: 4 hrs
Total Contact hour: 42 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of Immunology. This course will introduce the students with basic principles of immunology and recent advancements in the field of host immunity, including innate and adaptive immunity.

Course Description:

This course is mainly focused on the host immune system which includes basic concept of immunology, Type of immune system, Classes of immune cells, Antigen-Antibody interaction immune cell tolerance, vaccine technology and other relevant topics.

Course Contents:

Unit 1: Introduction: Basic concepts of Innate and Adaptive immune system, Immune Cells and Immune Organs.

Unit 2: Structure, Functions and Properties of: Immune Cells: Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs: Bone Marrow, Thymus, Lymph Node, Spleen, etc.

Unit 3: Antigens and Antibodies: Antigen: Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens, Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants. **Antibodies:** Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; immunodiffusion, immunoelectrophoresis, ELISA, RIA, Monoclonal and Chimeric antibodies.

Unit 4: Major Histocompatibility Complex: Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocyticpathways), Complement System: Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement activation.

Unit 5: Generation of Immune Response: Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells), Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals), Killing Mechanisms by CTL and NK cells, Introduction to tolerance; Vaccines.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept immune system and its importance.
CLO2. Discuss Structure, Functions and Properties of different type of Immune Cells and immune organs.
CLO3. Describe the Basic characteristics of an antigen and Structure, Types, Functions and Properties of antibodies.
CLO4. Explain the Major Histocompatibility Complex I & II molecules, basics of Components of the Complement system.
CLO5. Discuss the basic concept of Generation of Immune Response, in particular Generation of Humoral Immune and Cell Mediated Immune Response.

Text Books:

- Immunology, V Edition - Richard A.Goldsby, Thomas. J. Kindt, A. Osborne, JanisKuby, 2003. W.H. Freeman and company.
- Topley and Wilson principles of bacteriology, Virology and immunology, G. Wilson, A.Miles, M.T.Paker, 2004.
- Arnold, HeinemanAbbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
- Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition WileyBlackwellScientific Publication, Oxford.

Reference Books:

- Basic and Clinical Immunology, 2010, D.P. Stities and J.D. Stobo.
- Vaccines, New Approaches to immunization, F.Brown, KA Lerner, 1986. Cold spring Harborolab.Goldsby RA, Kindt TJ, Osborne BA. (2007).
- Kuby's Immunology. 6th edition W.H. Freeman andCompany, New York.
- Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

Online links for study & reference materials:

https://nptel.ac.in/courses/102103038/
https://nptel.ac.in/courses/102103041/18

B.Sc. Microbiology 1st Year
SEMESTER-II

BIOINFORMATICS (STUGMB2/GE2)

L	T	P
4	0	2

Course Name: Bioinformatics
Course Credit Hour: 4 hrs
Course Code: STUGMB2/GE2
Total Contact hour: 60 hrs

Course Objective:

This course is beneficial for students to understand the principles of analyzing biological data, building models and testing hypotheses using computer science algorithms. This course is a survey of algorithms and tools in biological sequence analysis, genome-wide disease association, and precision medicine. Basic concept machine learning and its application in the analysis of biological data are also included in this course.

Course Contents:

Unit 1: Introduction to Bioinformatics: Genomics and Proteomics. Bioinformatics – Online tools and offline tools. Biological databases. Types of data bases – Gen bank, Swiss port, EMBL, NCBL, and PDB. Database searching using BLAST and FASTA.

Unit 2: Sequence and Phylogeny analysis: Sequence Alignments, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.

Unit 3: Dynamic programming: Gene and Genome annotation – Tools used. Physical map of genomes. Molecular phylogeny - Concept methods of tree construction.

Unit 4: Bioinformatics tools in proteomics: Introduction, strategies and methods. Bioinformatics tools in proteomics. Application of proteomics. Protein-protein interactions.

Unit 5: Basic introduction of Proteomics technologies: Basic introduction of Proteomics technologies; 2D-electrophoresis, MALDI-TOF mass spectrometry. Biological Protein Databases: PDB, SWISSPROT, TREMBL. Protein secondary structure prediction. Protein 3D structure prediction.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept immune system and its importance.
CLO2. Discuss Structure, Functions and Properties of different type of Immune Cells and immune organs.
CLO3. Describe the Basic characteristics of an antigen and Structure, Types, Functions and Properties of antibodies.
CLO4. Explain the Major Histocompatibility Complex I & II molecules, basics of Components of the Complement system.
CLO5. Discuss the basic concept of Generation of Immune Response, in particular Generation of Humoral Immune and Cell Mediated Immune Response.

Text Books:

- Saxena Sanjay (2003) A First Course in Computers, Vikas Publishing House
- Pradeep and Sinha Preeti (2007) Foundations of Computing, 4th ed., BPB Publications
- Lesk M.A.(2008) Introduction to Bioinformatics . Oxford Publication, 3rd International StudentEdition

Reference Books:

- Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications,genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication
- Primrose and Twyman (2003) Principles of Genome Analysis & Genomics. Blackwell

Online links for study & reference materials:
https://microbenotes.com/category/instrumentation/
https://lecturenotes.in/download/material/18824-note-of-bioinstrumentation-by-nithya-biotech.
http://biomedikal.in/2009/12/lecture-notes-on-biomedical-instrumentation/

B.Sc. Microbiology 2nd Year
SEMESTER-III

GENETICS (STUGMB3/C05)

L	T	P
4	0	2

Course Name: Genetics
Course Credit Hour: 4 hrs

Course Code: STUGBT3/C05
Total Contact hour: 60 hrs

Course Objective:

The objective of this course is to build knowledge on the fundamentals of genetics, heredity, or inheritance. To build the foundation on the understanding of biological principles.

Course Description:
This course provides a detailed understanding of Mendelian and non-Mendelian inheritance; various techniques and methodologies that decipher genetic recombination, gene mapping and other relevant topics.

Course Contents:

Unit I: Prokaryotic Genomes - Physical organization of bacterial genomes; Structure of the bacterial nucleoid, Replication and partitioning of the bacterial genome and Genome of Archaea.

Unit 2: Mechanism of genetic exchange: Plasmid and bacterial sex, Types of plasmids (F Plasmid: a Conjugate plasmid', Mobilization of Non-conjugative plasmid, R plasmid, Col plasmid Copy number and incompatibility), Episomes. Transposable elements (Insertion sequence and transposons, Integrons and Antibiotic-Resistance cassettes, Multiple Antibiotic Resistant bacteria, Mu–virus); Bacterial Genetics (Mutant phenotype, DNA mediated Transformation; Conjugation (Cointegrate Formation and Hfr Cells, Time–of–Entry Mapping, F' Plasmid); Transduction (Generalized transduction, Specialized Transduction)-gene mapping.

Unit 3: Molecular Mechanism of gene regulation in prokaryotes - Transcriptional regulation in prokaryotes (inducible and repressible system, positive regulation and negative regulation); Operon concept – lac, trp, Ara operons.

Unit 4: Bacteriophages: Stages in the Lytic Life Cycle of a typical phage, Properties of a phage infected bacterial culture, Specificity in phage infection, *E. coli* PhageT4, *E.coli* Phage T7, E.coli phage lambda, Immunity to infection, Prophage integration, Induction of prophage, Induction & Prophage excision, Repressor, Structure of the operator and binding of the repressor and the Cro product, Decision between the lytic and lysogenic Cycles, Transducing phages, *E.coli* phage phiX174, The lysogenic Cycle.

Unit 5: Bacteriophage Genetics: Plaque Formation and Phage Mutants, Genetic recombination in the lytic cycle, (concept of recon, muton, cistron)

Course Learning Outcomes (CLOs):
After successful completion of the course the students:

CLO 1. Will have knowledge of Mendelian, non- Mendelian inheritance and an insight of Gene concept and alleles

CLO 2. Will have an understanding of various methods employed in Gene mapping

CLO 3. Insight of differentiation of sex in plants and animals and various diseases associated with improper differentiation of sex. Evaluate difference between extra-chromosomal inheritances from chromosomal inheritance.

CLO 4. Biochemical changes that lead to difference in inheritance of characters & their expression

CLO 5. Various techniques involved in studying human genetics and their quantification

Text Books:
- P. K. Gupta, GENETICS. Rastogi Publication. 9788171338429, 8171338429
- Strickberger M. W., Genetics. Mac Millan Publishing Co., 9780024180902

Reference Books:
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R., "Molecular Biology of the Gene", 5th Ed., Pearson Education, 9780321762436, 0321762436

Online links for study and reference materials:
- www.biologydiscussion.com
- www.khanacademy.org
- https://www.ncbi.nlm.nih.gov/pmc

B.Sc. Microbiology 2nd Year
SEMESTER-III

BACTERIOLOGY AND VIROLOGY (STUGMB3/C06)

L	T	P
4	0	2

Course Name: Bacteriology and Virology **Course Code:** STUGMB3/C06
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

Microbiology and Virology - Amidst the current conditions of the global pandemic, we all know the importance of scientists who are capable of learning and implementing the measures required for handling such microorganisms capable of affecting human life. With the advancement in technologies such as electron microscopy and other visual aids, more and more research and studies along with other productive activities are possible in the field of "Microbiology and Virology".

Course Description:

This course focus on the basis of Bacteriology and virology. It basically covers the ultastructure of bacterial, biochemical testing (IMVIC TESTS). It also covers the basis of microbial genetics as well as Classification and replication of viruses.

Course Contents:

Unit 1 : Introduction to Bacteriology: Ultra structure of bacterium & its parts, nutrition requirements & growth curve.History (Louis Pasteur, Robert Koch, Antonie Van Leeuwenhoek, Joseph Lister) Father of (microbiology, bacteriology, virology), aseptic surgery, Robert Hooke.Instrumentation of microbiology (Autoclave, hot air oven, microscope, incubator and laminar air flow) their working principle care & maintenance & types.Classification of bacteria on various things (temperature, morphology, flagella, energy source, pH, cell wall). Sterilization and Infection.

Unit 2: Culture media- inoculation techniques, culture media types and examples, storing and stocking of bacterial culture. Biochemical reactions for Identification of microbes: Colony characteristics, staining technique (Gram Staining, AFB staining, Negative Staining, Special staining), biochemical reactions (IMViC), enzyme tests (Urease, oxidase, coagulase, catalase) carbohydrate utilization test.

Unit 3: Basis of microbial genetics (conjugation, transformation, transduction)

Unit 4: Gram +ve – *Staphylococcus, Streptococcus, Clostridium, Corynebacterium. Gram –ve bacteria: E coli, Klebsiella, Pseudomonas,Mycoplasma*.

Unit 5: Introduction to virology: Classification of viruses, ultrastructure of viruses, replication of viruses, laboratory diagnosis of viruses, virions and prions. Detail study of (Retro virus, TMV, Rhabdo virus (rabies virus), Polio virus.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept of bacteriology, Morphology and Ultra structure of bacteria and its importance.
CLO2. Discuss the general account of prokaryotic genome and plasmid, Conjugation: F-factor, sex Pilli, Hfr cells, mechanism and its role in development of multi drug resistance.
CLO3. Describe the basic characteristics of general characteristics of Viruses, morphological variations, envelope, capsids and nucleic acids of viruses, replication and classification of viruses, viroids, prions.
CLO4. Discuss the basic concept of bacteriophage, detailed description of lambda phage, M13 phage and T phage. One step growth.

Text Books:

- Black, J.G. (2011) Microbiology: principle and exploration. 7th edition, Wiley publications.
- Cann, A (2011) Principle of molecular Virology. Academic press London
- Microbiology and Parasitology PMFUMicrobiology and Parasitology PMFU B. S. Nagoba, ASHA PICHARE M.B.B.S. M.D. (MICROBIOLOGY)B. S. Nagoba, ASHA PICHARE M.B.B.S. M.D.

Reference Books:

- Davis, B.D Delbecco. R. Eisen, H.N Ginsberg, H.S and Wood, W.B (2007) Microbiology, IInd edition. Vol. II. Harper and Row
- Flint S.J; Enquist, L.W; Skalka, AMK (2004) Principles of Virology; molecular biology; pathogenesis and control, ASM press
- Paniker, CJK (2013) A textbook of Microbiology, 9th edition, University Press
- Stainer, R.Y, Ingraham, J.L, Wheelis, M.L, and Painter, P.R (2013). General Microbiology, MacMillan Press Ltd. UK

Online links for study & reference materials:
https://europe.microbiologyconferences.com
https://nptel.ac.in/courses/102103041/18

B.Sc. Microbiology 2nd Year
SEMESTER-III

ENVIRONMENTAL BIOTECHNOLOGY (STUGMB3/C07)

L	T	P
4	0	2

Course Name: Environmental Biotechnology **Course Code:** STUGMB3/C07
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

To offer insights on the basic ecological and evolutionary theories and their interrelationships in the environment. Evolution- Definition, scope and history, Darwinian view of life.

Course Description:

This course presents the Study and the Management of the Environment Goals: To make the student to understood Ecology and Conservation of the Environment Objectives: On successful completion of the subject the student should have understood Ecosystem, energy flow and Uses and values of Biodiversity

Course Contents:

Unit 1: Microorganisms and their Habitats: Structure and function of ecosystems; Terrestrial Environment: Soil profile and soil microflora; Aquatic Environment: Microflora of fresh water and marine habitats; Atmosphere: Aeromicroflora and dispersal of microbes; Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body.Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic& osmotic pressures, salinity, & low nutrient levels. Microbial succession in decomposition of plant organic matter

Unit 2: Microbial Interactions: Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism,predation, Microbe-Plant interaction: Symbiotic and non symbiotic interactions. Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic luminescent bacteria

Unit 3: Biogeochemical Cycling: Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin, Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction, Phosphorus cycle: Phosphate immobilization and solubilisation, Sulphur cycle: Microbes involved in sulphur cycle, Other elemental cycles: Iron and manganese

Unit 4: Waste Management: Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill), Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary, sewage treatment

Unit 5: Microbial Bioremediation: Principles and degradation of common pesticides, organic (hydrocarbons, oil spills) and inorganic (metals) matter, biosurfactants.

Course Learning Outcomes:

CLO1. Provides knowledge about basic terminologies used in environmental biotechnology

CLO2. Explain the microbial processes and growth requirements underlying the activated sludge process, nitrification, denitrification, enhanced phosphorus removal, and anaerobic digestion

CLO3. Role of biogeochemical cycle concept and its applications in ecological balance

CLO4.To understand the knowledge of microbial clean up the polluted environmental biotechnology

CLO5. Evaluate the potential for biodegradation of organic pollutants, taking microbial and physical/chemical environments, as well as the chemical structure of the compound itself, into consideration

Text Books

- Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition.Pearson/ Benjamin Cummings
- Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, AcademicPress

Reference Books:

- Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, AcademicPress
- Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA

Web References/ NPTEL:

http://freebookcentre.net/Biology/Ecology-Books.html
www.khanacademy.org
www.biologydiscussion.org

FERMENTATION TECHNOLOGY (STUGMB3/SEEC1)

L	T	P
2	0	0

Course Name: Fermentation Technology
Course Code: STUGMB3/SEEC1
Course Credit Hour: 2 hrs
Total Contact hour: 30 hrs

Course Objective:

This course introduces various aspects of applied and industrial microbiology. The course helps the students to learn every important upstream and downstream components of fermentation process including strain selection, development, media design, formulation and recovery of products. Additionally, the course can educate the students about fermenter design, different types of fermentations and also the current trend of fermentation process in biotech-industry. Overall, the course helps in the student's exposure on industrial applications of bioprocesses.

Course Description:

To impact knowledge about biological and biochemical technology, with a focus on biological products, the design and operation of industrial practices

Course Contents:

Unit 1: Introduction to Fermentation technology: History, Scope and Development of Fermentation technology; Isolation and screening of industrially important microorganisms – primary and secondary screening; Maintenance of Strains; Strain improvement: Mutant selection and Recombinant DNA technology.

Unit 2: Fermentation media: Natural and Synthetic media; Basic components of an media (Carbon sources; Nitrogen sources; Vitamins; Minerals; Anti-foaming agents); Role of buffers in media; Process of aeration, and agitation.

Unit 3: Fermenter design: Basic designs of Fermenter; Type of fermenters: Wald of, Tower, Deepjet, Cyclone column, Packed tower and airlift fermenter; Scale up study and Product development; Down-stream processing and Product recovery; Regulation and safety.

Unit 4: Production of Microbial Products: Production of alcohol; Organic acid – Citric acid; Antibiotic – Penicillin, Amino acid – Glutamic acid; Vitamin – B1; Single Cell Protein (SCP).

Course Learning Outcomes (CLOs):

CLO1. The students shall get an adequate knowledge on evaluate factors that contribute in enhancement of cell and product formation during fermentation process..
CLO2. Understand the kinetics of cell and product formation in batch, continuous and fed-batch cultures and different types of fermenters.
CLO3. Students should get enough information on Basic designs of Fermenter; Type of fermenters
LO4. Discuss the protocol of the production of alcohol, organic acid, antibiotic, amino acid and other biological materials

Text Books:

- PF Stanbery, A. Whitaker and Steve Hall, Principles of Fermentation Technology, Third Edition, Elesvier (2016), ISBN No. 9781483292915, 1483292916
- M Shuler and F. Kargi, Bioprocess Engineering Basic Concepts, Prentice Hall Press (2015), ISBN No. 9781292025995, 1292025999

Reference Books:

- H C. Vogel and C M. Todaro, Fermentation and Biochemical Engineering Handbook, 2nd Editions, Elesvier (2014), ISBN No. 9780815517139, 0815517130

Online links for study & reference materials:
https://www.khanacademy.org/test-prep/mcat/biomolecules
https://nptel.ac.in/courses/104/105/104105076/

B.Sc. Microbiology 2nd Year
SEMESTER-III

BIOETHICS, BIOSAFETY AND IPR (STUGMB3/GE3)

L	T	P
4	2	0

Course Name: Bioethics, Biosafety and IPR
Course Code: STUGMB3/SEC1
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

To apprise the students of the various societal, governance and regulatory issues in biotechnology with special emphasis on ethics, safety and intellectual property rights. Through this course, the students develop a perspective on the importance of these aspects in the success of biotechnology products and services in the market. At the end of the course, they should be able to apply this perspective and the specific principles, laws, regulations etc., in academic and industrial settings for regulatory oversight and enforcement.

Course Description:

This course is mainly focused on the Bioethics, Biosafety and Intellectual Property Rights which includes basic concept of patents, patent regime (in India and abroad) registration aspects and other details.

Course Contents:

Unit 1: Biosafety: Introduction; biosafety issues in biotechnology; Biological Safety Cabinets & their types; Primary Containment for Biohazards; Biosafety Levels of Specific Microorganisms

Unit 2: Biosafety Guidelines: Biosafety guidelines and regulations (National and International); GMOs/LMOs- Concerns and Challenges; Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of International Agreements - Cartagena Protocol. **AERB/RSD/RES:** Guidelines for using radioisotopes in laboratories and precautions**.**

Unit 3: Introduction to Intellectual Property: Patents, Types, Trademarks, Copyright & Related Rights, Industrial Design and Rights, Traditional Knowledge, Geographical Indications- importance of IPR – patentable and non patentables – patenting life – legal protection of biotechnological inventions – World Intellectual Property Rights Organization (WIPO).

Unit 4: Grant of Patent and Patenting Authorities: Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; An introduction to Patent Filing Procedures; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies, Rights and Duties of patent owner.

Unit 5: Agreements and Treaties: GATT, TRIPS Agreements; Role of Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty on international recognition of the deposit of microorganisms; UPOV & Brene conventions; Patent Co-operation Treaty (PCT); Indian Patent Act 1970 & recent amendments.

Course Learning Outcomes (CLOs):

CLO1. The students shall get an adequate knowledge on patent and copyright. This provide further way for developing their idea or innovations.
CLO2. Identify the role of regulatory committees in controlling the risk.
CLO3. Students should get enough information on ethical issues linked to research on animal models, transgenics, clinical trials.
CLO4. Students to consider Intellectual Property (IP) as a career option as IP Counsel/Patent Examiner/Patent agent.

Text Books:

- Singh K K (2015). Biotechnology and Intelectual Property Rights: Legal and Social Impliocations, Springer India.
- Senthil Kumar Sadhasivam and Mohammed Jaabir, M. S. 2008. IPR, Biosafety and biotechnology Management. Jasen Publications, Tiruchirappalli, India.

Reference Books:

- Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
- Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
- V Sreekrishna, 2017. Bioethics and Biosafety in Biotechnology by New Age International publishers.

Online links for study & reference materials:
http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

B.Sc. Microbiology 2nd Year
SEMESTER-IV

MICROBIOLOGY (STUGMB4/C08)

L	T	P
4	0	2

Course Name: Microbiology
Course Code: STUGMB4/C08
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

This course focus on the basis of applied microbiology technology and their techniques. It basically covers the Air microbiology, sewage microbiology, water microbiology etc. It also covers the scope and importance of sources of contamination of milk, desirable and undesirable changes in milk, milk borne diseases, Microbial examination of water, Water borne diseases etc.

Course Description:

Microbiology course involves the study of microorganisms with particular emphasis on the biology of bacteria, viruses, fungi and protozoan parasites. You will also cover aspects of the biochemistry, physiology and genetics of microorganisms. Introduction to Microbiology is appropriate for students with some background in biology and chemistry whose career path intersects the study of microbes or simply have an interest in microbiology. This course introduces the basic principles of microbiology examining the microbes that inhabit our planet and their effect on the biosphere. Introduction to Microbiology explores this impact through the lens of all areas of microbiology.

Course Contents:

Unit 1: Historical developments: Discovery of microorganisms, Spontaneous Generation Controversy, Germ theory of fermentation, Germ theory of disease.

Unit 2: Air Microbiology: Definition and composition of air, sources of microorganisms in air, significance of microorganisms in air, droplet, droplet nuclei and droplet infection, air borne diseases, enumeration of microorganisms in air, control of microorganisms in air, air pollution.

Unit 3: Water Microbiology: Types of water, Sources of microorganisms in water, Significance of microorganisms in water, Fecal contamination of water, Index of water pollution, Different indicator microorganisms, Coliform bacteria, Microbial examination of water, Water borne diseases

Unit 4: Sewage Microbiology: Definition of sewage, composition and strength of sewage (BOD and COD), Microbiology of sewage, Domestic sewage treatment, Municipal sewage treatment, Water purification, Water reclamation.

Unit 5: Milk Microbiology: Definition and composition of milk, sources of contamination of milk, desirable and undesirable changes in milk, milk borne diseases, bacteriological examination of milk, reductase test, pasteurization of milk, application of microorganisms in dairy industry (examples and microflora).

Course Learning Outcomes: (CLOs):

CLO1. History of air microbiology and significance of microorganisms in air, water, sewage and soil.
CLO2. Micro-organisms in natural food products and their control.
CLO3. Scope and importance of Microbial examination of air, water and soil.
CLO4. Introduction to Water purification, Water reclamation.
CLO5. Objectives, importance and functions of Milk quality and milk borne diseases.

Text Books:

- Air Microbiology An environment And Health Prospective by Aithal, Wakte & Manwar. Cinnamonteal print and publishing Margao, Goa-403601
- Fundamental principles of bacteriology by A.J. Salle.

Reference Books:

- Fundamentals of Microbiology by Martin Frobisher
- General Microbiology by Stanier. Ingraham, Wheelis, Painter: Macmillan Press Ltd.

Online links for study & reference materials:
www.microbiologysummit.com
https://biopharmaceutics.pharmaceuticalconferences.com

B.Sc. Microbiology 2nd Year
SEMESTER-IV

FOOD TECHNOLOGY & BIOPROCESS TECHNOLOGY (STUGMB4/C09)

L	T	P
4	0	2

Course Name: Food and bioprocess technology
Course Code: STUGMB4/C09
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

This course focus on the basis of bioprocess technology and their techniques. It basically covers the spoilage of food stuffs and food processing. It also covers the scope and importance of packaging and functions of quality control, the essential prerequisites for preservation of food stuffs and preserving techniques.

Course Description:

Food Technology is a science branch that deals with the techniques involved in production, processing, preservation, packaging, labeling, quality management, and distribution of food products. To impart knowledge on different configurations of bioreactors, optimization and fermentation process control, which are required for novel bioprocess applications such as in food, environment, pharmaceutics and tissue culture systems.

Course Contents:

Unit 1: Foods as a substrate for microorganisms: Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general.

Unit 2: Microbial spoilage of various foods: Principles, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods. Food sanitation and control: HACCP, Indices of food sanitary quality and sanitizers

Unit 3: Principles and methods of food preservation: Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO2, nitrite and nitrates, ethylene, oxide, antibiotics and bacteriocins.

Unit 4: Fermented foods: Dairy starter cultures, fermented dairy products: yogurt, acidophilus milk, kumiss, kefir, dahi and cheese, other fermented foods: dosa, sauerkraut, soy sauce and tampeh, Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market.

Unit 5: Food borne diseases (causative agents, foods involved, symptoms and preventive measures): Food intoxications: *Staphylococcus aureus*, *Clostridium botulinum* and mycotoxins; Food infections: *Bacillus cereus*, *Vibrio parahaemolyticus*, *Escherichia coli*, *Salmonellosis*, *Shigellosis*, *Yersinia enterocolitica*, *Listeria monocytogenes* and *Campylobacter jejuni*. Cultural and rapid detection methods of food borne pathogens in foods.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic background of microbiology of food stuffs.
CLO2. Discuss the Micro-organisms in natural food products and their control.
CLO3. Describe the Basic Scope and importance of food processing.
CLO4. Explain the basic concept of food packaging.
CLO5. Discuss the basic concept of food intoxications and infections. Explain the cultural and rapid detection methods of food borne pathogens in foods.

Text Books:

- Neeser JR & German BJ. 2004. Bioprocesses and Biotechnology for Nutraceuticals.
- Chapman & Hall. Robert EC. 2006. Handbook of Nutraceuticals and Functional Foods. 2nd Ed.
- Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional,London.

Reference Books:

- Wildman. Shi J. (Ed.). 2006. Functional Food Ingredients and Nutraceuticals: Processing Technologies. CRC Press.
- Webb GP. 2006. Dietary Supplements and Functional Foods. Blackwell Publisher.
- Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBSPublishers and Distributors, Delhi, India.

Online links for study & reference materials:
www.bioprocessingsummit.com
https://biopharmaceutics.pharmaceuticalconferences.com

B.Sc. Microbiology 2nd Year
SEMESTER-IV

BASICS OF GENETIC ENGINEERING (STUGMB4/C10)

L	T	P
4	0	2

Course Name: Basics of Genetic Engineering
Course Credit Hour: 4 hrs

Course Code: STUGMB4/C10
Total Contact hour: 60 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of genetic engineering. This course will make the students familiar about the translation machinery and concept of r-DNA technology and their application in advanced research.

Course Description:

This course is mainly focused on the basic concept of genetic engineering which includes basic knowledge in the area of molecular biology and recombinant DNA technology. The student would be able to understand the working details of the cloning of a gene. They would also be able to assimilate recent research findings, advancement and development in the relevant subject.

Course Contents:

Unit 1: Molecular Tools: Restriction Enzymes: Types I, II and III; Linkers and adaptors; Sites of cleavage (Isoschizomers, neoschizomers; and isocaudomers); DNA modifying enzymes; End-modifying enzymes and theirapplications.

Unit 2: Vectors: properties of vectors; Plasmid vectors; Viral vectors; Cosmids; Fosmids; YAC; PAC; shuttle vectors. Vectors for plants and Animals.

Unit 3: Recombinant Screening: Selection of transformed cells; DNA introduction into host cells- bacterial cell (chemical method and electroporation) and plant cell (Direct gene transfer and vector mediated gene transfer); in animals (transduction and transfection).

Unit 4: Polymerase chain reaction: Primer designing; Reaction cycles; Modifications to PCR techniques (Asymmetric PCR, RT-PCR, Quantitative Real time PCR, Inverse PCR, RACE, RAPD, AFLP.

Unit 5: Genetic Engineering in Animals: Primary and secondary cultures; cell lines; Culture media; Growth patterns. Applications of animal cell culture. **Genetic Engineering in Plants**: Gene transfer strategies; Ti plasmid; Strategies for production of transgenic plants; Applications; Molecular farming.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept of molecular tool such as restriction enzyme and its application.
CLO2. Discuss the concept of Plasmid vectors; Viral vectors; Cosmids; Fosmids; YAC; PAC; shuttle vectors
CLO3. Describe the preparation of transformed cells; DNA introduction into host cells-bacterial cell (chemical method and electroporation) and plant cell (Direct gene transfer and vector mediated gene transfer)
CLO4. Explain the major PCR techniques.
CLO5. Discuss the basic concept of genetic engineering n Animal and Plant cells.

Text Books:

- Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
- Watson JD, Baker TA, Bell SP et al. (2008) Molecular Biology of the Gene, 6th Ed., Benjamin Cummings
- Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India

Reference Books:

- Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings
- Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
- Maloy SR, Cronan JE and Friefelder D(2004) Microbial Genetics 2nd EDITION., Jones and Barlett Publishers

Online links for study & reference materials:
https://learn.genetics.utah.edu/
https://ocw.mit.edu/courses/biology/7-03-genetics-fall-2004/

B.Sc. Microbiology 2nd Year
SEMESTER-IV

BASICS OF FORENSIC SCIENCES (DNA) (STUGBT4/ SEEC2)

L	T	P
2	0	0

Course Name: Basics of Forensic Sciences (DNA) **Course Code:** STUGBT4/SEEC2
Course Credit Hour: 2 hrs **Total Contact hour:** 40 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of DNA forensic sciences. This course will make the students familiar about the general information about forensic sciences focused on DNA based methods and their application in forensic research.

Course Description:

This course is mainly focused on the basic concept of forensic sciences which includes basic knowledge in the area of molecular biology techniques and associated tools. The student would be able to understand the working details of the biological blueprint of life. They would also be able to assimilate recent research findings, advancement and development in the relevant subject.

Course Contents:

Unit 1: History of Development of Forensic Science in India: Functions of forensic science. Historical aspects of forensic science. Definitions and concepts in forensic science. Scope of forensic science. Need of forensic science. Basic principles of forensic science. Frye case and Daubert standard

Unit 2: Organizational set up of Forensic Science Laboratories in India: Hierarchical set up of Central Forensic Science Laboratories, State Forensic Science Laboratories, Fingerprint Bureaus, Basic services and optional services.

Unit 3: Basic Principles DNA as biological blueprint of life. Extraction of DNA for analysis. Quantitation of DNA – yield gel quantitation and slot blot quantitation. Forensic DNA Typing Collection of specimens. Polymerase chain reaction – historical perspective, sequence polymorphisms, individualization of evidence.

Unit 4: DNA forensic science: Instrumentation Sample preparation for chromatographic and spectroscopic evidence. Chromatographic methods. Fundamental principles and forensic applications of thin layer chromatography, gas chromatography and liquid chromatography.

Unit 5: Spectroscopic methods. Fundamental principles and forensic applications of Ultravioletvisible spectroscopy. Colorimetric analysis and Lambert-Beer law.

Course Learning Outcomes (CLOs):

CLO1. Understand the fundamental principles, functions and significance of forensic science to human society.
CLO2. Describe the organizational set up of Forensic Science Laboratories in India.
CLO3. Describe the collection method of specimens, isolation of DNA from different specimens, and amplification of DNA using PCR.
CLO4. Explain the basic tools used in DNA forensic science.
.
Text Books:

- Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
- Watson JD, Baker TA, Bell SP et al. (2008) Molecular Biology of the Gene, 6th Ed., Benjamin Cummings
- Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India

Reference Books:

- Russell PJ. (2009). i Genetics- A Molecular Approach. 3rd Ed, Benjamin Cummings
- Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
- Maloy SR, Cronan JE and Friefelder D(2004) Microbial Genetics 2nd EDITION., Jones and Barlett Publishers

Online links for study & reference materials:
https://learn.genetics.utah.edu/
https://ocw.mit.edu/courses/biology/7-03-genetics-fall-2004/

B.Sc. Microbiology 2nd Year
SEMESTER-IV

PLANT PATHOLOGY (STUGMB4/SEC2)

L	T	P
4	0	2

Course Name: Plant Pathology **Course Code:** STUGMB4/SEC2
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of Plant Pathology. This course will introduce the students with basic concept of plant disease- definitions of disease, disease cycle & pathogenicity, symptoms associated with microbial plant diseases.

Course Description:
This course is mainly focused on the host pathogen interaction. A study of the nature and causes of disease in plants, emphasizing the principal diseases in India. Practical hands on training for identification of disease symptoms at earliest stage. Making students aware about the ambience plants and related diseases and treatment if any, especially biological control.

Course Contents:

Unit 1: Introduction and History of plant pathology: Concept of plant disease- definitions of disease, disease cycle & pathogenicity, symptoms associated with microbial plant diseases, types of plant pathogens, economic losses and social impact of plant diseases. Significant landmarks in the field of plant pathology- Contributions of Anton DeBary, Millardet, Burrill, E. Smith, Adolph Mayer, Ivanowski, Diener, Stakman, H.H. Flor, Van Der Plank, molecular Koch's postulates. Contributions of eminent Indian plant pathologists.

Unit 2: Stages in development of a disease: Infection, invasion, colonization, dissemination of pathogens and perennation.

Unit 3: Plant disease epidemiology: Concepts of monocyclic, polycyclic and polyetic diseases, disease triangle & disease pyramid, forecasting of plant diseases and its relevance in Indian context.

Unit 4: Host Pathogen Interaction: A. Microbial Pathogenicity Virulence factors of pathogens: enzymes, toxins (host specific and non-specific) growth regulators, virulence factors in viruses (replicase, coat protein, silencing suppressors) in disease development. Effects of pathogens on host physiological processes (photosynthesis, respiration, cell membrane permeability, translocation of water and nutrients, plant growth and reproduction).

Unit 5: Control of Plant Diseases: Principles & practices involved in the management of plant diseases by different methods, viz. regulatory - quarantine, crop certification, avoidance of pathogen, use of pathogen free propagative material cultural - host eradication, crop rotation, sanitation, polyethylene traps and mulches chemical - protectants and systemic fungicides, antibiotics, resistance of pathogens to chemicals.

Course Learning Outcomes (CLOs):

CLO1. To introduce concepts and principles of plant pathology
CLO2. To acquaint with different strategies for management of plant diseases
CLO3. To acquaint with different strategies for management of higher yield from healthy soil.
CLO4. To impart knowledge on detection and diagnosis of plant diseases and their management.
CLO5. To study principles and application of ecofriendly and sustainable management strategies of plant diseases.

Text Books:

- Lucas JA. (1998). Plant Pathology and Plant Pathogens. 3rd edition. Blackwell Science, Oxford.
- Mehrotra RS. (1994). Plant Pathology. Tata McGraw-Hill Limited.

Reference Books:

- Agrios GN. (2006). Plant Pathology. 5th edition. Academic press, San Diego,

Online links for study & reference materials:
http://ecoursesonline.iasri.res.in/
https://phytopath.ca/education/websites/
https://bsppjournals.onlinelibrary.wiley.com/journal/13653059

B.Sc. Microbiology 3rd Year
SEMESTER-V

PRINCIPLE OF GENOMICS AND PROTEOMICS (STUGMB5/C11)

L	T	P
4	2	0

Course Name: Principle of Genomics and Proteomics **Course Code:** STUGMB5/C11
Course Credit Hour: 4 hrs **Total Contact hour:** 42 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of Genomics and Proteomics. It also aims to familiarize them with the developments in the experimental approaches used by researchers to understand the complexity and diversity of genomes. Recent advances in genomics have transformed the way in which biologists study cells and biological systems. Furthermore, this course also provides knowledge of the use of high throughput techniques to study the entire range of proteins present in any cell/tissue/organism under specific conditions, to obtain a global view of cellular processes at the protein level.

Course Description:
This course is mainly focused on the Genomics and Proteomics and discuss the basic concept of genomics, such as origin, evolution and application of genomics and proteomics. This course also focuses to elaborates the Genomic and Proteomics techniques; from basic to advance level. It covers basic understanding of Genomics, Annotation of whole genome sequence & functional genomics, Pharmacogenomics and Proteomics.

Course Contents:

Unit 1: Origin and Evolution of genomics: Study and Scope: Introduction, definition concepts and approaches of proteomics studies and activities. Origin of genomics, the first DNA genomes, microsatellite and SCOT, DNA based phylogenetic trees, genomes and human evolution, evolution of nuclear and organelle (mitochondrial and Chloroplast genome), Anticipated Benefits of Genome Research

Unit 2: Molecular maps of genomes and comparative genomics: Genetic maps, physical maps, EST and transcript maps, functional maps, comparative genomics and collinearity/synteny in maps.

Unit 3: Whole Genome sequencing: Whole genome shotgun sequencing, clone-by-clone or 'hierarchical shotgun' sequencing, microbial genomes, plant genomes and animal genomes.

Unit 4: Annotation of whole genome sequence and functional genomics: *In silico* methods, insertion mutagenesis (T-DNA and transport insertion), EST contigs and unigene sets, use of DNA chips and microarrays.

Unit 5: Pharmacogenomics: Use in biomedicine involving diagnosis and treatment of diseases, genomics in medical practice, personalized medicine, DNA polymorphism and treatment of diseases, use of SNP in pharmacogenomics, pharmacogenomics and industry.

Course Learning Outcomes (CLOs):

CLO1. Gain an understanding of the basic concepts of genomics and its scope.
CLO2. Outline the fundamental of DNA based phylogenetic trees.
CLO3. Discuss the Annotation of whole genome sequence and functional genomics.
CLO4. Describe the basic concepts of pharmacogenomics and its future prospective.
CLO5. Explain the fundamentals of proteomics and advance molecular biology techniques.

Text Books:

- Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Campbell AM & Heyer LJ, Benjamin Cummings 2007; CSH Press, NY.
- Introduction to Proteomics: Tools for the New Biology. Daniel C. Liebler, 2002 Humana Press Inc.
- Primrose SB and Twyman RM. Genomics: Applications in human biology. Blackwell Publishing, 2008 Oxford, U.K

Reference Books:

- Genome III – T.A. Brown Garland Science Publ. June 08, 2006
- Bioinformatics and Functional Genomics – Jonathan Pevsner - 2nd edition, Wiley-Blackwell, 2009.
- Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press

Online links for study & reference materials:

http://www.genomenewsnetwork.org/resources
http://www.pss.co.jp/english/sc_bio/contents4.html
http://www.premierbiosoft.com/tech_notes/microarray.html

B.Sc. Microbiology 3rd Year
SEMESTER-V

ELEMENTARY MOLECULAR BIOLOGY (STUGMB5/C12)

L	T	P
4	0	2

Course Name: Elementary Molecular Biology **Course Code:** STUGBT5/C12
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of Molecular Biology. This course will introduce the students with basic and advanced knowledge of molecular biology such as understand molecular Biological processes like DNA replication, transcription, repair systems and other relevant topics.

Course Description:

This course is mainly focused on the Elementary Molecular Biology which will provide the technical details and use of different gene expression systems for overexpression of recombinant proteins and protein complexes for different applications. The course will also provide details about the purification of proteins expressed in different expression systems..

Course Contents:

Unit 1: Molecular of Life: An introduction experimental proof of DNA and RNA as genetic Material, Nucleic Acids, Structure and function of DNA and RNA, Watson and Crick model of DNA and other forms of DNA (A and Z), Functions of DNA and RNA including ribosome's.

Unit 2: DNA Replication: Prokaryotic and Eukaryotic-Enzymes and proteins involved in replication, Theta model and Rolling circle model. Mechanism of DNA replication, replication origin and replication fork, DNA repair

Unit 3: DNA Repair: Causes and mechanism –photo reactivation, excision repair, mismatch repair, SOS repair. Recombination in prokaryotes, Transformations, Conjugation and Transduction. Wobble hypothesis.

Unit 4: Transcription and Translation: Transcription in Prokaryotes and Eukaryotes, Mechanism, promoters and RNA polymerase, transcription factors, post transcriptional, modifications a eukaryotic mRNA. Translation: Mechanism of translation in Prokaryotes and

Eukaryotes. Ribosomes, mechanism of translation, post translational modification, translational inhibitors, and genetic code.

Unit 5: Regulation of Gene expression: Regulation of Gene expression in Prokaryotes-Person concept (Lac and Trip), Regulation of Gene expression in Eukaryotes –transcriptional activation. Transposable elements in Maize and Drosophila, gene silencing.

Course Learning Outcomes (CLOs):

CLO1. Students who study the molecular biology re able to understand the central dogma

CLO2. Students who earn the plant pathology minor will integrate plant pathology principles into the understanding of their major discipline(s) through the study of agronomic diseases, horticultural diseases, turf diseases, entomology, applied microbiology, biotechnology and other relevant career fields**.**

CLO3. To learn to observe how mutation can cause the change in gene expression

CLO4. To learn various agents of DNA mutation and its repair

CLO5. Discuss the basic concept of Gene expression in Prokaryotes-Person concept (Lac and Trip), Regulation of Gene expression in Eukaryotes.

Text Books:

- Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
- Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009) The World of the Cell, 7th edition, Pearson Benjamin Cummings Publishing, San Francisco

Reference Books:

- De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia
- Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.

Online links for study & reference materials:
https:// Biologynotes.com
https:// Easy biology class.com/

B.Sc. Microbiology 3rd Year
SEMESTER-V

MEDICAL MICROBIOLOGY (STUGMB5/DSC2)

L	T	P
4	0	2

Course Name: Medical Microbiology **Course Code:** STUGMB5/DSC2
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

This course provides learning opportunities in the basic principles of medical microbiology and infectious disease. It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases.

Course Description:

Medical Microbiology is a three-year post-graduate programme dedicated to cover the medical and molecular aspects of immunology, mycology, virology, and bacteriology to infection. The programme equips students with the knowledge of diagnosing and treating diseases caused by bacteria, fungi and parasites. It covers medical and molecular aspects of microbiology and immunity to infection, incorporating traditional and current methods of laboratory diagnosis, treatment, epidemiology and management of infection.

Course Contents:

Unit 1: Bacterial infection: Etiology, epidemiology, pathogenesis, symptomatology, laboratory diagnosis, treatment and prophylaxis of the following: a) Cholera, b) Typhoid, c) Diphtheria, d) Tuberculosis e) Spirochetes

Unit 2: Viral infection: Etiology, epidemiology, pathogenesis, symptomatology, laboratory diagnosis, treatment and prophylaxis of the a) AIDS b) Polio c) Hepatitis

Unit 3: Protozoan diseases: List of diseases of various organ systems and their causative agents. The following diseases in detail with Symptoms, mode of transmission, prophylaxis and control Malaria, Trypanosomiasis, Kala azar.

Unit 4: Fungal diseases: Brief description of each of the following types of mycoses and one representative disease to be studied with respect to transmission, symptoms and prevention

Cutaneous mycoses: Tinea pedis (Athlete's foot) Systemic mycoses: Histoplasmosis Opportunistic mycoses: Candidiasis, aspergillosis

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept of medical microbiology and significance of diseases related to air, water, sewage.
CLO2. Discuss the Micro-organisms related to diseases and their control.
CLO3. Describe the Basic characteristics of Epidemiology, treatment, symptoms of diseases.
CLO4. Explain the basic control and treatment related to pathogenic diseases.
CLO5. Discuss the basic objectives, importance and functions HIV-AIDS, Polio, bacterial and fungal diseases.

Text Books:

- Medical Microbiology An environment And Health Prospective by Aithal, Wakte & Manwar. Cinnamonteal print and publishing Margao, Goa-403601
- Fundamental principles of medical microbiology by A.J. Salle.
- Text book of Microbiology by R. Anantharayanan, C.K. JayaramPanikar, Orient Longman,Mumbai.

Reference Books:

- Fundamentals of Microbiology by Martin Frobisher
- General Microbiology by Stanier. Ingraham, Wheelis, Painter: Macmillan Press Ltd.
- Kuby's Immunology. 6th edition W.H. Freeman andCompany, New York.

Online links for study & reference materials:
www.microbiologysummit.com
https://biopharmaceutics.pharmaceuticalconferences.com

B.Sc. Microbiology 3rd Year
SEMESTER-V

INDUSTRIAL MICROBIOLOGY (STUGMB5/DSC2)

L	T	P
4	0	2

Course Name: Industrial Microbiology **Course Code:** STUGMB5/DSC2
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

This course focus on the basis of Industrial microbiology technology and their techniques. It basically covers the Air microbiology, sewage microbiology, water microbiology etc. It also covers the scope and importance of sources of contamination of milk, desirable and undesirable changes in milk, milk borne diseases, Microbial examination of water, Water borne diseases etc.

Course Description:

Microbiology course involves the study of microorganisms with particular emphasis on the biology of bacteria, viruses, fungi and protozoan parasites. You will also cover aspects of the biochemistry, physiology and genetics of microorganisms. Introduction to Microbiology is appropriate for students with some background in biology and chemistry whose career path intersects the study of microbes or simply have an interest in microbiology. This course introduces the basic principles of microbiology examining the microbes that inhabit our planet and their effect on the biosphere.

Course Contents:

Unit 1: Introduction to industrial microbiology: Sources of industrially important microbes, strain development, types of fermentation and fermenters, process optimization, and recent developments in fermentation technology.

Unit 2: Downstream processing of microbial products: Filtration, centrifugation, cell disruption, liquid-liquid extraction, chromatography, membrane processes, drying (lyophilization and spray drying), and crystallization

Unit 3: Fermentation economics: Basic objective for successful economically viable fermentation process, cost break down for well-established fermentation processes, market potential of the products, cost aspects of various stages in the processes development including effluent treatment.

Unit 4: Production aspects: Microbial strains, substrates, strain improvement, flow diagrams, product optimization, and applications of industrial alcohol (ethanol and butanol), amino acids (lysine, phenylalanine, tryptophan), antibiotics (cephalosporins, tetracyclines, polyenes), enzymes and immobilized enzymes, SCP, microbial polyesters, biosurfactants, and recombinant products (insulin, somatostatin, thaumatin).

Unit 5: Microbiology of foods: Vegetables, fruits, milk, fermented and non-fermented milk products, fresh meats, poultry and non-dairy fermented foods. Microbial spoilage of foods Food preservation: Chemical, physical and biological methods. Fermentation processes: Production of milk and milk products, plant based products, fish products, meat products and food beverages.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept of industrial microbiology
CLO2. Discuss the downstream processing of microbial products such as Filtration, centrifugation, cell disruption, liquid-liquid extraction, chromatography, membrane processes, drying (lyophilization and spray drying), and crystallization.
CLO3. Describe the Basic characteristics of fermentation economics including basic objective for successful economically viable fermentation process, cost break down for well-established fermentation processes.
CLO4. Explain the basic knowledge microbial strains, substrates, strain improvement, flow diagrams, product optimization, and applications of industrial alcohol, amino acids, antibiotics and others
CLO5. Discuss the basic objectives, importance and functions microbial spoilage of foods food preservation such as Chemical, physical and biological methods.

Text Books:
- Biotechnology: A Text Book of Industrial Microbiology by W. Crueger& A. Crueger, Panima Publishing Corporation, New Delhi/Bangalore, 2000.
- Text book of Microbiology by R. Anantharayanan, C.K. JayaramPanikar, Orient Longman,Mumbai.

Reference Books:
- Modern Industrial Microbiology & Biotechnology by N. Okafer, Scientific Publishers, Enfield, USA., 2007.
- Industrial Microbiology: An Introduction by Waites, Morgan, Rockey& Highton, Blackwell Science, 2001.

Online links for study & reference materials:
www.microbiologysummit.com
https://biopharmaceutics.pharmaceuticalconferences.com

B.Sc. Microbiology 3rd Year
SEMESTER-VI

MYCOLOGY (STUGMB6/C13)

L	T	P
4	**0**	**2**

Course Name: Mycology **Course Code:** STUGMB6/C13
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of mycology. This course will introduce the students with the basic aspects of fungal classification and morphology, diagnosis, and disease production. To comprehend what diseases that the medically important fungal organisms cause and the details of the infection process. Lecture material supplemented with slides

Course Description:

This subject is three credit-hour course will examine the biology of the true fungi and other groups of organisms traditionally classified with the fungi. Topics covered will include taxonomy, life history traits, ecology, physiology, and evolutionary biology of the major classes and orders of fungi. Particular emphasis will be placed on the impact of fungi on human affairs. Laboratory exercises will emphasize the identification of these orders. Also get aware about common plant disease and their control measures for better plant productivity.

Course Contents:

Unit 1: Introduction to mycology: Characteristics, Common fungal infections, lab diagnosis, Different specimens, Collection & transportation, Culture medias, Staining techniques, Oculomycosis, Otomycosis, Mycotic poisoning

Unit 2: Superficial cutaneous mycoses: Introduction, A-etiology, pathogenicity, lab diagnosis and treatment) Taenia nigra, Piedra, Dermatophytosis

Unit 3: Subcutaneous mycosis: Introduction, A-etiology, pathogenicity, lab diagnosis and treatment) Mycetoma, Sporotrichosis, Rinosporidiosis, Lobomycosis

Unit 4: Systemic **mycosis:** Introduction, A-etiology, pathogenicity, lab diagnosis and treatment) Histoplasmosis, Blastomycosis, Coccidomycosis, Paracoccidomycosis

Unit 5: Opportunistic mycosis: Introduction, A-etiology, pathogenicity, lab diagnosis and treatment) Candidiasis, Cryptococcosis, Pencilliosis, Aspergillosis, Zygomycosis

Course Learning Outcomes (CLOs):

CLO1. To evaluate specimen acceptability of fungus

CLO2. Further ability to collect, label, identify, and log in specimens accurately, know how for transportation requirement of fungus**.**

CLO3. Ability to perform appropriate laboratory techniques used in the processing of specimens and identification of parasites and fungi

CLO4. Remedial measures for fungal infections

CLO5. Ability to describe basic morphology and physiology of parasites and fungi

Text Books:

- Textbook of Microbiology' by CP Baveja , 2nd edition, Arya longman Pvt. ltd
- Text book of Medical Laboratory' by Satish Gupta, Edition - latest, J.P. Bros, New Delhi – 1998

Reference Books:

- Medical parasitology' by Chatarjee, 3th edition
- Medical Microbiology and Immunology' by Warren Levinson, eighth Edition, Lange Medical books/ McGraw-Hill Publication.

Online links for study and reference materials:
https://www.sciencemag.org/careers/2009/07/fun-fungi-mycology-careers
https://academic.oup.com/mmy/article/44/Supplement_1/S39/1748427

B.Sc. Microbiology 3rd Year
SEMESTER-VI

ENTREPRENEURSHIP (STUGMB6/C14)

L	T	P
4	2	0

Course Name: Entrepreneurship
Course Code: STUGMB6/C14
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

This course focus on the basis of Skills of bio-entrepreneur and biotechnology entrepreneurship. It basically covers the patenting, licensing and partnership in biotechnology industry It also covers the scope and importance of product development in biotech industries. It also includes about the marketing of the desired pharmaceutical drug.

Course Description:

This is a course to introduce the student to understanding creative abilities, recognizing their creative abilities, changing their way of viewing creativity, understanding who they are as a creative person, promoting innovation in themselves and others, and demonstrating productive thinking.

Course Contents:

Unit 1: Introduction: Basic definition, history and scope of Biotechnology Entrepreneurship

Unit 2: Biotechnology Marketing & Companies 1: Biotechnology in capital market; Initial Public Offering (IPO) in the capital market; examples of success and failure of biotechnology companies and the possible reasons; factors that influence success of company; product selection; failure of the product ;

Unit 3: Biotechnology Marketing & Companies II: Product development ; R&D with expertise ; cost of product development. Mergers and acquisitions of biotechnology companies: Celera Genomica and Axys Pharmaceutical; Monsanto and other companies (use other examples).

Unit 4: Patenting, licensing and partnership in biotechnology industry: Patents on biological inventions, licensing revenue, selection of right partner; negotiations of the terms of the terms of the deal.

Unit 5: Entrepreneurship Skills: Entrepreneurship Skills of bio-entrepreneur, bio-entrepreneurial training; research experience, creativity, communication skills and other attributes; participation in conferences, training and educational courses; institutes offering entrepreneurship courses.

Course Learning Outcomes (CLOs):

CLO1. Discuss the basic introduction of biotechnology entrepreneurship.
CLO2. Discuss the Biotechnology Marketing & industries.
CLO3. Describe the basic knowledge patenting, licensing and partnership in biotechnology industry.
CLO4. Explain the Major Entrepreneurship Skills.
CLO5. Discuss the Training, entrepreneurship courses, educational courses offered by various institutes.

Text Books:

- Entrepreneuship by P.F. Stanbury, W. Whitaker &S.J. Hall, Aditya Books (P) Ltd., New Delhi, 1997.
- Biotech Entrepreneur-to-Entrepreneur: http://www.bioe2e.org

Reference Books:

- Startup junkies http://www.startupjunkies.org/research.html by N. Okafer, Scientific Publishers, Enfield, USA., 2017.
- Biopreneur serves as a focal point for bringing together scientists, Businesspeople and investors, 2019

Online links for study & reference materials:

http://www.biopreneur.org/biotech-investment.htm
http://www.bioenterprise.com/assets/entrepreneurguide.pdf
http://www.bioe2e.org

B.Sc. Microbiology 3rd Year
SEMESTER-VI

PARASITOLOGY (STUGMB6/DSC3)

L	T	P
4	2	0

Course Name: Parasitology
Course Credit Hour: 4 hrs
Course Code: STUGMB6/DSC3
Total Contact hour: 42 hrs

Course Objective:

This course will enable students to acquire knowledge on the fundamentals of Parasitology. It enables them to understand emerging and advanced concept in host pathogen interaction and this course also focuses on the host parasite interaction which include etiology, pathogenicity, life cycle, lab diagnosis and treatment. This program will facilitate the students to acquire knowledge in fields various aspects and molecular tools used in clinical application in alleviation of human disease.

Course Description:

This course is mainly focused to understand emerging and advanced concept in molecular pathogenesis of disease and role of biotechnology in diagnosis, prevention and therapeutics. An understanding of the basic biology and life cycles of human parasites; human parasitic infections, including epidemiology, clinical features, laboratory diagnosis, treatment and prevention.

Course Contents:

Unit 1: Introduction: Parasites, Classification of Parasites, Host, Types of host, Relationships between host and parasites

Unit 2: Protozoa: (introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment) Entamoeba, Giardia, Plasmodium, Leishmania, Trypanosoma

Unit 3: Platyhelminthes: (Introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment) Taenia, Echinococcus

Unit 4: Nemathelminthes: (introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment) Ascaris, Ancylostoma, Necator, Enterobius, Wuchereria

Unit 5: Lab Diagnosis: Different specimens of parasitology, Collection & transportation. Processing of parasitological specimens

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept Parasitology and its importance.
CLO2. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of protozoan parasite.
CLO3. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of Platyhelminthes.
CLO4. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of Nemathelminthes.
CLO5. Explain the method for collection and processing of parasitological specimens.

Text Books:

- Textbook of Microbiology' by CP Baveja, 2nd edition, 1998, Arya longman Pvt. Ltd
- Textbook of Medical Lab Technology' 2010, by Praful Godkar
- Text book of Medical Laboratory' by Satish Gupta, Edition - latest, 2006, J.P. Bros.

Reference Books:

- Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.
- Medical parasitology' by Chatarjee, 3th edition
- Medical Microbiology and Immunology' by Warren Levinson, eighth Edition, Lange Medical books/ McGraw-Hill Publication

Online links for study & reference materials:

https://www.cdc.gov/parasites/about.html
http://www.onlinebiologynotes.com/
http://www.biologydiscussion.com/parasites/classification-of-parasites-parasitology/62036

B.Sc. Microbiology 3rd Year
SEMESTER-VI

TRANSCRIPTOMICS AND METABOLOMICS (STUGMB6/DSC3)

L	T	P
4	2	0

Course Name: Basics of Immunology
Course Code: STUGMB6/DSC3
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

The primary objective of this course is to develop knowledge on the basics of omics and their versatile applications as well as integration of omics approaches for improvement of life. This subject will help in the development of technical skills and knowledge on versatile techniques in Omics.

Course Description:

An introduction to workflows for the resolution and characterization of complex mixtures of biomolecules, from DNA to small molecule metabolites. The course will emphasize the potential and challenges of omic approaches and will include data handling tasks and demonstration

Course Contents:

Unit 1: Gene, Genome and Genomics: Online genomics databases and tools. Standalone bioinformatics analysis of genomic data. Applications of genomics.

Unit 2: Proteomics: Aims, strategies and methods. Bioinformatics tools in proteomics. Application of proteomics. Proteomics technologies: 2D-electrophoresis, MALDI-TOF mass spectrometry, yeast 2-hybrid system. Protein-protein interactions: experimental and computational methods, databases.

Unit 3: Proteomics and Generation of Interactomics: High-throughput proteomics, Construction of interactomics, Bioinformatics and data visualization software for proteomics

Unit 4: Transcriptomics: Microarrays, EST, SAGE. Bioinformatical methods in transcriptomics. Application of transcriptomics

Unit 5: Metabolomics: Technologies in metabolomics, Nutrigenomics, Other omics, Nuclear Magnetic Resonance Spectroscopy and Mass Spectrometry in metabolomics.

Course Learning Outcomes:

By the end of this course students will be able to:

CO1: Critically discuss information flow in biology, and evaluate the benefits of the different levels of omic data collection; discuss challenges to omic data collection;

CO2: Evaluate strategies to characterize a genome/transcriptome/proteome/metabolome;

CO3: Compare and contrast data from different "-omic" data collection approaches (genomics, transcriptomics, proteomics, metabolomics).

CO4: Identify appropriate applications for different omic approaches and Design an experimental strategy to exploit an omic analysis

CO5: Critically discuss the importance of controls and validation in 'omics strategies

Text Books:

- Barh D, Azevedo V, Omics Technologies and Bio-engineering: Towards Improving Quality of Life, Academic Press, ISBN: 9780128158708, 0128158700
- Wittmann, C, Lee SY, Systems Metabolic Engineering, Springer Science & Business Media, ISBN: 9789400745346, 9400745346
- Dunkler D, Sánchez-Cabo F, Heinze G. Statistical Analysis Principles for Omics Data. Methods in Molecular Biology. Totowa, NJ: Humana Press; 2011.

Reference Books:

- Pevsner J, Bioinformatics and Functional Genomics, Wiley-Blackwell , ISBN: 978-81-265-3834-8
- Kihara, D, Protein Function Prediction for Omics Era, Springer Science & Business Media, ISBN: 9789400708815, 9400708815
- Microbial Proteomics: Functional Biology of Whole Organisms by Ian Humphery-Smith and Michael Hecker (2006) Publisher: Wiley-Interscience; 1st edition ISBN-10: 0471699756, ISBN-13: 978-0471699750
- Microbial Genomics and Drug Discovery by Thomas J. Dougherty and Steven J. Projan(2003) Publisher: CRC; 1st ed. ISBN-10: 0824740416, ISBN-13: 978-0824740412

Online links for study & reference materials:
https://www.khanacademy.org/
https://nptel.ac.in

B.Sc. Microbiology 3rd Year
SEMESTER-VI

CLINICAL RESEARCH (STUGMB6/DSC4)

L	T	P
4	2	0

Course Name: Clinical Research
Course Credit Hour: 4 hrs
Course Code: STUGMB6/DSC4
Total Contact hour: 60 hrs

Course Objective:

This course focus on the basis of Drug development process. It basically covers the (Preclinical, clinical and toxicological studies). It also covers the scope and importance of product development in biotech industries. It also includes about the marketing of the desired pharmaceutical drug.

Course Description:

Clinical research is a study conducted to understand health and diseases in the particular human body. It is branch of healthcare that governs the safety and effectiveness of medications, diagnostic products, devices, and treatment procedures proposed for human use. Clinical research is a branch of healthcare sciences in which research is conducted to understand health and diseases in human beings.

Course Contents:

Unit 1: Drug discovery: Introduction, conventional drug design approaches, irrational Vs Rational, subacute and chronic toxicity studies. Irwin profile test, Drug development process (Preclinical, clinical and toxicological studies).

Unit 2: Clinical Research: Past, Present and future Importance, Mile stones of regulations. FDA, US, Indian clinical research, global scenario of clinical research, Regulatory agency.

Unit 3: Designing clinical trials- History, principles, scheme for conducting clinical trials, planning defining, objectives, variables, study populations, testable hypothesis.

Unit 4: Ethical Issues in clinical research: Introduction, codes, declaration and guidelines, informed concent, special issues, Roles and responsibilities of IRBS, issues with ethics review.

Unit 5: ICH-GCP: History of ICH, Objectives, ICH structure, Guidelines, Future of ICH.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept of Drug development process.
CLO2. Discuss the drug discovery, rational drug design. Delivery of biopharmaceuticals, Pre-clinical trials, and clinical trials.
CLO3. Describe the international pharmacopoeia, guide to good manufacturing practice, Manufacturing facility,sources of pharmaceuticals, production and analysis of final product..
CLO4. Explain the History of ICH, Objectives, ICH structure, Guidelines, Future of ICH.

Text Books:

- Research in Education- John V. Best, John V. Kahn 7th edition.
- Presentation skills - Michael Hallon- Indian Society for Institute education.

Reference Books:

- Practical Introduction of copyright.- Gavin Mcfarlane
- R2. Reference book on Thesis projects in Science & Engineering – Richard M. Davi.

Online links for study & reference materials:

https://europe.microbiologyconferences.com
https://nptel.ac.in/courses/102141/18

NOIDA INTERNATIONAL UNIVERSITY

GREATER NOIDA

CHOICE BASED COURSE SYLLABUS

BSc. HONOURS -CHEMISTRY

(ALL SEMESTERS)

Effective from the Session: 2021-2022

DEPARTMENT OF CHEMISTRY

SCHOOL OF SCIENCES

NOIDA INTERNATIONAL UNIVERSITY

Aims of Bachelor's degree programme in Chemistry

The broad aims of bacheleors degree programme in Chemistry are:
The aim of bachelor's degree programme in chemistry is intended to provide:
(i).Broad and balance knowledge in chemistry in addition to understanding of key chemical concepts, principles and theories.
(ii).To develop students' ability and skill to acquire expertise over solving both theoretical and applied chemistry problems.
(iii). To provide knowledge and skill to the students' thus enabling them to undertake further studies in chemistry in related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship.
(iv).To provide an environment that ensures cognitive development of students in aholistic manner. A complete dialogue about chemistry, chemical equations and its significance is fostered in this framework, rather than mere theoretical aspects.
(v).To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A chemisry graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
(vi).To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
(vii).To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination.

Program Learning Outcomes

The student graduating with the Degree B.Sc (Honours) Chemistry should be able to acquire

- **Core competency:** Students will acquire core competency in the subject Chemistry, and in allied subject areas.

(i). Systematic and coherent understanding of the fundamental concepts in Physical chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry and all other related allied chemistry subjects.
(ii).Students will be able to use the evidence based comparative chemistry approach to explain the chemical synthesis and analysis.
(iii).The students will be able to understand the characterization of materials.
(iv). Students will be able to understand the basic principle of equipment's, instruments used in the chemistry laboratory.
(v).Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Chemistry.
(vi). ***Disciplinary knowledge and skill***: A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding of both theoretical and experimental/applied chemistry knowledge in various fields of interest like Analytical Chemistry, Physical Chemistry, Inorganic Chemistry, Organic Chemistry, Material Chemistry, etc. Further, the student will be capable of using of advanced instruments and related soft-wares for in-depth characterization of materials/chemical analysis and separation technology.

(vii). ***Skilled communicator***: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.
(viii). ***Critical thinker and problem solver***: The course curriculum also includes components that can be helpful to graduate students to develop critical thinking ability by way of solving problems/numerical using basic chemistry knowledge and concepts.
(ix). ***Sense of inquiry***: It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planningand reporting experimental investigation.
(x). ***Team player***: The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field based situation and industry.
(xi). ***Skilled project manager***: The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.
(xii). ***Digitally literate***: The course curriculum has been so designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, and use of chemical simulation software and related computational work.
(xiii). ***Ethical awareness/reasoning***: A graduate student requires to understand and develop ethical awareness/reasoning which the course curriculum adequately provide.
(xiv). ***Lifelong learner***: The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

Noida International University

Study & Evaluation Scheme for B.Sc (Chemistry Honors)
Total Scheme
UNDERGRADUATE PROGRAMME
Choice Based Credit System (CBCS)

The course learning outcomes are aligned with program learning outcomes but these are specific-to-specific courses offered in a program. The course level learning shall be reflected as program level learning. The core courses shall be the backbone of this framework whereas discipline electives, generic electives and skill enhancement courses would add academic excellence in the subject together with multi-dimensional and multidisciplinary approach. In course learning outcomes, the student will attain subject knowledge in terms of individual course as well as holistically.

1. Core Papers=14 (Credit: 06 each) C 1-14
2. Discipline Specific Elective Papers=04 (Credit: 06 each) - DSE 1-4
3. Skill Enhancement Courses= 02 (Credit: 02 each)- SEC1-2
4. Ability Enhancement Compulsory Courses=02 (Credit: 02 each)- AECC 1-2
5. Generic Elective Papers=04 (Credit: 06 each) For other Departments/Disciplines- GE 1-4
6. Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6th Semester
7. Wherever there is a practical there will be no tutorial and vice-versa

Semester 1	**Semester 2**	**Semester 3**	**Semester 4**	**Semester 5**	**Semester 6**
C1	C3	C5	C8	C11	C13

C2	C4	C6	C9	C12	C14
GE1	GE2	C7	C10	DSE1	DSE3
AECC1	AECC2	GE3	GE4	DSE2	DSE4
		SEC1	SEC2		
Credit=20	**Credit=20**	**Credit=26**	**Credit=26**	**Credit=24**	**Credit=24**

Total Credit=140

Skill Development
Employability
Entrepreneurship

Noida International University

Study & Evaluation Scheme for B.Sc (Chemistry Honors)
1st Year, SEMESTER I

S.No	Course Code	Subject	Period			Evaluation Scheme					Credit	CBSC
						Sessional Exam			External Exam	Subject Total		
			L	T	P	CA	TA	Total				
1	STUGC/ C01	Structure and Bonding	4	0	0	20	20	40	60	100	4	C1
2	STUGC/ C02	Chemical Management with Safety	4	0	0	20	20	40	60	100	4	C2
3	GE 01	Generic Elective	4	0	0	20	40	60	60	100	4	GE 1
4	AECC 1	Environmental Sciences	2	0	0	20	20	40	60	100	2	AECC 1
Practical												
7	SPUGC/ C01	Structure And Bonding	0	0	2			25	25	50	2	C1 LAB
8	SPUGC/ C02	Chemical Management with Safety – Workshop	0	0	2			25	25	50	2	C2 LAB
9	GE 01	Generic Elective Lab	0	0	2			25	25	50	2	AECC 1 LAB
Total										**550**	**20**	

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

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Noida International University
Study & Evaluation Scheme for B.Sc Honours (Chemistry)
1st Year, SEMESTER II

S.No	Course Code	Subject	Period			Evaluation Scheme					Credit	CBCS
						Sessional Exam			External Exam	Subject Total		
			L	T	P	CA	TA	Total				
1	STUGC/ C03	Elements & Properties	4	0	0	20	20	40	60	100	4	C3
2	STUGC/ C04	Analytical Chemistry	4	0	0	20	20	40	60	100	4	C4
3	GE2	Generic Elective	3	0	0	20	20	40	60	100	4	GE2
4	AECC2	Technical Communi-Cation	2	0	0	20	20	40	60	100	2	AECC 2
Practical												
7	SPUGC/ C04	Elements & Properties Lab	0	0	2			25	25	50	2	C4 LAB
8	SPUGC/ C05	Analytical chemistry Lab	0	0	2			25	25	50	2	C5 LAB
9	GE2	Generic Elective Lab	0	0	2			25	25	50	2	GE2 LAB
Total										**550**	**20**	

Reference Books: for Laboratory Guide:.

- A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall, 7th Edn.
- A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall, 6th Edn.
- A.I. Vogel: Textbook of Practical Organic Chemistry, Prentice Hall, 5th Edn.
- F. G. Mann & B. C. Saunders: Practical Organic Chemistry, Orient Longman (1960).
  - Vogel, A.I. A Textbook of Quantitative Inorganic Analysis, ELBS.

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Study & Evaluation Scheme for B.Sc. Honors -Chemistry
2nd Year, SEMESTER III

S.No	Course Code	Subject	Period			Evaluation Scheme					Credit	CBCS
						Sessional Exam			External Exam	Subject Total		
			L	T	P	CA	TA	Total				
1	STUGC/ C05	Organic Chemistry-I	4	0	0	20	20	40	60	100	4	C5
2	STUGC/ C06	Physical Chemistry-I	4	0	0	20	20	40	60	100	4	C6
3	STUGC/ C07	Environmental Chemistry	4	0	0	20	20	40	60	100	4	C7
4	GE3	Generic Elective	4	0	0	20	20	40	60	100	4	GE 3
5	STUGC/ SEC1	Intellectual Property Rights	2	0	0	20	20	40	60	100	2	SEC 1
Practical												
1	SPUGC/ C05	Organic Chemistry-I Lab	0	0	2			25	25	50	2	C5 LAB
2	SPUGC/ C06	Physical Chemistry-I Lab	0	0	2			25	25	50	2	C6 LAB
3	SPUGC/ C07	Environmental Chemistry Lab	0	0	2			25	25	50	2	C7 LAB
9	GE3	Generic Elective Lab	0	0	2			25	25	50	2	GE LAB
Total										**700**	**26**	

Noida International University
Study & Evaluation Scheme for B.Sc Honors -Chemistry
2nd Year, SEMESTER IV

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBSC
						Sessional Exam			External Exam			
			L	T	P	CA	TA	Total				
1	STUGC/C 08	Inorganic Chemistry-I	4	0	0	20	20	40	60	100	4	C8
2	STUGC/C 09	Organic Chemistry-II	4	0	0	20	20	40	60	100	4	C9
3	STUGC/C 10	Green Chemistry	4	0	0	20	20	40	60	100	4	C10
4	GE4	Generic Elective	4	0	0	20	20	40	60	100	4	GE 4
5	STUGC/S EC2	Food Chemistry	2	0	0	20	20	40	60	100	2	SEC 2
Practical												
6	SPUGC/ C08	Inorganic Chemistry-I Lab	0	0	2			25	25	50	2	C8 LAB
7	SPUGC/ C09	Organic Chemistry-II Lab	0	0	2			25	25	50	2	C9 LAB
8	SPUGC/ C10	Green Chemistry Lab	0	0	2			25	25	50	2	C10 LAB
9	GE4	GE Lab	0	0	2			25	25	50	2	GE LAB
Total										**700**	**26**	

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Study & Evaluation Scheme for B.Sc Honors -Chemistry
3rd Year, SEMESTER V

S.No	Course Code	Subject	Period			Evaluation Scheme					Credit	CBCS
						Sessional Exam			External Exam	Subject Total		
			L	T	P	CA	TA	Total				
1	STUGC/C 11	Advance Organic Chemistry	4	0	0	20	20	40	60	100	4	C11
2	STUGC/ C12	Polymers Chemistry	4	0	0	20	20	40	60	100	4	C12
3	STUGC/ DSE 1	Industrial Chemistry-I	4	0	0	20	20	40	60	100	4	DSE 1
4	STUGC/ DSE 2	Forensic Chemistry	4	0	0	20	20	40	60	100	4	DSE 2
Practical												
6	SPUGC/ C11	Advance Organic Chemistry Lab	0	0	2			25	25	50	2	C11 LAB
7	SPUGC/ C12	Polymers Chemistry Lab	0	0	2			25	25	50	2	C12 LAB
8	SPUGC/ DSE 1	Industrial Chemistry-I Lab	0	0	2			25	25	50	2	DSE 1 Lab
9	SPUGC/ DSE 2	Forensic Chemistry Lab	0	0	2			25	25	50	2	DSE 2 Lab
Total										**600**	**24**	

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Study & Evaluation Scheme for BSc. Honors -Chemistry
3rd Year, SEMESTER VI

S.No	Course Code	Subject	Period			Evaluation Scheme					Credit	CBCS
						Sessional Exam			External Exam	Subject Total		
			L	T	P	CA	TA	Total				
1	STUGC/C 13	Physical Chemistry-A Molecular Approach -II	4	0	0	20	20	40	60	100	4	C 13
2	STUGC/C 14	Organic Chemistry-III	4	0	0	20	20	40	60	100	4	C 14
3	STUGC/ DSE 3	Industrial Chemistry-II	4	0	0	20	20	40	60	100	4	DSE 3
4	STUGC/ DSE 4	Drug Synthesis	4	0	0	20	20	40	60	100	4	DSE 4
Practical												
6	SPUGC/ C13	Physical Chemistry-II Lab	0	0	2			25	25	50	2	C 13 LAB
7	SPUGC/ C14	Organic Chemistry-III Lab	0	0	2			25	25	50	2	C14 LAB
8	SPUGC/ DSE 3	Industrial Chemistry-II Lab	0	0	2			25	25	50	2	DSE 3 LAB
9	SPUGC/ DSE 4	Drug Synthesis Lab	0	0	2			25	25	50	2	SEC 4 LAB
Total										600	24	

Course Code :STUGC/C01 **Course Name: Structure andBonding**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- Elementary knowledge of chemistry.
- Application based learning of the subject.
- Elementary idea of periodic table and their periodic trends, structure, bonding, hybridization and stereochemistry.
- Understand the importance of the elements in the periodic table including their physical and chemical nature and role in the daily life.

Course Description :

- Students will be able to compare and contrast the elements of s, p and d block elements.
- To know the basic properties of elements based on their relative position in group and column.
- To understand the bonding and structure of different kinds of molecules.
- To gain a brief information on chemical properties and reactions of alkanes, alkenes and alkynes.
- To understand Fischer, Saw-horse and Newman projection formulae, Chirality-optical activity,
- To understand the difference between enantiomerism and diasteroisomerism.

Course Contents: L-4 T-0 P-2

Unit 1:
Basic Concepts of Inorganic Chemistry: Introduction: Elements, Classification of Elements (metals, non-metals and metalloids). Periodic table and modern periodic law, classification of periodic table in groups and column. Classification of periodic table into s-block, p-block and d-block elements.

Unit 2: Atomic Structure:
Schrodinger wave equation; H atom; Radial and angular wave functions: quantum numbers and concept of orbitals; Slater orbitals.

Unit 3: Bonding:
Molecular orbital theory and molecular energy level diagram of Homo- and Hetero- nuclear molecules. Hybridization, its definition and hybridization involving s, p and d- orbitals. VB and MO approach of H_2 molecule

Chemical Bonding: Chemical bonding, types of bonding (ionic, covalent, coordinate, metallic and hydrogen bonding).

Unit 4: Hydrocarbons: Akanes: Chlorination of methane, Alkenes: Addition reactions (Electrophilic and Free radical), Hydration, hydroxylation, hydroboration, epoxidation and ozonolysis. Alkynes: Reduction, Electrophilic addition, acidity and metal acetylides.

Unit-5: Stereochemistry:
Fischer, Saw-horse and Newman projection formulae, Chirality-optical activity, enantiomersim and diasteroisomerism involving one and two chiral centres. Configuration; D/L, erythrose, threose and R/S nomenclatures. Geometrical isomerism and E/Z nomenclatures. Conformations of n-butane.

Course Learning Outcomes (CLOs) :

CLO-1: To understand the elements, their arrangement in periodic table, periodic law and significance of atomic numbers and electronic configuration as the basic for periodic classification.

CLO-2: To know the discovery of electron, proton and neutron and their characteristics. To understand the nature electromagnetic radiation, quantum theory and orbital concept.

CLO-3: To study different types of molecular orbitals, hybridization and chemical bonding involved on bond formation. To explain the concepts of geometry of simple molecules.

CLO-4: To learn about major reactions and their mechanism of alkanes, alkenes and alkynes hydrocarbons.

CLO-5: To know about the concepts of stereochemistry and understand the difference between configuration and conformation. The study the reactivity and stability of an organic molecule based on structure, including conformation and stereochemistry and their nomenclature.

Text Books:

1. *Basic Inorganic Chemistry*, F. A Cotton, G. Wilkinson, and Paul L. Gaus, 3rd Edition (1995), John Wiley & Sons, New York.
2. *Concise Inorganic Chemistry*, J. D. Lee, 5th Edition (1996), Chapman & Hall, London.
3. *Organic Chemistry*, Paula Y. Bruice, 2nd Edition, Prentice-Hall, International Edition (1998).
4. *Organic Chemistry*, I. L. Finar, Vol. I, 6th Edition (1973), ELBS and Longman Ltd., New Delhi.
5. *Organic Chemistry*, R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.

6. Organic Chemistry, Paula Y. Bruice, 2nd Edition, Prentice-Hall, International Edition (1998).

Reference books :

1. Organic Chemistry, J. Clayden, N. Greeves, S. Warren, and E. Wothers, , Oxford Univ. Press, Oxford (2001).
2. Organic Chemistry, R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
3. Organic Chemistry, I. L. Finar, Vol. I, 6th Edition (1973), ELBS and Longman Ltd., New Delhi.
4. "Inorganic Chemistry", Puri and Sharma
5. "Advanced Inorganic Chemistry", Sathyaprakash.

Online links for study & reference materials:

1. https://www2.chemistry.msu.edu
2. https://chem.libretexts.org
3. http://web.uvic.ca/~rlipson/C347-2014/5%20A%20CHEM%20347%20Applications%20of%20SWE%20free%20particle%201D%20PIB%20UNFILLED.pdf
4. https://chem.libretexts.org/Textbook_Maps/Organic_Chemistry/Map%3A_Organic_Chemistry_(McMurry)/Chapter_07%3A_Alkenes%3A_Structure_and_Reactivity/7.07_Electrophilic_Addition_Reactions_of_Alkenes.
5. http://www.chem.ucalgary.ca/courses/350/Carey5th/Ch06/ch6-2.html
6. https://www.quora.com/What-are-the-applications-of-the-Schrodinger-wave-equation.
7. https://www.quora.com/What-is-isomerism

Course Code : STUGC/C02 Course Name: Chemical Management WithSafety
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- This introductory course in laboratory chemical safety is required for all entering chemistry graduate students. Topics to be covered include laboratory emergencies, chemical hazards, lab inspections and compliance, managing and working with chemicals, waste handling, case studies of university accidents, laboratory equipment, biosafety, radiation, and animals, and microfabrication and nanomaterials.

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- Negligence in chemical industry could result in devastating consequences. Incidences could arise at any stage and at any time such as during erection, commissioning, manufacturing, maintenance, disposal or transportation. Whenever it happens, chemical incidents might end up with fire and/or toxic releases. A major mishap could spill catastrophe in terms of loss of life, occupational disease, and threat to the environment. As a result, organizationsmay face high consequence incidents, incur costs of treatment and rehabilitation, face legal costs and may have to pay fines and compensation claims.
- The course aims to provide a deep understanding of chemical safety which will yield benefit in terms of reducing serious accidents involving hazardous chemicals handling, storage and transportation, moreover, it would lead to improvement while working in the lab and will be boosting student's productivity while working in chemical industry in future.

Course Description :

- In this course, several useful topics will be there as safety and risk management; material hazards; hazard evaluation and risk assessment techniques; laboratory safety; PPE kit, handling, storage and transportation of hazardous chemicals, handling, storage and transportation of gas cylinders; safety devices; utilities; radiation safety; environmental impact assessment; management practice, Emergency preparedness, Disposal of chemical waste and Environmental health and safety guidelines.

Course Contents : **L-4 T-0 P-2**

Instructor(s):

Unit 1: Introduction to Laboratory Safety: Introduction: The Texas Tech incident (Lessons to be learned: shared responsibilities), Risks in a research laboratory health effects due to "Hazardous" chemical exposure (How does one determine the hazards associated with specific chemicals, exposure routes, toxicity risk assessment), Personal protective equipment (PPE), proper attire (eye/face protection, lab coats, gloves, respirators, disposal/removal of PPE), Emergency equipment safety showers/eye washes, Key campus and department chemical safety contacts, Environmental health and safety (EHS), Case study: Dartmouth chemical poisoning (Key Lessons).

Unit 2: Laboratory Emergencies: Spills and Fires: General preparation for emergencies, Handling the accidental release of hazardous materials, working with compressed gases (parts of the cylinder, cylinder pressure regulator, storage guidelines, transporting cylinders, handling compressed gas cylinders), working with cryogenics (Health Hazards, Liquid N_2) spill containment and clean-up, Leaking gas cylinders, Fires classification, fire extinguishers (how they work, types), risk assessment, Case study: University of Texas Austin sodium fire (lessons learned).

Unit 3: Chemical Hazards: Chemical hygiene plan: Introduction to laboratory safety, the new safety data sheets (SDS) versus the old material safety data sheets (MSDS),

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Assessment of chemical toxicity: Toxic hazards (dose, risk assessment, types of toxins), Chemical hazards associated with microfabrication and nanoparticles, instrument hazards associated with microfabrication, Flammable Hazards: flammability characteristics, flammability classes, causes of ignition, reactive hazards, explosives, Precautions for minimizing exposure – Handling, Case study: University of Wisconsin – LiAlH4 explosion (lessons learned).

Unit 4: Lab Inspections and Compliance: Ordering and receiving chemicals, Regulatory compliance – History of occupational safety and environmental laws, Current research regulations, Regulatory inspections that occur at University, Environmentalhealth & safety department (roles, responsibilities, organization), Inspections (EHS, self- inspections)**,** Case studies: DuPont facility – Phosgene release (lesson learned)

Unit 5: Managing and Working with Chemicals: General considerations (chemical segregation, transfer and transport, chemical fume hoods (safety, types, operation), other types of ventilation)**,** waste handling: characterization of waste, collection and storage (lids, leaks, labels, location, containers), consequences of mixing incompatibles, solid wastes (chemicals, broken glass, sharps, cylinders, pick-up), Special Cases, hazardous waste minimization, Biosafety, radiation, and animals. Case Studies. the "UCLA Incident" (Looper)

Course Learning Outcomes (CLOs) :

After completion of the course Student will learn followings

CLO-1: Identification of hazardous substances at work, Compliance with existing rules and regulations as well Clean-up of chemical spills using appropriate protective apparel and equipment. Hazard signs and symbols.

CLO-2: Control of exposure/Emergencies, Storage and handling of chemical as acids, ethers, toxic and poisonous chemicals, Enable students to apply these concepts when working in a laboratory.

CLO-3: Identification of hazardous activities and their elimination, Use of hazard identification tool like HAZOP (hazard and operability study) to mitigate hazards, Recognize common laboratory hazards

CLO-4: Chemical hygiene plans (CHP), Reporting all accidents and potential chemical exposures immediately, Emergency preparedness

CLO-5: Control measures, including, Engineering controls (equipment such as hoods,ventilation systems, and safety interlocks),Administrative controls (procedures, processes, and training), Personal protective equipment (PPE),Properly disposing of all hazardous waste material.

Text books :

1. Robert H. Hill, Jr., David C. Finster, Laboratory safety for chemistry students,Wiley, ISBN: 978-0-470-34428-6
2. Najat Rashid , Ramnik Sood Manual of Laboratory Safety, JBP, ISBN: 978-9350906224
3. National Research Council,Safe Science: Promoting a Culture of Safety in Academic Chemical Research, National Academies Press 9780309300940, 0309300940

4. Pooja Sharma, S. C. Bhatia, Shweta Sharma ,Environmental Chemistry, CBS Publishers & Distributors, ISBN: 9788123908267, 9788123908267
5. Hill Robert H. ,Laboratory Safety for Chemistry Students, John Wiley and Sons Ltd, ISBN: 9781119027669, 9781119027669

Reference books :

6. L. Bretherick, Handbook of Reactive Chemical Hazards, Elsevier Science, fourth, ISBN: 9781483162508, 1483162508
7. Richard P. Pohanish, Stanley A. Greene, Wiley Guide to Chemical Incompatibilities,wiley, second, ISBN: 9780471721628, 047172162X

Online links for study & reference materials:

8. https://www.shponline.co.uk/ppe-personal-protective-equipment/
9. https://www.carleton.edu/environmental-health-safety/work-practices/compressed-gas/
10. https://nsc.nasa.gov/docs/default-source/system-failure-case-studies/sfcs-2015-04-14-deadlyexposure-presentation.pdf?sfvrsn=ad4eecf8_2
11. https://sunypoly.edu/sites/default/files/Research/Contractor%20Forms%20and%20Training/EHS-00005%20R12%20Chemical%20Handling%20and%20Storage_0.pdf

Course Code : AEC 1 Course Name: Fundamentals Of ComputerApplications

Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- Write about what is intended to teach & Learn in this course.
- Write about 3 to 4 lines

Course Description :

- Write a brief summary indicating how this will be conducted specifying the key topics of the whole course.
- Write about 4 to 5 lines or till 7 lines, if some course description demands.

Course Contents : L-2 T-0 P-2

Unit-I Fundamental: H/W and S/W part of computer system, Computer Block Diagram, online processing, time sharing system, real time system, batch system, ultra programming, multiprocessing, SPOOLING, distributed data processing. Element of computer file, ypes of files, file processing activities, file design factors, access methods, pros and cons of file organization

Unit-II: MS office: Introduction to MS Office; Introduction to MSWord; Features & area of use. Working with MS Word.; Menus & Commands; Toolbars & Buttons; Shortcut Menus, Wizards & Templates; Creating a New Document; Different Page Views and layouts; Applying various Text Enhancements; Working with – Styles, Text Attributes; Paragraph and Page Formatting; Text Editing using various features ; Bullets, Numbering, Auto formatting, Printing & various print options

Unit-III: MS Excel: Introduction and area of use; Working with MS Excel.; concepts of Workbook & Worksheets; Using Wizards; Various Data Types; Using different features with Data, Cell and Texts; Inserting, Removing & Resizing of Columns & Rows; Working with Data & Ranges; Column Freezing, Labels, Hiding, Splitting etc.; Using different features with Data and Text; Use of Formulas, Calculations & Functions; Cell Formatting including Borders & Shading; Working with Different Chart Types; Printing of Workbook.

Course Learning Outcomes(CLOs) :

CLO-1 : CLOs can be identified from each units and written here.

CLO-2 :

CLO-3 :

CLO-4 :

Text books :

- Joe Habraken, Microsoft Office 2000, 8 in 1 by, Prentice Hall of India
- Deitel & Deitel: C How to Program (Prentice Hall), 1996.
- Yashwant Kanetker, Let us C, BPB Publications.
- R. B. Patel, Fundamental of Computers and Programming in C, Khanna Book Publishing Company PVT.LTD. Delhi, India, 1st edition, 2008, ISBN: 13: 978-81-906988-7-0, pp. 1-962.
- Gottfried, Programming with C, Tata McGraw Hill.
- Brian W. Kernighan, Dennis M. Ritchie, The C Programming Language, 2nd Ed., Prentice Hall of India.

Reference books : Author, Title of text book, edition, name of publisher, issbn number

Online links for study & reference materials :

Course Code: AECC 01 **Course Name:** Environmental Science

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Course Credit Hour: 2hr **Total Contact Hour:** 47hr

Course Objective:

- The Compulsory course on Environmental Science at Undergraduate level (AECCI) aims to train students to cater to the need for ecological citizenship through developing a strong foundation on the critical linkages between ecology-society-economy.

Course Description:

- Graduates will evolve into ecologically informed and socially responsible citizens who are empowered to protect the natural resources while ensuring sustainable lifestyle and developmental model.

Course Contents:

Unit 1: Introduction to Environmental Studies (2 lectures)

- Multidisciplinary nature of environmental studies
- Scope and importance; Concept of sustainability and sustainable development

Unit 2: Ecosystem (8 lectures)

- Definition and concept of Ecosystem
- Structure of ecosystem (biotic and abiotic components); Functions of Ecosystem
- Physical (energy flow), Biological (food chains, food web, ecological succession)
- Biogeochemical (nutrient cycling) processes. Concepts of productivity, ecological pyramids and homeostasis
- Types of Ecosystem – Tundra, Forest, Grassland, Desert, Aquatic (ponds, streams, lakes, rivers, oceans, estuaries) – their importance and threats on them with relevant examples from India Ecosystem services (Provisioning, Regulating, Cultural and Supporting). Basics of Ecosystem restoration

Unit 3: Natural Resources (6 lectures)

- Land resources and land use change Land degradation, soil erosion and desertification
- Forest resources and causes of deforestation; impacts of mining and dam building on environment, forests, biodiversity and tribal populations
- Water resource: Use and over exploitation of surface and ground water, floods, drought conflicts over water (international & inter-state)
- Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs
- Case studies: National Solar Mission, Cauvery river water conflict etc

Unit 4: Biodiversity and Conservation (8 lectures)

- Definition of Biodiversity; Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India

- India as a mega-biodiversity nation; Endemic and endangered species of India; IUCN Red list; biodiversity hotspots
- Value of biodiversity: Ecological, economic, social, ethical, aesthetic and informational value of biodiversity with examples; sacred groves and their importance with example
- Current mass extinction crisis; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasion with emphasis to Indian biodiversity
- Biodiversity conservation strategies: in-situ and ex-situ methods of conservation; Biosphere reserves; Keystone and Flagship species; Species reintroduction and translocation
- Case studies: Project Tiger, Vulture breeding program etc

Unit 5: Environmental pollution (8 lectures)

- Environmental pollution (Air, water, soil, thermal and noise): causes, effects and controls; Air and water quality standards
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste
- Pollution case studies: Ganga Action plan (GAP), Delhi air pollution and public health issues etc

Unit 6: Global Environmental Issues and Policies (8 lectures)

- Climate change, Global warming, Ozone layer depletion, Acid rain and impacts on human communities and agriculture
- International agreements: Earth Summit, UNFCCC, Montreal and Kyoto protocols and Convention on Biological Diversity (CBD)
- Sustainable Development Goals and India's National Action Plan on ClimateChange Environment legislation in India: Wildlife Protection Act, 1972; Water (Prevention and Control of Pollution) Act, 1974; Forest (Conservation) Act 1980, Air (Prevention & Control of Pollution) Act, 1981; Environment Protection Act, 1986; Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006

Unit 7: Human Communities and the Environment (7 lectures)

- Human population growth: Impacts on environment, human health and welfare
- Resettlement and rehabilitation of project affected persons; case studies
- Disaster management: floods, earthquake, cyclones and landslides
- Environmental movements: Chipko movement, Silent valley movement, Bishnois of Rajasthan, Narmada Bachao Andolan etc
- Environment justice: National Green Tribunal and its importance
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi, Swachh Bharat Abhiyan)

Field work/ Practical (Equal to 5 lectures)

- Field visit to any of the ecosystems found in Delhi like Delhi Ridge/ Sanjay lake/ Yamuna river and its floodplains etc. or any nearby lake or pond, explaining the theoretical aspects taught in the classroom
- Visit to any biodiversity park/ reserve forests/ protected area/ zoo/ nursery/ natural history museum in and around Delhi, explaining the theoretical aspects taught in the classroom
- Visit to a local polluted site (Urban/Rural/Industrial/Agricultural), Wastewater treatment plants
- Study of common plants, insects, birds and basic principles of identification
- Organize a seminar/ conference/ workshop/ panel discussion on relevant topics for enhancing awareness, capacity building and critical reasoning among students

Course Learning Outcomes (CLOs): The course will empower the undergraduate students by helping them to:

CLO-1 Gain in-depth knowledge on natural processes that sustain life, and govern economy.

CLO-2: Predict the consequences of human actions on the web of life, global economy and quality of human life.

CLO-3: Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.

CLO-4: Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participating actively in solving current environmental problems and preventing the future ones..

CLO-5: Adopt sustainability as a practice in life, society and industry.

Text books:

1. William P. Cunningham, Mary Ann Cunningham, Barbara Woodworth Saigo, Environmental Science: A global concern, McGrawHill 2003
2. William Cunningham, Mary Cunningham, Principles of Environmental Science: Seventh Edition, Mc Graw Hill 2014 UGC DOCUMENT ON LOCF ENVIRONMENTAL SCIENCE 24
3. Rogers PP, Jalal, KF, Boyd JA, An introduction to sustainable development, Earthscan

Reference books:

1. Roosa SA, Sustainable Development Handbook, CRC Press 2008 ¬
2. Atkinson G., Dietz S., Neumayer E., Agarwala M, Handbook of Sustainable Development, Edward Elger, 2014 ¬

3. Robbins P., Hintz J., Moore S.A., Environment and Society: A critical introduction, Wiley Blackwel 2014

Online links for study & reference materials:

https://www.hzu.edu.in/bed/E%20V%20S.pdf

Course Code : SEC 1 **Course Name : Fundamentals of C Programming**

Course Credit Hour : 2hr **Total Contact Hour :** 30hr

Course Objective :

- Write about what is intended to teach & Learn in this course.
- Write about 3 to 4 lines

Course Description :

- Write a brief summary indicating how this will be conducted specifying the key topics of the whole course.
- Write about 4 to 5 lines or till 7 lines, if some course description demands.

Course Contents : L-4 T-0 P-2

Unit 1 Introduction

Elements of C: C Character set, Constants, Variables and Keywords, Types of C Constants, Rules for Constructing Integer Constants, Rules for Constructing Real Constants, Rules for Constructing Character Constants, Types of C Variables, Rules for Constructing Variable Names, identifiers, data types, declaration and definition, storage classes in C- Global, local, register, types conversion, types of error, 'C' macro, macrosvs function

Unit 2 Operator

Operators: Arithmetic, Relational, logical, bitwise, unary, assignment and conditional operator and their hierarchy & associativity, Integer and Float Conversions, Type Conversion in Assignments, Data input/output.

Unit 3 Control Statement

Control Statements: Sequencing, Selection: The *if* Statement, The *if-else* Statement, Nested *if-elses*, The *else if* Clause Loops, The *while* Loop, The *for* Loop, Nesting of Loops, Multiple Initialisations in the *for* Loop, The *break* Statement, The *continue* Statement, The *do-while* Loop, Decisions Using *switch*, *switch* Versus *if-else*, The *goto* Keyword.

Unit 4 Array & Functions

What are Arrays, A Simple Program Using Array, Array Initialization, Passing Array Elements to a Function, Pointers and Arrays, Functions: Definition, prototypes, passing parameters, recursion.

Unit 5 Data Structure and Pointer

Pointers: Declaration, operations on pointers, array of pointer, pointers to array, Data Structure: Why Use Structures, Declaring a Structure, Accessing Structure Elements, and How Structure Elements are stored structure, union, structure vs Union.

Course Learning Outcomes(CLOs) :

CLO-1 : CLOs can be identified from each units and written here.

CLO-2 :

CLO-3 :

CLO-4 :

CLO-5 :

Text books :

1. Gupta: Computer Concepts & C Programming, Comdex
2. Jones, C Programming with problem solving, Wiley India
3. Let Us C : Yashwant Kanetkar [BPB]
4. Mastering C ,K.R.Venugopal,S.R.Prasad [TMH]
5. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, [India Edition]

Reference books :

Author, Title of text book, edition, name of publisher, issbn number

Online links for study & reference materials :

Course Code: STUGC/C03 **Course Name: ELEMENTS AND PROPERTIES**

Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- Application based learning of the subject. Students will learn to apply and incorporate the scientific principles. To understand the importance of the Periodic table of the elements, how it came to be, and its role in organizing chemical information.

Course Description:

- Students will be able to compare and contrast the properties of s, p and d block elements. To convert scientific equation in straight line to get physical parameter for slope and intercept. To understand the deviation of real gas from ideal behavior. To Understand critical constant and Vander Waals constant and basic idea of surface tension.

Course Contents: L-4 T-0 P-2

Unit 1:
Periodic trends and properties: Size, Ionization Energy, Electron Affinity, Electronegativity, Lattice and Hydration Energies, Use of redox potential and reaction feasibility.

Unit 2:
Chemistry of *s* and *p*-block elements: Alkali and alkaline earth metals: Hydrides and Complexation tendencies. Structural features of hydrides, halides, oxides and oxyacids.

Unit 3:
Chemistry of *d*-block elements: Salient features, characteristic properties of 3*d*-elements with reference to oxidation states, colour, magnetic behaviour, and complex formation tendency.

Physical Chemistry
Unit 4:
Gaseous State: Kinetic theory of gases, ideal gas laws based on kinetic theory. Collision in a gas- mean free path, collision diameter, collision number. Behaviour of real gases - the van der Waal's equation. Critical phenomena - critical constants of a gas and their determination, the van der Waals equation and critical state, Principle of corresponding states.

Unit 5:
Liquid State: Surface tension of liquids - capillary action, experimental determination of surface tension, temperature effect on surface tension. Viscosity of liquids, experimental determination of viscosity coefficient, its variation with temperature.

Course Learning Outcomes (CLOs):

CLO-1: To study the periodic trends, properties and study the use of redox potential and reaction feasibility.

CLO-2: To classify the elements into a s, p, d and f blocks and learn their main characteristics.

CLO-3: To study the chemistry of *d*-block elements and its characteristic properties with reference to oxidation states, colour, magnetic behaviour, and complex formation tendency.

CLO-4: To differentiate between gaseous state and vapour. To explain the kinetic theory of gases. To state and apply the laws of thermodynamics; perform calculations with ideal and real gases.

CLO-5: To learn depth knowledge about liquid states. To explain the properties of liquids. To describe condition required for liquefaction of gases.

Text books:

1. *Basic Inorganic Chemistry*, F. A Cotton, G. Wilkinson, and Paul L. Gaus, 3rd Edition (1995), John Wiley & Sons, New York.
2. *Concise Inorganic Chemistry*, J.D. Lee, 5th Edition (1996), Chapman & Hall, London.
3. *Physical Chemistry*, P. Atkins and J. De Paul, 8th Edition (2006), International Student Edition, Oxford University Press.
4. *Physical Chemistry*, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999)

Reference books:

1. P rinciples of Physical Chemistry", B.R. Puri, L.R. Sharma and M.S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.
2. "Physical Chemistry", N. Kundu and S.N. Jain.
3. Physical Chemistry, P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.

Online links for study & reference materials:

1. https://www2.chemistry.msu.edu.
2. https://chem.libretexts.org.
3. https://chemistry.tutorvista.com/inorganic-chemistry/oxidation-states.html.
4. http://www.uou.ac.in/sites/default/files/slm/BSCCH-201.pdf
5. https://www.bing.com/videos/search?q=liquid+states+of+matter&&view=detail&mid=888BE9D5C1C2757422F9888BE9D5C1C2757422F9&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3Dliquid%2Bstates%2Bof%2Bmatter%26qpvt%3Dliquid%2Bstates%2Bof%2Bmatter%26FORM%3DVDVRE

6. https://www.bing.com/videos/search?q=liquid+states+of+matter&qpvt=liquid+states+of+matter&view=detail&mid=82FE5301226D18B8C5D182FE5301226D18B8C5D1&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3Dliquid%2Bstates%2Bof%2Bmatter%26qpvt%3Dliquid%2Bstates%2Bof%2Bmatter%26FORM%3DVDRE

Course Code : STUGC/C02 **Course Name : Analytical Chemistry**

Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective:

- The course aims to provide a deep understanding of Analytical chemistry and an overview of important analytical methods and their range of application within detection of inorganic and organic compounds. It is to acquire basic concepts, principles, and techniques of modern analytical chemistry that would empower students with an analytical mind set and the abilities to solve diverse analytical problems in an efficient and quantitative way that conveys the importance ofaccuracy and precision of the analytical results. Finally, this course will help students to develop critical, independent reasoning which they can apply to new problems in chemistry and its related fields.

Course Description:

- Analytical chemistry covers the fundamentals of experimental and analytical methods and the role of chemistry around us. It also includes the concepts of handling and storage of toxic chemicals inside the lab, sampling,analyses of real samples, statistical analysis and calibration. The quantitative principles of solution equilibria and applications to complexometric titrations Gravimetric and volumetric techniques of analysis. Electrochemical methods (e.g. potentiometry, coulometry, voltammetry) will be introduced, both from the point ofview of theory and the associated instrumentation. The basic principles of chromatography will be introduced and the associated instrumentation.

Course Contents : L-4 T-0 P-2

Objectives 1. To help the student to develop the habit of accurate manipulation and an attitude of critical thinking. 2. To learn the basic analytical methods and appreciate what is involved in an analysis.

UNIT 1: HANDLING OF CHEMICALS AND ANALYSIS (8 h)

1.1 Safety and hygiene in the Chemistry Lab Storage and handling of chemicals, handling of acids, ethers, toxic and poisonous chemicals, antidotes, threshold vapour concentration and first aid procedure. Heating methods, stirring methods filtration techniques. Calibration of pipette, standard measuring flask and burette. Weighing principle in chemical balance and single pan balance.

1.2 Error in chemical analysis Accuracy, precision, Types of error-absolute and relative error, methods of eliminating or minimizing errors. Methods of expressing precision: mean, median, deviation, average deviation and coefficient of variation. Significant figures and its application with respect to the glassware used. Normal error curve and its importance.

UNIT 2: SEPARATION AND PURIFICATION TECHNIQUES

2.1 General purification techniques Purification of solid organic compounds, recrystallisation, use of miscible solvents, use of drying agents and their properties, sublimation. Purification of liquids. Experimental techniques of distillation, fractional distillation, distillation under reduced pressure. Extraction, use of immiscible solvents, solvent extraction. Chemical methods of purification and test of purity. 2.2 Chromatography Principle of adsorption and partition chromatography. Column chromatography: adsorbents, classification of adsorbents, solvents, preparation of column, adsorption and applications. Thin Layer Chromatography: choice of adsorbent, choice of solvent, preparation of chromatogram, sample, Rf value and its applications. Paper chromatography, solvent used, Rf value, factors which affect Rf value. Ion exchange chromatography, resins used, experimental techniques, applications. Gas Chromatography, principle, detector (FID, TCD, ECD), Applications.

UNIT 3: TITRIMETRIC METHODS OF ANALYSIS

3.1 General Introduction General principle. Types of titrations. Requirements for titrimetric analysis. Concentration systems: Molarity, formality, normality, wt% ppm, milliequalence and millimoles-problems. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, endpoint and equivalence point.

3.2 Acid-base Equilibria pH of strong and weak acid solutions. Buffer solutions. Henderson equations. Preparation of acidic and basic buffers. Relative strength of acids and bases from Ka and Kb values. Neutralisation-titration curve, theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange.

3.3 Complexometric titrations Stability of complexes, titration involving EDTA. Metal ion indicators and characteristics.

3.4 Problems based on titrimetric analysis.

UNIT 4: SOLUBILITY EQUILIBRIA

4.1 General Separation Techniques Solubility and solubility products, expressions for solubility products. Determination of solubility from solubility products.

4.2 Precipitation titrations Argentometric titrations, indicators for precipitation titrations involving silver. Determination of chloride by Volhard’s method. Adsorption indicators.

4.3 Gravimetric methods of analysis Separation by precipitation, factors affecting solubility, gravimetric factor. Purity of precipitates, von Weiman ratio. Co-precipitation, post precipitation.

Course Learning Outcomes (CLOs) :

On completion of course, the students will be able to:

CLO-1: Control of exposure/Emergencies, Storage and handling of chemical as acids, ethers, toxic and poisonous chemicals, Enable students to apply these concepts when working in a laboratory, as well calibration of all the analytical apparatus.

CLO-2: Will be able to evaluate the analytical data in terms of statistics as types of errors in chemical analysis, expresses the terms such as mean, median, precision, accuracy,absolute error and relative error.
CLO-3: Explain the theoretical principles of various separation techniques in chromatography, and typical applications of chromatographic techniques.
CLO-4: Explain the theoretical principles and important applications of classical analytical methods within titration (acid/base titration, complexometric titration, redox titration, precipitation titration), and various coulometric methods as well interprets the redox titrations.
CLO-5: Will be able to interpret different gravimetric analysis methods, properties of precipitate and precipitating agents, employs the gravimetric calculations, solves problems related to gravimetric method applications.

Text books :

1. D.A. Skoog, D.M. West and F.J. Holler, Analytical Chemistry: An Introduction, 5th edition, Saunders college publishing, Philadelphia, 1990.
2. U.N. Dash, Analytical Chemistry: Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 1995.
3. R.A. Day Jr. A.L. Underwood, Quantitatives Analysis, 5th edition, Prentice Hall of India Private Ltd., New Delhi, 1988.
4. R. Gopalan, Analytical Chemistry, S. Chand and Co., New Delhi

Reference books

1. Elementary Organic Spectroscopy: Principles and Chemical Applications, S.Chand and company Ltd., Ram Nagar, New Delhi, 1990.
2. V.K. Srivastava, K.K. Srivastava, Introduction to Chromatography: Theory and Practice, S. Chand and company, New Delhi, 1987.
3. R.M. Roberts, J.C. Gilbert, L.B. Rodewald, A.S. Wingrove, Modern Experimental Organic Chemistry, 4th edition, Holt Saunders international editions.
4. A.K. Srivastava, P.C. Jain, Chemical Analysis: An Instrumental Approach for B.Sc. Hons. and M.Sc. Classes, S. Chand and company Ltd., Ram Nagar, New Delhi.

Reference Books

1. U.N. Dash, Analytical Chemistry: Theory and Practice, Sultan Chand and sons Educational Publishers, Ist edition,ISBN-13 : 978-8180549533
2. Recent Advances in Analytical Chemistry Muharrem Ince and Olcay Kaplan, Intech open ISBN:9781789858099, 1789858097
3. Douglas A. Skoog, F. James Holler, Stanley R. Crouch ,Fundamentals of Analytical Chemistry, Cengage Learning, 7th Edition, ISBN 13:978-1-305-57721-3
4. G. H. JEFFERY J. BASSETT J. MENDHAM R C. DENNEY,Text book of quantitative analysis, 5th Edition, ISBN 0-582-Wb93
5. Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Fundamentals of Analytical Chemistry, Cengage Learning, 2nd edition, ISBN:9781285607191, 1285607198

6. C. Krupadanam, G.L.D.Vijaya Prasad, D.Varaprasad Rao, K.Reddy, K.L.N.Sudhakar, Analytical Chemistry, Universities Press,1st edition, ASIN : 8173713855

Online links for study & reference materials:

1. http://www.airproducts.com/~/media/Files/PDF/company/safetygram-11.pdf
2. https://sunypoly.edu/sites/default/files/Research/Contractor%20Forms%20and%20Training/EHS-00005%20R12%20Chemical%20Handling%20and%20Storage_0.pdf
3. https://www.chem.ucla.edu/~bacher/General/30BL/tips/TLC1.html
4. https://ijpsr.com/bft-article/an-overview-on-thin-layer-chromatography/?view=fulltext
5. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Book%3A_Analytical_Chemistry_2.1_(Harvey)/07%3A_Obtaining_and_Preparing_Samples_for_Analysis/

Course Code: AECC2 **Course Name:** TechnicalCommunication

Course Credit Hour: 2Hr **Total Contact Hour:** 30hr

Course Objective:

- The course aims to provide insights related to communication skills. It aims to train the student in the basic concept of effective communication and Interview preparation.

Course Description:

- This course introduces the fundamental concepts of communication skills, writing skills presentation skills, and interview skills. Topic includes an introduction to Grammar, speaking skills, Writing Skills, Presentationskills, Interview skills.

Course Contents:

Unit 1: Communicative Grammar and learning: (6lecture)

Spotting the errors about nouns, pronouns, adjectives, and adverbs; Principle of proximity between subject and verb. Changing the voice: from Active to Passive and Passive to Active. Idioms and Phrases; Words often confused; One-Word Substitutes; Formation of words (suffixes, prefixes).

Unit 2: Oral Communication and Vocabulary building: (6 lectures)

Introduction to principal components of spoken English – Transcription, Word accent, Intonation, developing listening and speaking skills through various activities, such as

(a) role-play activities, (b) Practicing short dialogues (c) Group discussion (d) Debates (e) Speeches (f) Listening to news bulletins (g) Viewing and reviewing T.V. programmers, etc.

Unit 3: Written Communication: (6 lectures)

Developing reading and writing skills through such tasks/activities as developing outlines, key expressions, situations, slogan writing and theme building exercises, dialogue writing, interpreting pictures/cartoons.

Unit 4: Book Review and Technical writing – (6lecture)

Herein the students will be required to read and submit a review of a book (Literary or non-literary) of their own choice. This will be followed by a presentation of the same in the class. Violence and War- Amitav Ghosh, 'Ghosts of Mrs. Gandhi'
Living in a Globalized World- Imtiaz Darker, 'At the Lahore Karhai'

Technical Writing:

(a) Business Letters, Format of Business letters, and Business letter writing

(b) E-mail writing

(c) Reports, Types of Reports, and Format of Formal Report.

Unit-5: Proper use of Language (6 lecture)

Communication Skills, The effective Speech.

Effective self-presentation & facing interview: The interview process & preparing for it, the presentation skills.

Course Learning Outcomes (CLOs):

CLO-1: Develop vocabulary building and basic grammar concepts.

CLO-2: Inculcate speaking skills and listening skills.

CLO-3: Develop the writing skills.

CLO-4: Understand technical writing skills.

CLO-5: Demonstrate all skills in presentation and interviews.

Textbooks:

1. Raman, Meenakshi & Sangeeta Sharma. *Technical Communication Principles and Practice*. New Delhi Oxford University Press, 2004.
2. Spoken English for India, R.K. Bansal & J.B. Harrison, Orient Longman, Delhi.

3. Objective English, Tata Mc. Graw Hill Publishing Company Ltd., New Delhi.
4. The sounds of English, Veena Kumar, Makaav Educational Software, New Delhi.

Reference books:

(i) English Phonetics & Phonology, P. Roach, Cambridge University Press, London
(ii) Common Errors in English, Abul Hashem, Ramesh Publishing House, New Delhi.

Course Code : BSC 203 **Course Name :** Introductionto operating system

Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- To study concepts related to operating systems, like process management, concurrency and control of processes, deadlocks, memory management, processor and disk scheduling, parallel processing, and file system organization and implementation. Also to study different methods for protection and security that are becoming vital now-a-days.

Course Description :

- To master the basic concepts related to operating systems. To learn in detail about process management. To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems. To be familiar with principles of deadlock and itsprevention. To understand the concepts of file system interface.

Course Contents :

Unit – I: Operating system and function, Evolution of operating system, Batch, Interactive, multiprogramming, Time Sharing and Real Time System, multiprocessor system, Distributed system, System protection. Operating Systemstructure, Operating System Services, System Program and calls.

Unit – II: Process concept, State model, and process scheduling, job and process ynchronization, structureof process management, Threads interprocess Communication and Synchronization: Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Hardware Synchronization, Critical Regions, Conditional critical region, Monitor, Inter P rocessCommunication. CPU Scheduling: Job scheduling functions, Process scheduling, Scheduling Algorithms, Non Preemptive and preemptive. Strategies, Algorithm Evaluation,
Multiprocessor Scheduling.Deadlock: System Deadlock Model, Deadlock Characterizati on, Methods for handling deadlock, Prevention strategies, voidance and Detection, Recov ery from deadlockcombined approach.

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UnitIII: Single Contiguous Allocation: H/W support, S/W support, Advantages and dis advantages, Fragmentation, Paging, Segmentation, Virtual memory concept, Demand paging,
Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Swapping, Overlays
Unit – IV: Principles of I/O hardware, Device controller, Device Drivers, Memorymapped I/O,
Direct Access Memory, Interrupts, Interrupt Handlers, Application I/O interface, I/O Sch eduling, Buffering, Caching, Spooling, Disk organization, Disk space management, Disk allocation Method, Disk Scheduling, Disk storage.
Unit - V : File Concept, File Organization and Access Mechanism, File Directories, Basic file system, File Sharing,Allocation method, Free space management. Policy Mechanism, Authentication, Internalexcess Authorization.

Course learning outcomes (CLOs) :

CLO1 : To master the basic concepts related to operating systems. To learn in detail about process management.
CLO2: : To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.
CLO3: To be familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.
CLO4 :To familiar with file system implementation. To understand mass storage management functions of operating systems.
CLO5: To familiar with Protection and security aspects of operating systems. To expose to other operating systems like distributed OS, Multi-processor OS, RTOS and Mobile OS.

Text books :

1. Operating System by alvin Operating System by Tanenbaum
2. Operating System by William Stalling

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Course Code: STUGC/C05 **Course Name : Organic Chemistry -I Course**
Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- On completion of this course, the students will be able to understand the reactivity for hydrocarbons with mechanisms of halocarbons, alkenes, dienes, and arenes by understanding and applying concepts of organic chemical structure and bonding and stability.

Course Description :

- Student will learn the write a brief summary indicating how this will be conducted specifying the key topics of the whole course like aromaticity, aromatic electrophilic substitution mechanism, aryl halogen compounds, nucleophilic aromatic substitutions, Carbonyl compounds-Preparations, reactions with mechanisms, Phenols-preparation and reactions, Comparative study of Acidity of the molecules like phenol, alcohol and carboxylic acid. Nitrogen Containing compounds-Comparative basicity of aliphatic and aromatic amines and Diazonium Salts-synthetic applications.

Course Contents : L-4 T-0 P-2

Unit 1:
Aromaticity: Aromaticity and Huckel rule - A general concept. Molecular orbital picture of benzene. Aromatic Electrophilic Substitution: Mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts (alkylationa and acylation) reactions. Effects of substituents on orientation and reactivity.

Unit-2:
Aryl Halogen Compounds: Chlorobenzene-electrophilic and nucleophilic aromatic substitutions; side chain chlorination of toluene.

Unit-3:
Chemistry of Carbonyl compounds: Preparations and reactions: addition and condensation reactions; Cannizzaro, Perkin, aldol, benzoin, haloform, oxidation and reduction reactions. Important reactions of acids, HVZ reaction, Relative reactivity ofacid chlorides, acid anhydrides, amides and esters. Comparative acidity of carboxylic andsulphonic acids.

Unit-4:
Phenols: General methods of preparation and reactions. Reimer-Tiemann and Kolbe reactions. Relative acidity of phenol, alcohol and carboxylic acid.

Unit-5:
Nitrogen Containing compounds: Nitronbenzene and reduction products.
Comparative basicity of aliphatic and aromatic amines.
Diazonium Salts: Preparation and synthetic applications.

Course Learning Outcomes (CLOs) :

CLO-1 : To understand the concept of aromaticity, aromatic electrophilic substitution reactions with mechanisms.
CLO-2 : To understand the Aryl Halogen Compounds Reactivity, stability of organic molecules, structure, stereochemistry.

CLO-3 : To learn the Chemistry of Carbonyl compounds-nomenclature, structure, acidity, preparations, reactions and mechanisms.
CLO-4 : To learn the Phenols nomenclature, structure, acidity, preparations, reactions and mechanisms.
CLO-5 : To understand the Nitrogen Containing compounds- nomenclature, structure, basicity, preparations, reactions and mechanisms.

Text books :

1. Organic Chemistry, Paula Y. Bruice, 2nd Edition, Prentice-Hall, International Edition (1998)
2. Organic Chemistry", R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
3. Organic Chemistry, I. L. Finar, [Vol. I, 6th Edition (1973), Reprinted in 1980 & Vol. II, 5th Edition (1975), Reprinted in1996], ELBS and Longman Ltd., New Delhi.
4. Organic Chemistry, L.G. Wade Jr., 5th Edition (2001) Prentie Hall International INC. USA.
5. Organic Chemistry, J. Clayden, N. Greeves, S. Warren, and E. Wothers, , Oxford Univ. Press, Oxford (2001).
6. Physical Chemistry, P. C. Rakshit, 5th Edition (1985), 4th Reprint (1997), Sarat Book House, Calcutta.
7. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.

Reference books :

1. Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, 6th Edn., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Pine S. H. Organic Chemistry, Fifth Edition, McGraw Hill, (2007)
3. F. A. Carey, Organic Chemistry, Seventh Edition, Tata McGraw Hill (2008).
4. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd Ed., (2012), Oxford Universitiy Press.
5. F. A. Carey, R. J. Sundberg, Advanced Organic Chemistry, Part A: Structure and mechanism, Kluwer Academic Publisher, (2000).

Online links for study & reference materials:

6. http://www.freebookcentre.net/Chemistry/Organic-Chemistry-Books.html
7. https://chem.ucr.edu/curricular-materials/textbook
8. https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm
9.https://chemistry.com.pk/free-download-chemistry-books/
10.https://bookboon.com › chemistry-ebooks

Course Code: **STUGC/C06** **Course Name: Physical Chemistry-I**
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- Application based learning of the subject. Discussion on the improvement of technology by increasing the heat efficiency. To study the reactions and their kinetics awareness. To acquire general idea about the heat flow, work done, enthalpy. Concept of system and types. Brief knowledge of laws of thermodynamics, kinetics, electrochemical cells and thermochemistry.

Course Description

- Better understanding of the heat changes, internal energy, enthalpy and heat capacity. Mathematical relations of different physical quantity. Entropy changes and heat efficiency concept better learning. Reactions, their dependence and kinetics. Electrochemical cells and thermochemistry basic knowledge.

Course Contents: L-4 T-0 P-2

Unit 1: First Law of Thermodynamics I: Basic Concepts

Thermodynamic processes, Reversible and irreversible processes, Nature of heat and work, Internal energy, units, First law of thermodynamics, Enthalpy, Molar heat capacity,Joule-Thomson effect, Joule-Thomson coefficient of real (van der Waal) gases, Adiabatic expansion of an ideal gas.

Unit 2: Second law of Thermodynamics:

The spontaneous processes, Entropy, Physical concept of entropy, the second law of Thermodynamics, Numerical definition of entropy, Units of entropy, Standard entropy, The Carnot cycle, Derivation of entropy from Carnot cycle, Net work done in one cycle, Entropy change for an ideal gas. Free energy and its concept, Work function (A) Gibbs and Helmholtz free energies and their relationship, Variation of free energy with temperature and pressure.

Unit 3: Thermochemistry:
Introduction, Definition, Units of energy changes, Enthalpy of a reaction, Exothermic and Endothermic reactions, Thermochemical equations, Enthalpy of reaction, Kirchhoff's equation, Different types of enthalpy of reaction, Energy changes during transitions or phase changes, Hess's law. Application of Hess's law.

Unit 4: Electrochemical Cells:
Reactions in reversible cells, free energy and *emf* of reversible cell. Single electrode potential (Nernst equation), its measurement and sign convention. Standard electrode potential. *Emf* of reversible cell from electrode potentials. Types of reversible activities, pH, and equilibrium constant. Potentiometric titration. Concentration cells with and without transference. Liquid junction potential and its elimination.

Unit 5: Chemical Kinetics:
Order and molecularity of chemical reactions, pseudo order. Kinetic law for second order reactions, determination of the rate constant and order of reaction from kinetic data. Effect of temperature on rate of reaction: collision theory of rates of bimolecular reactions and its comparison with Arrheninus equation.

Course Learning Outcomes (CLOs) :

CLO-1: To state and apply the laws of thermodynamics; joule Thomson effect and adiabatic expansion of ideal gases.

CLO-2: To design practical engines by using thermodynamic cycles; predict chemical equilibrium and spontaneity of reactions by using thermodynamic principles. To be able to describe the stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters from them.

CLO-3: To study the use of simple models for predictive understanding of physical phenomena associated to chemical thermodynamics and kinetics

CLO-4: Students can learn depth concepts about electrochemistry, emf, concentration cells and potentiometric titrations

CLO-5: The use of simple models for predictive understanding of physical phenomena associated to chemical thermodynamics and kinetics. To study the limitations and uses of models for the solution of applied problems involving chemical thermodynamic and kinetics

Text books :

1. Paul L Houston, Chemical Kinetics and Reaction Dynamics, Dover Publications Inc.; Illustrated edition (29 December 2006) ISBN-13: 978-0486453347

2. Physical Chemistry, P. C. Rakshit, 5th Edition (1985), 4th Reprint (1997), Sarat Book House, Calcutta.
3. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.

4. Physical Chemistry, K. J. Laidler and J. M. Meiser, 3rd Edition, Houghton Mifflin Comp., New York, International Edition (1999).

Reference books :

1. Physical Chemistry - P.W. Atkin, ELBS fourth edition.
2. Physical Chemistry – R.A. Alberty, R.I. Bilby, Johy Wiley – 1995
3. Essentials of Physical chemistry - Bahl and Tuli, S. Chand-2012
4. An Introduction To Electrochemistry, by samuel glassstone, East-West Press (Pvt.) Ltd. (1 January 2006) ISBN-13 : 978-8176710138

Online links for study & reference materials:

1. https://courses.lumenlearning.com
2. https://www.siyavula.com
3. 5.https://www.britannica.com/science/chemical-equilibrium
4. https://courses.lumenlearning.com
5. https://www2.estrellamountain.edu
6. https://application.wiley-vch.de/books/sample/3527330747_c01.pdf
7. http://library.umac.mo/ebooks/b28113640.pdf

Course Code : STUGC/ C07 **Course Name : Environmental Chemistry**
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective:

➢ Environmental science is the foundation of the increased environmental understanding today and chemistry plays a major role in this. The properties and reactions of substances in the environment can profoundly influence the world we live in. These substances may be natural or man-made, and there is increasing interest in the interface between man-made systems and the natural environment. Understanding of the chemical basis of environmental science is developed in this course via studies in the areas of water, soil, earth and atmosphere. The objectives of this course are to (1) teach the students basic knowledge of environmental chemistry, such as chemistry of atmosphere, hydrosphere, pedosphere and biosphere; (2) teach the student how to apply basic theories and methods of chemistry to study the environmental issues caused by chemical substances (pollutants); (3) provide the students with broad and strong knowledge base for solving related problems.

Course Description:

➢ During this course students will study the chemistry of air, water, and toxic organic compounds as well as how anthropogenic activities affect this chemistry on planet Earth. Specifically, they will examine the sources, reactions, transport, effects, and fates of chemical species found in air and water as well as the effects of technology thereon. This course is divided into 4 major parts that reflects the most pressing issues in Environmental Chemistry today: (1) Atmospheric Chemistry and Air Pollution (2) Water Chemistry and Water Pollution (3) Soil Chemistry and soil pollution and (4) Pedospheric Chemistry. All students who take this course are expected to demonstrate a mastery of all topics through successful completion of quizzes, problem sets, and exams as well as the pollutantassignment.

Course Contents : L-4 T-0 P-2

Unit: 1. Atmospheric Chemistry

Atmospheric structure, Atmospheric composition, Air pollution, Particles and Clouds, Climate, Stratospheric ozone depletion, Water in the atmosphere-Acid rain.

Unit: 2. Hydrospheric Chemistry

Water chemistry basics, Colloids, Adsorption and reaction at surfaces, Oxidation and reduction, Dispersions, Dissolution and precipitation, Endocrine disruptors in water

Unit: 3. Pedospheric Chemistry

Soil Structure and Components, Soil properties, Heavy metals in soil, Agricultural chemicals in soil.

Unit: 4. Biospheric Chemistry

Bioaccumulation of pollutants, Chemical contaminants and ecotoxicology, Transport and transformation of typical pollutants in the environment.

Course Learning Outcomes(CLOs) :

Environmental chemistry is the study of the distribution and interactions of matter (chemicals) in the environment, which includes both the outdoors and the indoors Students learn the basic principles of environmental chemistry. After completion of the course, they will be able to

CLO-1: Understand the interconnections between different sectors of the environment (soil, water, atmosphere) and the effect of human activities on the natural chemical processes.

CLO-2: Develop skills in recognizing chemically based environmental problems, an awareness of the possible effects of chemicals on the environment and a capacity to interpret environmental data and to apply diverse chemical principles in the explanation of environmental phenomena.

CLO-3 Demonstrate knowledge of chemical and biochemical principles of fundamental environmental processes in air, water, and soil.

CLO-4: Describe causes and effects of environmental pollution by industry and discuss some mitigation strategies.

CLO-5: Discuss local and global environmental issues based on the knowledge gained throughout the course.

Text books :

1. Pani, B. (2017), Textbook of Environmental Chemistry, I.K.International Publishing House.
2. De, A. K. (2012), Environmental Chemistry, New Age International Pvt, Ltd, New Delhi.
3. Khopkar, S.M.(2010), Environmental Pollution Analysis, New Age International Publisher.
4. Michael Baird, Colin, Cann, Environmental Chemistry, W. H. Freeman and Company, 5th edition, ASIN : B00HQ22RPG
5. W. Hawker, D. W. Conell, M. Warne, P. D. Vowles: Basic Concepts of Environmental Chemistry, Lewis Publishers, ISBN-13 : 978-0873719988
6. P. Schwarzenbach, P. M. Gschwend, D. M. Imboden: Environmental Organic Chemistry, J. Wiley and Sons, 3rd edition, ISBN: 978-1-118-76723-8.
7. G. Howard: Aquatic Environmental Chemistry, Oxford Science Publ.,5th edition ISBN-13 : 978-0198502838

Reference books :

1. Baird, et al ENVIRONMENTAL CHEMISTRY by, W. H. Freeman and Company, New York, 4th Edition.ISBN-13: 9781429201469, ISBN-10: 1429201460.
2. Friedland, R. Relyea and D.Courard-Hauri, ENVIRONMENTAL SCIENCE FOUNDATIONS AND APPLICATIONS, W. H. Freeman and Company, 2nd edition, ISBN-13: 9781429240291, ISBN-10: 0429240296.

Online links for study & reference materials:

1. https://climate.ncsu.edu/edu/Structure
2. https://www.researchgate.net/publication/265849316_Effects_of_Heavy_Metals_on_Soil_Plants_Human_Health_and_Aquatic_Life
3. http://www.pollutionissues.com/A-Bo/Bioaccumulation.html
4. https://nptel.ac.in/content/syllabus_pdf/104103020.pdf

Course Code : STUGC/SEC1 **Course Name: Intellectual Property Rights**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries. To disseminate knowledge on patents, patent regime in

India and abroad and registration aspects. To disseminate knowledge on trademarks and registration aspects. To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects To aware about current trends in IPR and Govt. steps in fostering IPR.

Course Description :

- This course is an intensive study of the core subjects of intellectual property law: patents, copyrights, trade secrets, and trademarks. It examines the fundamental principles of these bodies of law, their underlying policies, and how the laws inter-relate. Course will provide. comprehensive knowledge to the students regarding Indian position of the Patent Law (1970), Historical development, Procedure for granting a patent, Infringement
- Comprehensive knowledge to the students regarding Indian position of the Copyright Law, 1957, Historical background and Development of Copyright Law, Infringement. comprehensive knowledge to the students regarding Indian position of the Trademark Act, 1999, Historical development of the concept of trademark and trademark law, Registration of trademark, Infringement of trademark, geographical indications and for industrial designs too.

Course Contents : L-4 T-0 P-2

Unit I: Introduction to Intellectual Property
Historical Perspective, Different Types of IP, Importance of protecting IP.

Unit II: Copyrights
Introduction, How to obtain, Differences from Patents.

Unit III: Trade Marks
Introduction, How to obtain, Different types of marks – Collective marks, certification marks, service marks, Trade names, etc. Differences from Designs.

Unit IV: Patents
Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India.

Unit V: Geographical Indications
Definition, rules for registration, prevention of illegal exploitation, importance to India.

Unit VI: Industrial Designs
Definition, How to obtain, features, International design registration.

Course Learning Outcomes(CLOs) :

CLO 1: The students once they complete their academic projects, shall get an adequate knowledge on patent and copyright for their innovative research works

CLO 2: During their research career, information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provides further way for developing their idea or innovations

CLO 3: Pave the way for the students to catch up Intellectual Property (IP) as a career option

a. R&D IP Counsel

b. Government Jobs – Patent Examiner

c. Private Jobs

d. Patent agent and Trademark agent

e. Entrepreneur

Text Books :

1. N.K. Acharya: Textbook on intellectual property rights, Asia Law House (2001), 6th Edition, ISBN No: 978-9381849309
2. Manjula Guru & M.B. Rao, Understanding Trips: Managing Knowledge in Developing Countries, Sage Publications (2003), 1st Edition, ISBN-10 : 0761997385 ISBN-13 : 978-0761997382

3. P. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, Tata McGraw-Hill (2001), 1st Edition, ISBN-10 : 0074638602 ISBN-13 : 978-0074638606

Reference Books:

4. Arthur Raphael Miller, Micheal H.Davis; Intellectual Property: Patents,Trademarks and Copyright in a Nutshell, West Group Publishers (2000), 3rd Edition, *ISBN*-10 : 0314235191; *ISBN*-13 : 978-0314235190
5. Jayashree Watal, Intellectual property rights in the WTO and developing countries, Oxford University Press, Oxford, 1st Edition, ISBN-10 : 0195661702 ISBN-13 : 978-0195661705

Online links for study & reference materials :

1. http://cipam.gov.in/
2. (https://www.wipo.int/about-ip/en/
3. (http://www.ipindia.nic.in/
4. http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf

Course Code : STUGC/C08 **Course Name : Inorganic Chemistry-I**
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- To understand the concept of acid and bases, related theories and strengths. To make the students understand that solutions which have water as a solvent are called aqueous solutions and those with solvent other than water are called non- aqueous solutions. To understand the concepts of metal ligand bonding in transition complex compounds. To understand the nomenclature, classification, properties and preparations of coordination compounds. In order to study transition metals to understand the trends in properties and reactivity of the d- block elements. To explain and differentiate the physical and chemical properties of lanthanides and actinides. To Identify and define various typesof nuclear changes or processes including fission, fusion and decay reactions.

Course Description :

- This course provides an overview of fundamental topics in inorganic chemistry. Acid base concept, their strength, non-aqueous solvents their characteristics, metal ligand bonding, nomenclature, classification, properties and preparations of coordination compounds. In order to study transition metals to understand the trends in properties and reactivity of the d-block elements lanthanides and actinides their properties and differentiation. Nuclear chemistry to understand the nuclear fission, fusion, radioactivity half-life and application.

Course Contents : L-4 T-0 P-2

Unit 1:
Acids and bases: Bronsted-Lowry, Lux-Flood, Solvent System and Lewis concepts of acids and bases. Factors affecting strengths of Lewis acids and bases. HSAB theory and applications

Unit 2:
Non-aqueous solvents: Physical properties of a solvent for functioning as an effective reaction medium, types of solvents and their general characteristics. Liq. NH_3 as a non-queous solvent

Unit 3:
Coordination compounds: Nomenclature, Werner's theory. Isomerism. Sidgwick'sEAN concept and Valence Bond Theory. Stereochemistry of coordination compounds with coordination no. 4, 5 and 6.

Unit 4:
Lanthanides: Comparative study of lanthanide elements with respect to electronic configuration atomic and ionic radii, oxidation state and complex formation, lanthanide contraction. Separation of lanthanides. Application of lanthanide complexes.

Unit 5:
Nuclear Chemistry: Nucleus and its classification, nuclear forces, nuclear binding energy, stability of nucleus. Radioactivity: Radioactive elements, general characteristics of radioactive decay, decay kinetics (decay constant, half life, mean life period), units of radioactivity.

Course Learning Outcomes (CLOs) :

After completion of the course student will be

CLO-1 : Able to state the acid base theory as well factors affecting their relative strength.

CLO-2: Familiar with the basic knowledge of the non-aqueous solutions and applications of non-aqueous solvents in analytical chemistry.

CLO-3 : Recognize the bonding in transition compounds by VBT and CFST theories. 2. Able to predict the geometry of coordination compounds and type of hybridization.
CLO-4 : Able to understand the various uses of lanthanides elements in flash light powders, in dying cotton and in lasers

CLO-5 : Able to define radioactive compound and their general properties as half -life, decay constant.

Text books :

1. *Recent Aspects in Inorganic Chemistry*, R.C. Agarwal, Kitab Mahal
2. *Inorganic Chemistry*, J.E. Huheey, E.A. Keiter and R.L. Keiter.
3. *Basic Inorganic Chemistry***,** F. A Cotton, G. Wilkinson, and Paul L. Gaus, 3rd Edition (1995), John Wiley & Sons, New York.
4. *Physical Chemistry for the Chemical and Biological Sciences*, Raymond Chang; University Science Book, California (2000).
5. *New Trends in Green Chemistry*, V.K. Ahluwalia, M. Kidwai, Anamaya Publication, New Delhi (2004)
6. *Physical Chemistry for the Chemical and Biological Sciences*, Raymond Chang; University Science Book, California (2000).
7. *New Trends in Green Chemistry*, V.K. Ahluwalia, M. Kidwai, Anamaya Publication, New Delhi (2004)
8. *Green Chemistry: Environmentally Benign Reactions***,** V. K. Ahluwalia, 2007
9. *Modern Molecular Photochemistry*, N. J. Turro, University Science Books, Sausalito California (1991).
10. *Green Chemistry: An Introductory Text,* Mike Lancester, RSC Paperback, Edn. (2002)

Reference books :

1. R.C. Agarwal , Recent Aspects in Inorganic Chemistry, Kitab Mahal, 1st edition, ISBN-13 : 978-8122500349

2. J.E. Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry, pearson, 4th edition *ISBN*-10 : 006042995X; *ISBN*-13 : 978-0060429959 .

3. F. A Cotton, G. Wilkinson, and Paul L. Gaus, Basic Inorganic Chemistry, Wiley, 3rd Edition, ISBN: 978-0-471-50532-7

4. Raymond Chang , Physical Chemistry for the Chemical and Biological Sciences, University Science Book, California (2000),3rd Edition, ISBN 978-1-891389-06-1

5. ASIM K. DAS, FUNDAMENTAL CONCEPTS OF INORGANIC CHEMISTRY, CBS PUBLISHERS & DISTRIBUTORS PVT LTD , 3rd Edition, ISBN-13 : 978-9389565973

6. J.D. Lee Concise Inorganic Chemistry, wiley, 4th Edition,ISBN-13 : 978-8126564200

Online links for study & reference materials:

1. http://www2.hkedcity.net/sch_files/a/scg/scg-chem/visitor_cabinet/5325/d-block.pdf
2. http://www.vandemataramcollege.com/app/webroot/files/notes/Chemistry_of_Lanthanides_and_Actinides-TY_Bsc.pdf
3. https://edurev.in/studytube/Non-Aqueous-Solvents--Part-1--Acids-and-Bases--Ino/28aefa4a-3eed-4cd8-9c40-93b893191011_t
4. https://www.elsevier.com/books/non-aqueous-solvents-in-inorganic-chemistry/holliday/978-0-08-011335-7
5. https://www.fkit.unizg.hr/_download/repository/PDF_chemistry_of_transition_element.pdf
6. https://www.alchemyst.co.uk/pdf/Inorganic/lanthanides_and_actinides.pdf

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Course Code : STUGC/ C09 **Course Name : Organic Chemistry-II**

Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- On completion of this course, the students will be able to understand the basic of organic molecules, structure, bonding, reactivity and reaction mechanisms. Electrophile, nucleophiles, free radicals, electronegativity, resonance, and intermediates along the reaction pathways. Mechanism of organic reactions (effect of nucleophile/leaving group, solvent), substitution *vs*. elimination.

Course Description :

- Write a brief summary indicating how this will be conducted specifying the key topics of the whole course. Alkyl halides-SN1, SN2, SNi, E1, E2, Ecb mechanisms. Grignard reagents, primary, secondary and tertiary alcohols, Active methylene compounds preparation and applications, Conjugated and isolated dienes, resonance stabilization, Natural pigments- General structural features, occurrence, biological importance and applications.

Course Contents : L-4 T-0 P-2

Unit 1:
Alkyl Halides: Nucleophilic substitution: SN1, SN2, SNi mechanisms; Eliminations reactions: E1and E2, Ecb mechanisms, Elimination versus substitution reactions; energy profile diagrams-transition states (general considerations). Grignard reagents: Preparation and synthetic applications.

Unit 2:
Alcohols: Comparative study of substitution, dehydration, oxidation, and esterification of primary, secondary and tertiary alcohols.

Unit 3:
Active methylene compounds: Preparation and synthetic applications of ethyl acetoacetate and diethyl malonate, Tautomerism

Unit 4: Dienes
Conjugated and isolated dienes, resonance stabilization, 1,2-versus 1,4-addition, Diels-Alder reaction.

Unit 5: Natural pigments
General structural features, occurrence, biological importance and applications of carotenoids, anthocyanins, quinones, flavones, pterins and porphyrins (chlorophyll).

Course Learning Outcomes (CLOs) :

CLO-1 : To learn the Alkyl halides reactivity -SN1, SN2, SNi, E1, E2, Ecb mechanisms.

CLO-2 : To learn the Grignard reagents-types, preparations , reactions and applications

CLO-3 : primary, secondary and tertiary alcohols,

CLO-4 : To learn the Active methylene compounds preparation and applications, Conjugated and isolated dienes, resonance stabilization.

CLO-5 : To understanding the Natural pigments- General structural features, occurrence, biological importance and applications.

Text books :

1. Organic Chemistry", R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.

2. Organic Chemistry, I. L. Finar, [Vol. I, 6th Edition (1973), Reprinted in 1980 & Vol. II, 5th Edition (1975), Reprinted in1996], ELBS and Longman Ltd., New Delhi.
3. Organic Chemistry, J. Clayden, N. Greeves, S. Warren, and E. Wothers, , Oxford Univ. Press, Oxford (2001).

Reference books :

1. Pine S. H. Organic Chemistry, Fifth Edition, McGraw Hill, (2007)
2. F. A. Carey, Organic Chemistry, Seventh Edition, Tata McGraw Hill (2008).
3. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd Ed., (2012), Oxford
4. Universitiy Press.
5. F. A. Carey, R. J. Sundberg, Advanced Organic Chemistry, Part A: Structure and mechanism, Kluwer Academic Publisher, (2000).

Online links for study & reference materials :

6. http://www.freebookcentre.net/Chemistry/Organic-Chemistry-Books.html 7.
7.https://chem.ucr.edu/curricular-materials/textbook

8. https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm

9.https://bookboon.com › chemistry-ebooks

Course Code : STUGC/ C10 **Course Name : Green Chemistry**
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- Today's society is moving towards becoming more and more environmentally conscious. There is rising concern of environmental pollution, depletingresources, climate change, ozone depletion, heaps and heaps of landfills piling up,legislation which is getting stringent with strict environmental laws, rising cost of waste deposits and so on. We are faced with a challenge to work towards sustainable practices. Green chemistry has arisen from these concerns. It is not a new branch of chemistry but the way chemistry should be practiced.
- The primary goal of this course is to make students aware of how chemical processes can be designed, developed and run in a sustainable way. Green chemistry has been defined as “the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products. No one person can be an expert in all areas of green chemistry but this course should provide a base of knowledge and understanding of resources and directions of innovations in green chemistry and green engineering for future awareness. Ultimately, the current

green chemistry community of scholars hopes that the term "green chemistry" becomes obsolete because ALL chemistry will be approached with the 12 principles in mind.

- Innovations and applications of green chemistry in education has helped companies not only gain environmental benefits but at the same time achieve economic and societal goals also. This is possible because these undergraduate students are ultimate scientific community of tomorrow.

Course Description :

- Understand the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances. Understand stoichiometric calculations and relate them to green chemistry metrics. They will learn about atom economy and how it is different from percentage yield. Learn to design safer chemical, products and processes that are less toxic, than current alternatives. Importance led reactions in various green solvents. Green chemistry is a way to boost profits, increase productivity and ensure sustainability with absolute zero waste. Success stories and real world cases also motivate them to practice green chemistry.
- We will learn about the principles of green chemistry and chemical engineering and their modern application in both academia and industry. Green chemistry metrics will be defined to help quantify improved processes. Students learn the basic principles of green chemistry. They will study green process metrics. They learn alternative solvent media and energy sources for chemical processes. They learn about renewable feedstocks for the chemical industry, present and under development. They review the principles of catalysis, photochemistry and other interesting processes from the viewpoint of green chemistry. They perform laboratory experiments in which they apply some of the concepts previously learnt (stoichiometry, green solvent, reagents …) and they put into practice some of the principles of green chemistry. Case studies will be used to illustrate the use of alternative feedstocks, reagents, and reaction media, recent developments in environmentally benign catalysis and synthetic methods, and broaderconsiderations of energy utilization.

Course Contents : L-4 T-0 P-2

Unit l Introduction to Green Chemistry

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/Obstacles in the pursuit of the goals of Green Chemistry.

Unit II Principles of Green Chemistry and Designing a Chemical synthesis

Twelve principles of Green Chemistry with their explanations and examples; Designing a Green Synthesis using these principles; Prevention of Waste/byproducts; maximum incorporation of the materials used in the process into the final products (Atom

Economy); prevention/minimization of hazardous/toxic products; designing safer chemicals – different basic approaches to do so; selection of appropriate auxiliary substances (solvents, separation agents), green solvents, solventless processes, immobilized solvents and ionic liquids; energy requirements for reactions - use of microwaves, ultrasonic energy; selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protectinggroups; use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; designing of biodegradable products; prevention of chemical accidents; strengthening/development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

Unit III Examples of Green Synthesis/Reactions

1 Green Synthesis of the following compounds: adipic acid, catechol, BHT, methyl methacrylate, urethane, aromatic amines (4-aminodiphenylamine), benzyl bromide, acetaldehyde, citral, ibuprofen, paracetamol, turtural. (furfural)
2 Microwave assisted reactions in water: Hofmann Elimination, Hydrolysis (of benzyl chloride, benzamide, n-phenyl benzamide, methylbenzoate to benzole acid), Oxidation (of toluene, alcohols).

Unit IV Future Trends in Green Chemistry
Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; oncovalent derivatization; Green chemistry in sustainable development.

Course Learning Outcomes (CLOs) :

After finishing the course student will be able to:

CLO-1: To understand the principles of green chemistry and end-of-pipe method

CLO-2: To understand and can plan green solutions for industrial production of Petroleum and petrochemicals, Surfactants, Organic and inorganic chemicals

CLO-3: To provide green solutions for chemical energy storage, Energy carriers and alternative fuels including electrofuels and hydrogen

CLO-4: To present examples of successful green technologies

Text books :

1. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers (2005).
2. A.S. Matlack: Introduction to Green Chemistry, Marcel Deckkar, (2001).
3. M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).

4. M.A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002).
5. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers, 1st Edition, ISBN 978-94-015-7102-9
6. Dr. Indu Tucker Sidhwani, Rakesh K. Sharma **An Introductory Text on Green Chemistry,** 1st edition, ISBN-10 : 812655407X
7. R. A. Sheldon, Isabella Arends, Ulf Hanefeld , Green Chemistry and Catalysis, Wiley, 1st Edition, ISBN:9783527611010, 3527611010

Reference books :

1. P.T. Anastes & J.K. Warmer: Oxford Green Chemistry- Theory and Practical, University Press (1998). ISBN: 9780198506980
2. Lancaster, M.(2016),Green Chemistry An Introductory Text.2nd Edition, RSC Publishing.
3. Cann ,M. C. ; Connely, M. E.(2000), Real-World cases in Green Chemistry, American Chemical Society, Washington.
4. Matlack, A.S.(2001),Introduction to Green Chemistry, Marcel Dekker.
5. Alhuwalia, V. K.; Kidwai, M.R.(2005),New Trends in Green chemistry, Anamalaya Publishers.

Online links for study & reference materials :

https://www.acs.org/content/dam/acsorg/greenchemistry/education/summerschool/Kirchhoff%20Green%20Chemistry%20Principles%20and%20Practice2.pdf

https://oregonstate.edu/instruct/ch390/lessons/media/lesson1.pdf

faculty.swosu.edu/tim.hubin/share/Microwave%20Synthesis.pdf

https://oatao.univ-toulouse.fr/10066/1/Lesage_10066.pdf

Course Code : STUGC/SEC2 **Course Name : Food Chemistry**
Course Credit Hour : 3 hr **Total Contact Hour :** 40hr

Course Objective :

This skill based course provides:

- Students the basic knowledge in Food Chemistry and modern trends in the industry. The practical training to the students in the food analysis. Generalknowledge of the biology and chemistry. Elementary idea of basic food groups, their functions and sources. Application based learning of the subject.

Course Description :

- Students will learn to apply and incorporate the principles of food science in practical, real- world situations and problems. Students will be able to apply the principles of food science to control and assure the quality of food products.

Course Contents : L-3 T-0 P-2

UNIT I: Introduction: Food Science (6 h)
Food: Introduction to different food groups and importance of food chemistry, Source, functions of food – food groups – food guide – basic five food groups, balance diet – food in relation to health. **Water:** Water in foods and its properties, Importance of water in relation to food content. **Milk:** Composition and effectiveness as a diet. Dairy and fairy product.

UNIT 2: Constituents of Foods: Properties and Significance (10 h)
Carbohydrates: Classification, Structure, Properties, Artificial sweetening agents. Principles involved in the analysis of carbohydrates.

Proteins: amino acids – peptides– proteins, Metabolism, Sources and physico-chemical and functional properties.

Fats and Oils: Nomenclature and classification. Emulsions and emulsifiers, rancidity of fats – chemistry of fat and oil processing – function and storage of fats. Analysis of oils and fats –iodine number, RM value, acid number and saponification values – principles.

UNIT 3: Additional Food Constituents: (10 h)
Minerals and Vitamins: Sources, functions, bioavailability and deficiency of the following minerals (calcium, phosphorous, magnesium, iron, copper, iodine, fluorine, sodium and potassium (elementary treatment). Vitamins - classification, sources, functions and deficiencies of fat- soluble vitamins – A, D, E and K, Water-soluble vitamins – C, thiamin, niacine, riboflavin, Bcomplex, - B6, Folic acid and B12.

Fibers: Importance in diet.

Enzymes: Nomenclature, classification, Enzymes used in food processing.

UNIT 4: Foods and Food Additives: (6 h)
Food additives: Artificial sweeteners– Food flavours Antioxidants. Acidulants, Woodsmoke, Formaldehyde, Spices, Alkalies, Food colours –Emulsifying agents and Edible foaming agents, Preservatives -leavening agents. Baking powder –Yeast, Stabilizers and Thickeners.
Sequesterants – uses and abuses of these substances in food beverages.

UNIT 5: Food Adulteration and Food Safety (4 h)
Adulterants: Common adulterants in different foods – milk and milk products, vegetable oils, and fats, spices and condiments, cereals, pulses, sweetening agents and beverages. Contamination with toxic chemicals, Microbial growth,
Quality control: Specifications and standards: PFA, FPO, FDA, drug license, WHO standards, ISI specifications, packing and label requirements, essential commodities act, consumer protection act. AGMARK.
Packaging of foods – classification of package, materials used for packing, laws related to packaging and nutrition labelling.

Course Learning Outcomes (CLOs) :

CLO-1: To know the chemistry underlying the properties and reactions of various food components, food groups, importance of balanced diet, properties of water and milk. To know the chemistry underlying the properties and reactions of various food components.
CLO-2: Students will be able to compare and contrast the structure and functions of the oligo and polysaccharides, proteins, fats and oils.
CLO-3: To understand the various sources, functions, bioavailability and deficiency of the minerals, vitamins, fibers and enzymes.
CLO-4: Ability to explain the benefits and limitations (scientific and ethical) of food additives and processing aids currently used by the food processing industry and those additives which may be permitted to be used in the future.

CLO-5: To know the major chemical reactions that limit shelf life of foods. Common adulterants used, how to preserve the quality and packaging of food materials.

Text books :

1. Swaminathan M. Advanced Text Book on Food and Nutrition , volume I and II Printing and Publishing CO., Ltd., Bangalore. 1993.
2. Swaminathan M. Text Book on Food chemistry, Printing and Publishing CO., Ltd., Bangalore. 1993.
3. Norman N. Potter, Food science, CBS publishers and distributors, New Delhi. 1994.
5. Owen R Fennema, Food Chemistry, Marcel Decker Inc., New York. 1996.
6. Srilakshmi B., Food Science, New age International Pvt. Ltd. Publishers, III ed. 2003.
7. Siva Sankar B., Food Processing and Preservation. Prentice – Hall of India Pvt. Ltd., New Delhi. 2002.
8. Ramakrishnan S., Prasannam K.G and Rajan R –Principles. Text book of medical biochemistry. Orient Longman Ltd. III ed. 2001.
9. Shakuntala Manay N. and ShadaksharaswamyM. FOODS: Facts and Principles. New age International Pvt. Ltd. Publishers, II ed. 2002

Reference books :

1. Food Microbiology by Frazier, Tata McGraw-Hill Education.18th edition ISBN: 9781259062513, 9781259062513
2. Lillian Hoagoland Meyer, Food Chemistry, CBS publishers and distributors, New Delhi. 1994. ISBN: 9788123911496
3. Louis J. ronsivalli and Ernest R. Viera, Elementary Food Science, 3rd edition
4. Dennis R. Heldman and Richard W. Hartel, Principles of food Processing (1996)

Online links for study & reference materials :

1. https://www.frontiersin.org/journals/all/sections/food-chemistry
2. https://www.toppr.com/guides/chemistry/biomolecule/carbohydrates/
3. http://www.cuchd.in/elibrary/resource_library/University%20Institutes%20of%20Sciences/Fundamentals%20of%20Biochemistry/Chap-10.pdf
4. https://revisionworld.com/gcse-revision/applied-science/aqa-additional-applied-science/unit-2-exam-topics/food-science/food-tests/fat-tests
5. https://www.webmd.com/diet/guide/types-fat-in-foods
6. https://www.healthlinkbc.ca/health-topics/ta3868
7. https://www.uofmhealth.org/health-library/ta3912
8. http://www.leadthecompetition.in/GK/functions-of-minerals-in-human-body.html
9. http://www.foodadditivesworld.com/flavorings.html
10. https://books.google.co.in/books?id=XcSp015g4X0C&pg=PA278&lpg=PA278&dq=sequestrants+in+food&source=bl&ots=y1nGrfKbaL&sig=Y1ikfJ7K9jZpGWR15RPsfqjOMGc&hl=en&sa=X&ved=2ahUKEwj6r-m52fbeAhUKfn0KHVF-DGMQ6AEwC3oECAsQAQ#v=onepage&q=sequestrants%20in%20food&f=false
11. https://www.worldofchemicals.com/Chemicals/Sequestrants/id-73.html?lst=trt

Course Code: GE-4 **Course Name : Fuel Chemistry and Batteries**

Course Credit Hour : 3hr **Total Contact Hour :** 60hr

Course Objective:

- To acquire knowledge of applied chemistry materials and about fuels and batteries. To describe the electrochemistry associated with several common batteries. To distinguish the operation of a fuel cell from that of a battery.

Course Description:

- The course will cover important technologies in energy conversion and storage in detail, including lithium-ion batteries and fuel cells. To recognize biofuels as alternative energy source. To study the fractional distillation of petroleum and different byproducts.

Course Contents : L-4 T-0 P-2

UNIT –I : Review of energy sources (renewable and non-renewable): (12h)

Classification of fuels and their calorific value. Coal: Uses of Coal (fuel and non-fuel) in various industries, its composition, carbonization of coal - coal gas, producer gas and water gas – composition and uses – fractionation of coal tar – uses of coal tar-based chemicals, requisites of a good metallurgical coke, coal gasification (Hydro gasification and catalytic gasification) coal liquefaction and solvent refining.

UNIT-II Petroleum and petrol chemical industry: (6h)

Composition of crude petroleum, refining and different types of petroleum products and their applications.

UNIT-III Fractional distillation (10 h)

Principle and process, cracking (Thermal and catalytic cracking). Reforming petroleum and non-petroleum fuels (LPG, CNG, LNG, biogas), fuels derived from biomass, fuel from waste, synthetic fuels (gaseous and liquids), clear fuels,

Petro-chemicals : vinyl acetate, propylene oxide , isoprene , butadiene, toluene and its derivative xylene.

UNIT-IV Lubricants: (10 h)

Classification of lubricants, lubricating oils(conducting and non-conducting) , solid and semi solid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

UNIT-V Batteries: (7 h)

Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

Course Learning Outcomes (CLOs) :

CLO-1: To discuss different types of fossil fuels and their calorific value.

CLO-2: To study the composition of crude petroleum, refining and different types of petroleum products and their applications. To understand and analyze the combustion mechanisms of various fuels.

CLO-3: To study the fractional distillation and other derived petrochemicals.

CLO-4: To learn the classification of lubricants and their properties.

CLO-5: To acquire detailed knowledge of batteries and their working.

Text books :

1. Engineering Chemistry by P.C. Jain & M. Jain, Dhanpatrai Publishing Company, New Delhi (2010)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai & Company (P) Ltd. Delhi (2011)
3. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015)

Reference books :

1. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, New Delhi. (2016)
2. Engineering Chemistry by Thirumala Chary and Laxminarayana, Scitech Publishers, Chennai (2016).
3. Dell, Ronald M Rand, David A J, 'Understanding Batteries', Royal Society of Chemistry, (2001).
4. M. Aulice Scibioh and B. Viswanathan 'Fuel Cells – principles and applications', University Press, India (2006).

Online links for study & reference materials :

1. CY8151 – unit 4 - Fuels introduction - Padeepz
2. CY8151 – unit 5 - Batteries & fuel cells - Padeepz
3. CY8151 – unit 5 - Fuel cells - Padeepz
4. Batteries and Fuel Cells | Chemistry for Majors (lumenlearning.com)
5. 3 Fuel Chemistry.pdf - FUEL CHEMISTRY LEARNING OUTCOMES \u25e6Classify fossil fuels(CO1 \u25e6Discuss the different steps in petroleum processing and | Course Hero

Course Code : STUGC/C 11 **Course Name : Advance Organic Chemistry**

Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- Familiarization about classes of organic compounds and their methods of preparation. Basic uses of reaction mechanisms. On completion of this course, the students will be able to understand the various Methods of DeterminingReaction Mechanism and Molecular Rearrangements.

Course Description :

- Write a brief summary indicating how this will be conducted specifying the key topics of the whole course the various methods of determining reaction mechanism, Principles and reactions of photochemistry, Synthesis and chemistry of heterocyclic compounds, organosulphur compounds synthesis and reactions, Molecular Rearrangements reactions with mechanisms.

Course Contents : L-4 T-0 P-2

Unit-1: Methods of Determining Reaction Mechanism: Guidelines for proposing a reasonable mechanism, product studies, bonds broken and formed, inter and intramolecular migration of groups, crossover experiments, exchange with solvents, importance of byproducts, reactive intermediates. Isotopic substitution in a molecule, primary and secondary kinetic isotope effects - their importance in mechanistic studies.

Unit -2: Photochemistry: Principles of photochemistry, Photochemical reactions of carbonyl compounds and olefins.

Unit -3: Heterocyclic Compounds: Synthesis and chemistry of indole, quinoline and isoquinoline.

Unit -4: Organosulphur and Organophosphorus Compounds: Introduction to organosulphur compounds, methods of synthesis and reactions of thiols, thioether and aliphatic sulphonic acids. Introduction to organophosphorus compounds, phosphate esters and phosphorus ylides, general methods of preparation and reaction. Wittig reaction.

Unit -5: Molecular Rearrangements Involving Electron Deficient Atoms: Pinacol-pinacolone, B e c k m a n n , Hofmann and Wolff rearrangements, Baeyer- Villiger oxidation.

Course Learning Outcomes (CLOs) :

CLO-1 : To learn the different types and methods of determining reaction mechanism,
CLO-2 : To learn the Principles and reactions of photochemistry.

CLO-3 : To learn the Structures, resonance, Synthesis and chemistry of heterocyclic compounds.

CLO-4 : To learn the various organo-sulphur compounds synthesis and reactions.

CLO-5 : To learn the different types of Molecular Rearrangements reactions with mechanisms.

Text books :

1. *"Organic Chemistry",* I. L. Finar, [Vol. I, 6th Edition (1973), Reprinted in 1980 & Vol. II, 5th Edition (1975), Reprinted in1996], ELBS and Longman Ltd., New Delhi.
2. *"A Guide Book to Mechanism in Organic Chemistry",* P. Sykes, 6th Edition (1997), Orient Longman Ltd., New Delhi.
3. *"Organic Chemistry",* R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
4. *"Organic Chemistry"*, S. M. Mukherji , S. P. Singh, and R. P. Kapoor, 1st Edition (1985), 5^{th} Reprint (1999), New Age International (P) Ltd.Publishers, New Delhi.

Reference books :

1. Solomons, T.W G., Fryhle, B. Craig. *Organic Chemistry*, John Wiley & Sons, Inc (2009).
2. McMurry, J.E. *Fundamentals of Organic Chemistry*, Seventh edition Cengage Learning, 2013.
3. P Sykes, *A Guide Book to Mechanism in Organic Chemistry*, 6th Edition (1997), Orient Longman, New Delhi.
4. Morrison R. T. and Boyd R. N. Organic Chemistry, Sixth Edition Prentice Hall India, 2003.

Online links for study & reference materials :

5. http://www.freebookcentre.net/Chemistry/Organic-Chemistry-Books.html https://chem.ucr.edu/curricular-materials/textbook
6. https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm
7. https://chemistry.com.pk/free-download-chemistry-books/ https://bookboon.com › chemistry-ebooks

Course Code : STUGC/ C12 **Course Name : Polymer Chemistry**

Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- The primary objective of this paper is to help the student to know about the synthesis, properties and applications of polymers. To study the fundamental concepts of polymer chemistry. To study the structure of monomers, functionality, and classification of polymers basis of source, composition, conditions, molecular weight, geometry, and Nomenclature of polymers.
- To study the various methods and techniques of polymerization reactions, their chemistry, mechanism, structures, properties and applications. To study the structure of polymers, Molecular weight and their types, polymer dispersity, degree of polymerization, chain length and polymerization techniques. To study the molecular structure, properties and applications are depending on structure. If structure changes (modify) properties and applications also changes.

Course Description :

- The course provides an introduction to polymer chemistry based on synthesis mechanisms associated with chain-growth and step-growth polymerization. Basic knowledge is provided with regards to polymerization kinetics, networkformation, and gelation. Industrial polymerization processes are considered in light of the form and properties of the product. Polymer structure/conformation and transitions from liquid (melt) to solid (polymer crystal or glass) states are discussed using equilibrium thermodynamics, kinetics and free volume considerations.
- By the end of this course, students will be able to: Know about history of polymeric materials and their classification, Learn about different mechanisms of polymerization and polymerization techniques, Evaluate kinetic chain length of polymers based on their mechanism, Differentiate between polymers and copolymers, Learn about different methods of finding out average molecularweight of polymers, Differentiate between glass transition temperature (Tg) and crystalline melting point (Tm), Determine Tg and Tm, Know about solid and solution properties of polymers, Learn properties and applications of various useful polymers in our daily life. This paper will give glimpse of polymer industryto the student and help them to choose their career in the field of polymerchemistry.

Course Contents : L-4 T-0 P-2

UNIT 1 : INTRODUCTION TO POLYMER

1.1 Monomers, Oligomers, Polymers and their characteristics

1.2 Classification of polymers : Natural synthetic, linear, cross linked and network; plastics, elastomers, fibres, Homopolymers and Co-polymers

1.3 Bonding in polymers : Primary and secondary bond forces in polymers ; cohesive energy and decomposition of polymers.

1.4 Determination of Molecular mass of polymers: Number Average molecular mass (Mn) and Weight average molecular mass (Mw) of polymers and determination by (i) viscosity (ii) Light scattering method (iii) Gel Permeation Chromatography (iv) osmometry and ultracentrifuging.

Self study: Molecular weight determination of high polymers by different methods.

UNIT 2 : KINETICS AND MECHANIISM FOR POLYMERIZATION

2.1 Chain growth polymerization : Cationic, anionic, free radical polymerization, Stereo regular polymers : Ziegler Natta polymers.

2.2 Polycondensation-non catalysed, acid catalysed polymerization, molecular weight distribution Step growth polymers

Self study: Degrees of polymerization

UNIT 3 : TECHNIQUES OF POLYMERIZATION AND POLYMER DEGRADATION

3.1 Bulk, Solution, Emulsion, Suspension, Melt polycondensation, solution polycondensation interfacial and gas phase polymerization

3.2 Types of Polymer Degradation, Thermal degradation, mechanical degradation, photodegradation, Photo stabilizers.

Self study: Solid and gas phase polymerisation

UNIT 4 : INDUSTRIAL POLYMERS: (10 hours)

4.1 Raw material, preparation, fibre forming polymers, elastomeric material.

4.2 Thermoplastics : Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester.

4.3 Thermosetting Plastics : Phenol formaldehyde and expoxide resin.

4.4 Elastomers : Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene. Conducting Polymers : Elementary ideas ; examples : poly sulphur nitriles, poly phenylene, poly pyrrole and poly acetylene.

Self study: Poly methylmethacrylate, polyimides, polyamides, polyurethanes, polyureas, polyethylene and polypropylene glycols

UNIT 5 : INTRODUCTION TO POLYMER PROCESSING : (5 hours)

5.1 Compounding: Polymer Additives: Fillers, Plasticizers antioxidants and thermal stabilizers fire retardants and colourants.

5.2 Processing Techniques: Calendaring, die casting, compression moulding, injection moulding, blow moulding, extrusion moulding and reinforcing.

Self study: Film casting,Thermofofming, Foaming.

Course Learning Outcomes (CLOs) :

CLO 1: Will understand the basic concepts, operation and applications of various techniques used for molecular weights of polymers Differentiate kind of polymers and their properties,

CLO 2: Understand the concept of synthesis of homo polymers, co -polymers, ter-polymers, block co-polymers.

CLO 2: Understand different techniques of polymerization of polymers, Concept of Molecular Weight and distribution.

CLO 3: understand various structure of polymers and their effect on different properties of polymers.

CLO 4: have deep understanding of the various analytical techniques used for identification and characterization of polymeric materials. Process of polymer degradation.

CLO 5: understand the processing techniques for various polymers additives,

Text books :

1. F. N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971, 2nd edition, ISBN-10 : 0471072990; ISBN-13 : 978-0471072997
2. A. Kumar and S. K. Gupta, Fundamentals and Polymer Science and Engineering, Tata McGraw-Hill, 1978.1st Edition, ISBN: 0-8247-0867-9
3. Seymour's Polymer Chemistry, Marcel Dekker Inc,3rd Edition, ISBN-10 : 0824787196; ISBN-13 : 978-0824787196
4. G. Odian: Principles of Polymerization, John Wiley, 1st Edition ISBN:9780471274001
5. V.R. Gowariker, Polymer Science, Wiley Eastern, 1995. 2. G.S. Misra, Introductory Polymer Chemistry, New Age International (Pvt) Limited, 1996.
6. 1.F. N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971.

Reference books :

1. V.R. Gowariker, Polymer Science, Wiley Eastern, 1995, 2nd Edition, ISBN: 9780852263075, 9780852263075
2. G.S. Misra, Introductory Polymer Chemistry, New Age International (Pvt) Limited, 1996,1st edition, ISBN:8122404715 9788122404715
3. Fred j devis, Polymer chemistry, oxford university press, 1st Edition, ISBN 0 19 850309 1
4. P. Ghosh: Polymer Science & Technology, Tata Mcgraw-Hill.
5. R.W. Lenz: Organic Chemistry of Synthetic High Polymers.
6. Reference Books • Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J. & Jones, A. (2011) Practical skills in chemistry. 2nd Ed. Prentice-Hall, Harlow.
7. Hibbert, D. B. & Gooding, J. J. (2006) Data analysis for chemistry. Oxford University Press.
8. Carraher,C. E. Jr. (2013), Seymour's Polymer Chemistry, Marcel Dekker, Inc.
9. Odian, G. (2004), Principles of Polymerization, John Wiley.
4. Billmeyer, F.W. (1984),Text Book of Polymer Science, John Wiley.
5. Ghosh, P. (2001),Polymer Science & Technology, Tata Mcgraw-Hill.
10. Lenz, R.W. (1967),Organic Chemistry of Synthetic High Polymers, Intersecience (Wiley).

Online links for study & reference materials :

1. https://www.britannica.com/science/polymerization#:~:text=Polymerization%2C%20any%20process%20in%20which,three%2C%20or%20more%20different%20compounds.
1. https://byjus.com/jee/polymerization/
2. https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_General_Chemistry_(Petrucci_et_al.)/27%3A_Reactions_of_Organic_Compounds/27.08%3A_Polymers_and_Polymerization_Reactions

3. https://www.corrosionpedia.com/definition/903/polymerization
4. https://royalsocietypublishing.org/doi/pdf/10.1098/rspa.1939.0059
5. https://www.nap.edu/read/2307/chapter/5

Course Code :STUGC/ DSE 1 **Course Name : Industrial Chemistry-I**
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- After completion of the course, the learner shall be able to understand about the industrial processes of various types of the chemical and derivatives preparation in industrial scale and challenges. Have sound knowledge of pharmaceuticals, cosmetics, perfumes and pesticides. Become well equipped to design, carry out, record and analyze the industrial preparations. Understand the ethical, historic, philosophical, and environmental dimensions of problems and issues facing industrial chemists. Become skilled in problem solving, critical thinking and analytical reasoning. Identify and solve chemical problems and explore new innovative areas of research. Know the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures.

Course Description :

- This course briefs about the industrial scale preparations of various types of Cosmetics and Perfumes, oils. Heterogeneous catalysis and their industrial applications. Battery Industry, Alloys-classification, properties and industrial applications.

Course Contents : L-4 T-0 P-2

Unit-1:
Cosmetics and Perfumes: A general study including preparation and uses of the following: Hair dye, hair spray, Shampoo, Sun-tan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams).
Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, ®-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.

Unit-2:

Catalysis Industry: General principles and properties of catalysts, homogenous catalysis and heterogeneous catalysis and their industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts in industry.

Unit-3:
Battery Industry: Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel Cells, Solar cell and polymer cell.

Unit-4:
Alloys: Classification of alloys, Ferrous and Non-Ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization, dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

Course Learning Outcomes (CLOs) :

CLO-1 : To understand the industrial scale preparations of various types of Cosmetics and Perfumes, oils with process flowcharts.
CLO-2 : To understand the concept and advantages of heterogeneous catalysis and their industrial applications. Catalyst deactivation process and regeneration.
CLO-3 : To understand the industrial scale preparations of various types of battery Industry
CLO-4 : To understand the concept and advantages of alloys-classification, properties and industrial applications.

Text books :

1. Vermani, O. P.; Narula, A. K. (2004), Industrial Chemistry, Galgotia Publications Pvt. Ltd.,
2. New Delhi.
3. Bhatia, S. C. (2004), Chemical Process Industries, Vol. I & II, CBS Publishers, New Delhi.
4. Barel, A.O.; Paye, M.; Maibach, H.I.(2014), Handbook of Cosmetic Science and
5. Technology, CRC Press.
9. Gupta, P.K.; Gupta, S.K.(2011),Pharmaceutics and Cosmetics, Pragati Prakashan
10. Butler, H. (2000),Poucher's Perfumes, Cosmetic and Soap, Springer

Reference books :

1. Stocchi, E.(1990), Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK.
2. 2. Felder, R. M.; Rousseau, R. W. (2015), Elementary Principles of Chemical Processes, Wiley

3. Publishers, New Delhi.
4. Kingery, W. D.;Bowen, H. K.;Uhlmann, D. R. (1976), Introduction to Ceramics, Wiley
5. Publishers, New Delhi.
6. Kent, J. A. (ed) (1997), Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
7. Jain, P. C.; Jain, M. (2013), Engineering Chemistry, Dhanpat Rai & Sons, Delhi.

Online links for study & reference materials :

1. https://bookboon.com › chemistry-ebooks
2. https://www.researchgate.net/publication/257417805_Industrial_Chemistry
3. https://chemistry.com.pk/free-download-chemistry-books/
4. https://www.kopykitab.com/Industrial-Chemistry-1-by-Dr-G-S-Gugale-Dr-A-V-Nagawade-Dr-R-A-Pawar-Dr-K-M-Gadave
5. https://www.internetchemistry.com/chemistry/industrial-chemistry.php

Course Code : STUGC/ DSE 2 **Course Name : Forensic Chemistry**
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- To give the students the importance of forensic chemistry and an exposure to find, analyse and find a suitable method to detect the crime. (Readings, discussion, video examples). Participation in this course will be familiarize the student with the methodologies involved in analyzing forensic samples. Provide a background in statistical analysis of data. Allow students to assess forensic methodologies utilized in the popular media

Course Description :

- Application based learning of the subject. Students will learn to apply and incorporate the forensic principles and analysis. To familiarize the student with the methodologies involved in analyzing forensic samples. To determine theaccuracy and reproducibility of methods studied in this course.

Course Contents : L-4 T-0 P-2

UNIT 1: JUSTICE AND SCIENCE

A brief history of forensic Science, Science and law, Evidence, Modern Practice of forensic Science, Methodology, Role of forensic scientist, Forensic chemistry, Theory of forensic analysis, identification, Comparative analysis: Classification and Individualization.

UNIT 2: FINGERPRINTS

Fingerprints as a means of identification, Fingerprint patterns, Fingerprint classification, Development of latent fingerprints, Composition of latent fingerprint residues, Physical methods, Chemical methods: Powder dusting, Ninhydrin reaction, Silver nitrate reaction, iodine fuming, superglue fuming, phenolphthalein reaction, combination/special illumination, systematic approaches.

UNIT 3: FORENSIC TOXICOLOGY

Drugs and poison as biological evidence, Application of forensic toxicology, Drug and Poison classes, Non-medicinal agents, Analytical Method in forensic toxicology, Chemical examination, Presumptive drug analysis, Chemical color tests, Microcrystalline tests, Microscopic analysis, Instrumental examination and IR spectroscopy, Thin layer chromatography, ink analysis, Soil analysis.

UNIT 4: ARSON, FIRE AND EXPLOSIVES.

Chemistry of fire or explosion, Behavior of fire, Origin and Cause Analysis, Accelerants, Fatal fire investigation, Collection of fire Debris evidence, Analysis of fire debris evidence, Explosives.

UNIT 5: TRACE EVIDENCE

Instruments of Microanalysis and Sample types, Basic Microscopy, Scanning Electron Microscopy, Microscopic Evidence and its Analysis: Glass, Hairs and furs, Fibers, Paint, Soils, Gunshot Residue.

Course Learning Outcomes (CLOs) :

CLO-1: To introduce the modern practices of forensic science, methodology and role of forensic scientist. To determine the accuracy and reproducibility of methods studied in this course.

CLO-2: To understand the different types of fingerprint techniques and their usage. To learn the strengths and weaknesses of the methods studied in this course

CLO-3: Understand how spectroscopic and analytical methods are used to analyze forensic samples like drugs, poisons and soil.

CLO-4: To study the fire patterns, their causes and behaviour analysis as a tool in forensic study.

CLO-5: To understand the importance of microscopic evidence and how its analysis are done.

Text books :

1. *Forensic Chemistry*, Suzanne Bell,© 2006, Pearson-Prentice Hall. ISBN 0-13-147835-4.
2. Forensic Chemistry, David Collins, Brigham Young University, Idaho.

3. Introduction to Forensic Chemistry by Kelly M. Elkins ISBN 9781498763103 published October 18, 2018 by CRC Press

Reference books :

1. *Forensic Chemistry*, Suzanne Bell,© 2006, Pearson-Prentice Hall. ISBN 0-13-147835-4.
2. Criminalistics: An Introduction to Forensic Science by Richard Saferstein (Author)
3. Trejos, T., Koch, S., & Mehltretter, A. (2020). Scientific foundations and current state of trace evidence – A review. Forensic Chemistry 18. doi:10.1016/j.forc.2020.100223.

Online links for study & reference materials :

1. www.onlinelibrary.wiley.com/doi/book/10.1002/9781118897768
2. https://bibleandbookcenter.com/read/forensic-chemistry/
3. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiPn5aV_5_tAhXQT30KHZXvCPMQFjALegQIFBAC&url=https%3A%2F%2Fsciencemonk.com%2Fforensictoxicology%2F&usg=AOvVaw3OvIJ52ayAvNfMGp11DPGj
4. Applications - Forensic and Toxicology - Markes International www.markes.com › Mass Spec application notes (google.com)
5. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiA36Lu_5_tAhXQT30KHZXvCPMQFjAAegQIAhAC&url=https%3A%2F%2Fwww.ncjrs.gov%2Fpdffiles1%2Fnij%2Fgrants%2F225085.pdf&usg=AOvVaw3VwUP1DpB2jpxNzTFid8yY
6. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiA36Lu_5_tAhXQT30KHZXvCPMQFjABegQIARAC&url=https%3A%2F%2Fwww.ncjrs.gov%2Fpdffiles1%2Fnij%2F181584.pdf&usg=AOvVaw2OTidxhmvH5bHMmX7ZtIxx

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Course Code: STUGC/C13 **Course Name : Physical Chemistry- A Molecular Approach-II**

Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- General knowledge of the spectroscopic and quantum chemistry. Elementary idea of atomic structures, degeneracy, eigen functions and quantum numbers. Provides a description of the physical properties of nature at the scale of atoms and subatomic particles. The gain basic knowledge of molecular statistics

Course Description:

- Students will learn to apply and incorporate spectroscopy for the analysis of chemical structures and characterization of chemical species. Basic knowledge of atomic structures and quantum mechanics.

Course Contents : L-4 T-0 P-2

Unit 1: Quantum Mechanics and Atomic Structure: A review of the black body radiation and the old quantum theory. The wave nature of electron. The Uncertainty Principle. Schrödinger's wave mechanics. Eigenfunctions and normalizations. Quantum mechanical operators. Expectation value of a physical quantity. Orthogonality of wave functions. The particle in a one-dimensional box problem and its solutions. Particle in a three-dimensional box. Degeneracy. The hydrogen atom problem. Atomic orbitals. Orbital quantum numbers and their physical significance. Electron spin. Helium atom and Pauli Principle. The variational principle.

Unit 2: Molecular Spectroscopy: Emission and absorption spectra. Transition probabilities and selection rules. Pure rotational spectra. Diatomic molecules. Rigid rotor model. Linear triatomic molecules. Vibrational- rotational spectra. Diatomic molecules. Harmonic oscillator-rigid rotor approximation. Anharmonicity effect. Normal modes of vibration. Infrared spectra of linear and bent AB_2 molecules. Characteristic group frequencies. Electronic spectra of diatomic molecules. Vibrational structure. Franck-Condon principle.

Unit 3: Molecular Statistics: The Boltzmann distribution. Maxwell distribution law for distribution of molecular speeds. The Maxwell-Boltzmann distribution law for the distribution of molecular energies. The partition functions. Thermodynamic quantities from partition functions. The Sackur-Tetrode equation for molar entropy of monoatomic gases. Rotational and vibrational partition functions. The characteristic temperature. The calculation of Gibbs free energy changes and equilibrium constant in terms of partition functions.

Unit 4: Transport Phenomena: General transport equation. Viscosity and diffusion.

Course Learning Outcomes (CLOs) :

CLO-1: To study about the wave nature of electron, schrodingers wave mechanics and orthogonality.

CLO-2: Application based learning of the subject. To gain elementary knowledge of vibrational, electronic, rotational spectroscopy.
CLO-3: To have the idea of anharmonicity, Franck-condon principle and different modes of vibration. Maxwell-Boltzmann distribution can be used to determine the distribution of the kinetic energy of for a set of molecules.
CLO-4: To learn the effect of temperature and pressure on transport phenomenon. Better understanding of viscosity and diffusion phenomenon.

Text books:

1. "Physical Chemistry", K. J. Laidler and J. M. Meiser, 3rd Edition (International Edition,1999), Houghton Mifflin Co., New York.
2. "Physical Chemistry", I. N. Levine, 4th Edition (International Edition, 1995), Mc Graw-Hill Inc., New York.
3. "Physical Chemistry - A Molecular Approach", D. A. McQuarrie and J. D. Simon, South Asian Edition (1998), University Science Books, Sausalito CA, by Viva Books, New Delhi.

Reference books :

1. Physical Chemistry, P. Atkins and J.De Paul, 8^{th} Edition (2006), International Student Edition, Oxford University Press.
2. Essentials of Physical chemistry - Bahl and Tuli, S. Chand- 2012
3. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.

Online links for study & reference materials :

1. https://chemistry.stackexchange.com/questions/40018/orthogonal-wavefunctions
2. Maxwell Boltzmann Distribution Derivation - Equation Derivation and Important FAQs (vedantu.com)
3. http://kkrk.chem.elte.hu/molim/lectures/Electronic_vibrational_line_shape_Part2.pdf
4. http://kkrk.chem.elte.hu/molim/lectures/Electronic_vibrational_line_shape_Part2.pdf

Course Code : STUGC/C 14 **Course Name : Organic Chemistry-III**

Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- After completion of the course, the learner shall be able to understand organic compounds and derivatives preparations and reactions with mechanisms. Isolation of industrially important organic molecules.

Course Description :

- This course summary shall indicate the specific key topics of the Carboxylic acids, general preparation, acidity and reactions, Cycloalkanes, general synthesis, Bayer's strain theory and its limitations, Five membered heterocycles & Condensed five membered heterocycles synthesis and reactions, classification, structure and synthesis of citral, geraniol and a-terpineol.

Course Contents : L-4 T-0 P-2

Unit-1: Carboxylic Acids and their Derivatives

Carboxylic acids, general preparation and reactions. Comparative acidity of carboxylic and sulphonic acids. Benzoic, phthalic and cinnamic acid. General chemistry of acid chlorides, acid anhydrides, amides and esters

Unit-2: Alicyclic Compounds

Cycloalkanes, general synthesis, Bayer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. Cyclohexane - chair and boat conformations, axial and equatorial bonds, conformation of mono substituted cyclohexanes.

Unit-3: Heterocyclic Chemistry:

Five membered heterocycles – Furan, Pyrrole and Thiophene, Condensed five membered heterocycles – Benzofuran, Indole and Benzothiophene, Pyridine, rings with more than one heteroatom 1, 2 –Azoles and 1, 3-Azoles, Purines and Pyrimidines.

Unit-4: Terpens

Occurrence, classification, structure and synthesis of citral, geraniol and a-terpineol.

Course Learning Outcomes(CLOs) :

CLO-1 : To understand the carboxylic acids, general preparation and reactions. Comparative acidity of carboxylic and sulphonic acids. Benzoic, phthalic and cinnamic acid. General chemistry of acid chlorides, acid anhydrides, amides and esters.

CLO-2 : To learn cycloalkanes, general synthesis, Bayer's strain theory and its limitations. Cyclohexane - chair and boat conformations, axial and equatorial bonds, conformation of mono substituted cyclohexanes.

CLO-3 : To understand the synthesis and reactions of five membered heterocycles compounds and Condensed five membered heterocycles. Chemistry of 1, 2 –Azoles and 1, 3-Azoles, Purines and Pyrimidines.
CLO-4 : To learn the about terpenoids, Occurrence, classification, structure and synthesis of citral, geraniol and a-terpineol.

Text books :

1. *"Organic Chemistry",* R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
2. *"Organic Chemistry"*, S. M. Mukherji , S. P. Singh, and R. P. Kapoor, 1st Edition (1985), 5th Reprint (1999), New Age International (P) Ltd. Publishers, New Delhi.

Reference books :

1. *"Organic Chemistry – Structure and Reactivity",* Seyhan N. Ege, AITBS publishers, Delhi (1998).
2. *"Organic Chemistry",* Paula Y. Bruice, 2nd Edition , Prentice-Hall Internattional Inc, New Jersey, International Edition (1998).

Online links for study & reference materials
http://www.freebookcentre.net/Chemistry/Organic-Chemistry-Books.html
https://chem.ucr.edu/curricular-materials/textbook

Course Code :STUGC/DSE 3 **Course Name : Industrial Chemistry-II**
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- After completion of the course, the learner shall be able to understand the industrial preparation process of various commercials pesticides, glass, ceramic materials, paints, dyes.

Course Description :

- This course summary shall indicate the specific key topics of the pesticides, Synthesis, applications and residual toxicity. The ammonia and ammonium salts, urea, Superphosphate, bio-fertilizers. Definition and manufacture of glasses, optical glass and coloured glass, Cement. Primary constituents of a paint, binders and solvents for paints, detergents.

Course Contents : L-4 T-0 P-2

Unit-I:

Pesticides & Fertilizers: Classification of pesticides, Synthesis, applications and residual toxicity of aldrin, parathion, malathion, DDT, paraquat, 2,4- Dichlorophenoxyacetic acid, Zineb, Bordeaux mixture. Industrial manufacturing process of ammonia and ammonium salts, urea, Superphosphate, biofertilizers.

Unit-2:

Glass and Ceramics: Definition and manufacture of glasses, optical glass and coloured glass. Clay and feldspar, glazing and vitrification, glazed porcelein, enamel. Portland cement: composition and setting of cement, white cement.

Unit-3:

Paints, Varnishes and Synthetic Dyes: Primary constituents of a paint, binders and solvents for paints. Oil based paints, latex paints, baked-on paints (alkyd resins). Constituents of varnishes. Formulation of paints and varnishes.

Unit-4:

Detergents: Production of toilet and washing soaps, detergent powder, liquid soaps.

Course Learning Outcomes (CLOs) :

CLO-1 : To learn the various types of fertilizers-preparations, applications. pesticides, Synthesis, applications and residual toxicity.

CLO-2 : To learn the various types of glass manufacturing of glasses, troubleshooting. Classification of cements-preparation, applications.

CLO-3 : To learn the various types of primary constituents of a paint, binders and solvents for paints colours and applications

CLO-4 : To learn the various types of detergents, effect of composition, preparation, process.

Text books :

1. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, John Wiley & Sons, Inc. Publishers, New Delhi.(2005 edition).

2. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
3. Richard Turton, Wallace B Whiting, Richard C Bailie Analysis, Synthesis and Design of Chemical Processes, 2020, Addison Wesley, ISBN-13: 9780134177403
4. Vermani, O. P.; Narula, A. K. (2004), Industrial Chemistry, Galgotia Publications Pvt. Ltd., New Delhi.
5. Bhatia, S. C. (2004), Chemical Process Industries, Vol. I & II, CBS Publishers, New Delhi.
6. Jain, P. C.; Jain, M. (2013), Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
7. Gopalan, R. Venkappayya, D.; Nagarajan, S. (2004), Engineering Chemistry, Vikas Publications.
8. Sharma, B. K. (1997), Engineering Chemistry, Goel Publishing House, Meerut

Reference books :

1. George T. A. (1977). Shreve's Chemical Process Industries. 5th edn. McGraw- Hill International Edition. Chemical Engineering Series. Singapore.
2. Chang R. and Tikkanen W. (1988). The Top Fifty Industrial Chemicals. Random House, New York.
3. Price R.F. and Regester M.M. (2000), WEFA Industrial Monitor, 2000-2001, John Wiley & Sons Inc., New York. Chang R. (1991). Chemistry, 4th Edition, McGraw-Hill Inc. New York.
4. Shukla S. D and Pandey G. N, (1978). A Textbook of Chemical Technology. Vol.1 (Inorganic/Organic). Vikas publishing House PVT Ltd. New Delhi.
5. Stephenson R.M. (1966). Introduction to the Chemical Process Industries, Reinhold Publishing Corporation, New York.
6. Groggins P.H. (1958). Unit Processes in Organic Synthesis, 5th Edition, McGraw-Hill Book Company, New Delhi.
7. Das R.K. (1988) Industrial Chemistry: Metallurgy, Kalyani Publishers, New Delhi. Gerhartz, W. (Editor), (1987). Ullmann's Encyclopaedia of Industrial Chemistry Vol A8, 5th Edition, VCH Verlagsgesellschaft mbH, Weinheim.

Online links for study & reference materials :

https://bookauthority.org/books/best-industrial-chemistry-books

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Course Code : STUGC/ DSE 4
Course Credit Hour : 4hr

Course Name : Drug Synthesis
Total Contact Hour : 60hr

Course Objective :

- General structural features of agents belonging to the therapeutic class. Relevant physicochemical properties. Relevant chemical reactions/synthetic pathways for selected drugs. Structural influences on mechanism of pharmacologic action (structure-activity relationship). Structural influences on pharmacologic/toxicological/therapeutic profiles.

Course Description :

- The course gives an introduction to the most common synthetic methods that are applied in industrial and laboratory drug synthesis. The course deals with Structure, stereochemistry, Mode of action, Structure activity relationships, synthesis of drugs and with the molecular mechanism of drug action.

Course Contents : L-4 T-0 P-2

1. Antibacterials: Penicillines, Cephalosporins, Tetracyclines, Aminoglycosides, Chloramphenicol, Macrolides, Lincomycins, Polypeptides antibiotics, Polyene antibiotics. Sulfonamides and Sulfones fluoroquinolines, Trimethoprim and other unclassified antibiotics. Antimycobacterials: Sulfanilamides, p-Aminosalicyclic acid derivatives, Thioamides, Thiourea, derivatives, Thiosemicarbonazones, Isoniazid, Kanamycin sulfate, Capreomycin, Rifaampin, Pyrazinamide, Anthionamide, Clofazimine, Cyclosporin, Dapsone, Sulfazem. Commercial synthetic/semi-synthetic routes to : 6-amino penicillanic acid, ampicillin, amoxycillin, production of penicillin, 7- amino cephalsporanic acid, cephalexin, ceftizoxime, cefaclor, cephslothin, Tetracyclins: doxycycline, nalidixic acid, sulfadiazine, Norflaxacin, Ciproflexacin, O-flaxacin, Amiflaxacin, Difloxacin, Chloramphenicol, Nitroflurantion, Sulfamethyoxazole, Acetysulfoxiazole, Trimethoprim.

2. Antimalarials: Cinchona alkaloids, 4-Aminoquinolines, 8-Aminoquinolines, 9-Aminoacridines, Biguanides, Pyramidines and Sulfones, Mefloquine, Sulfonamides. Commercial synthetic routes to: Chloroquine, pamaquine, primaquine, proguanil, Amodiaquine, Mefloquine, Pyremethamine, Sontoquine.

3. Antiamoebic and antiprotozoal drugs: Emetine hydrochloride, 8- Hydroxyquinoline, Iodochlorohydroxyquinol, Metronidazole, Diloxanide furoate, Bilamical hydrochloride, Hydroxystilbamidine isothinate, Pentamidine isothionate, Nifurtimox, Suramin sodium, Carbarsone, Glycobiarsol, Melarsoprol, Sodium stibogluconate, Dimercaprool, Diethylcabamazine citrate, Centarsone, Acetarsone, Antimony potassium tartarate, Bismuth sodium thioglycollate, Sulphonamide, Stibiophen. Bismuth sodium thioglycollamate, Furazolidone.

4. Anthelmintics: Introduction, Tetrachloroethylene, Piperazines, Gentian violet, Pyrvinium pamoate, Thiabendazole, Mabendazole, baphenium hydroxynaphthoate, Dichlophene, Niclosamide, Levamisole hydrochloride, Tetramisole, Niridazole, Biothional, Antimonypotassium tartarate, Stibiophen, Sodium Stibiocaptate.

5. Antifungal drugs: Fatty acids and their derivatives (Propionic acid, zinc propionate, sodium caprylate, zinc caprylate, undecylenic acid, Zinc undecylenate, Triacetin), Salicylanilids, Salicyclic acid, Tolnaftate, pchloromethoxylenol, Acrisocrin, Fluconazole, Itraconazole, Haloprogin, Clotrimazole, Econazole, Miconazole, Ketoconazole, Flucytosine, Griseofulvin, Polyene antibiotics (Nystatin, Amphoetericin-B), Chlorophenesin, Dithranol. Commercial synthetic routes to: Miconazole, Clotrimazole, Econoazole, Fluconazole, Griseofulvin, Ketoconazole, Nafttidine, Tolnaftate, Flucytosin.

Course Learning Outcomes(CLOs) :

After completion of the course student will be able to understand/explain

CLO-1 : Recognize the drug structure and predict its pharmacologic action.

CLO-2 : Relevant chemical reactions/synthetic pathways for selected drugs

CLO-3 : Knowledge of the connection between the structural features of the drugs and their physico-chemical characteristics, mechanism of action and use.

CLO-4: Application the gained knowledge about the drugs. Counseling and giving information to patients about the drug action.

Text books :

- Pharmaceutical Chemicals in Perspective. B.G. Reuben and H.A. Wittcoff, John Wiley & Sons, New York, 1989.
- W.C. Foye, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia,U.S.A.
- Strategies of Organic Drug Synthesis and Design, D. Lendnicer, John Wiley and Sons, New York, 1998.
- Thomas L. Lemke, David A. Williams, Victoria F. Roche, S. William Zito, Foye's Principles of Medicinal Chemistry, 7th Ed.,Lippincott Williams & Wilkins, 2012,ISBN 13: 9780781768795
- Graham L. Patrick, "An Introduction to Medicinal Chemistry", 5th Ed. Oxford University Press 2013, ASIN : 0199697396
- Wilson and Gisvolds Textbook of Organic Medicinal and Pharmaceuticals Chemistry, 8th edition, edited by R.F. Deorge, J.B. Lippincott Company, Philadelphia, 1982, ISBN 978-0-7817-7929-6

Reference books :

1. Jie Jack Li, Douglas S. Johnson, Modern Drug Synthesis, Wiley, 1st Edition, **ISBN**: 9780470768594
2. Pharmaceutical Chemicals in Perspective. B.G. Reuben and H.A. Wittcoff, John Wiley & Sons, New York, 1989., 1st Edition, ISBN 13: 9780471540366
3. Rama Rao nadendla, Principles of Medicinal Chemistry, New Ace publisher, 1st Edition, ISBN (13) : 978-81-224-2485-0
4. Strategies of Organic Drug Synthesis and Design, D. Lendnicer, John Wiley and Sons, New York, 1998.

Online links for study & reference materials :

5. https://www.sciencedirect.com/book/9780444521668/synthesis-of-essential-drugs
6. https://cmr.asm.org/content/12/4/501
7. https://www.sciencedirect.com/book/9780444521668/synthesis-of-essential-drugs, An introduction to medicinal chemistry, Graham L. Patrick
8. https://pubs.acs.org/doi/abs/10.1021/jm00388a027

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF BIOTECHNOLOGY & MICROBIOLOGY

SYLLABUS OF COURSES TO BE OFFERED

POSTGRADUATE PROGRAMME (BIOTECHNOLOGY)

Choice Based Credit System (CBCS)

(w.e.f. academic session 2019-20)

POSTGRADUATE PROGRAMME (BIOTECHNOLOGY)

Curriculum Drafting Committee

1.	Dr. Lomas Tomar, Director, School of Sciences, NIU	Chairperson
2.	Dr. Varun Kumar Sharma, Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member Secretary
3.	Dr. Namrata Dudha Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
4.	Dr. Kashish Gupta Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
5.	Dr. Garima Sharma Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
6.	Dr. Navroop Kaur Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member

PEOs, POs & PSOs of M.Sc. Biotechnology Programme

Programme Educational Objectives (PEOs): The Program Educational Objectives (PEOs) for the M.Sc. Biotechnology program enlists the accomplishments that a graduate aims to attain within two years after graduation.

PEO1: To motivate graduates to pursue research career in industry and academia by providing fundamental and practical knowledge foundation in branch of Biotechnology.

PEO2: To develop biotechnologists with high professional ethics to cope up with global and societal issues for overall development.

PEO3: To educate students with analytical and research skills, and empower them to critically analyze the research problems depending on area of specialization and also will nurture their entrepreneurial endeavors.

Programme Outcomes (POs): The Graduates of Masters programs (M.Sc. Biotechnology) will be able to:

PO1: Master of Science knowledge: Apply the knowledge of biotechnology, microbiology, biochemistry fundamentals, and bioinformatics to the solution of complex biological problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex biological problems reaching substantiated conclusions using various principles of biotechnology, bioinformatics, microbiology, biochemistry, cell and molecular biology sciences.

PO3: Conduct investigations of complex problems: Use the various protocols developed through extensive research-based knowledge and methods including design of experiments, analysis and interpretation of data, and provide valid and reproducible conclusions.

PO4: Post Graduate Student and society: Apply the classic and modern biological theoretical and practical knowledge gained to address societal, health, microbial and plant biodiversity studies, safety, ethical and cultural issues and the consequent responsibilities relevant to the professional up-gradation of the student and society as a whole.

PO5: Individual and team work: Be an independent thinker and researcher effectively as an individual, and as a member or leader of different teams, and in multidisciplinary research Institutions and Universities.

PO6: Communication: Communicate effectively on complex research activities with the scientific community and with society at large, as a scientist or a teacher, be well versed with scientific writing and write effective reports and design research projects, make effective presentations, and be able to defend it efficiently.

PO7: Project management and finance: Write good research and development projects relevant to the needs of society and environment and attract extra mural funds for himself and his team in the Institute or University from various funding agencies and manage R&D projects effectively.

Programme Specific Outcome (PSOs): After the successful completion of M.Sc. Biotechnology program, the students will able to:

PSO1: Have basic and advanced understanding of Biotechnology in its various domains including, health, nutrition, agriculture, biodiversity conservation, Biosafety etc.

PSO2: Address research questions related to all the above mentioned domains through carrying out specific experiments.

PSO3: Appear and successfully qualify the higher level examinations of various agencies like DBT (Department of Biotechnology), CSIR (Council of Scientific and Industrial Research), ARS (Agriculture Research Services), ICAR (Indian Council of Agriculture Research) and many more, so as to get chance to do research from reputed institutes within country and abroad with sound fellowships.

PSO4: Have enough subject knowledge to move ahead in entrepreneurship endeavors in biotechnology.

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for M.Sc. (Biotechnology)

M.Sc. Biotechnology 1st Year
SEMESTER-I

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
									External Exam		
			L	T	P	CA	TA	Total			
1	STPB-101	Cell Biology	4	0	0	20	20	40	60	100	4
2	STPB-102	Principles of Genetics	4	0	0	20	20	40	60	100	4
3	STPB-103	Diversity of Prokaryotes & Eukaryotes	4	0	0	20	20	40	60	100	4
4	STPB-104	Basics of Medical Biotechnology & Molecular Medicine	4	0	0	20	20	40	60	100	4
5	STPB-105/ TC	Bioethics, Biosafety and IPR/ Technical Communication	2	0	0	20	20	40	60	100	2
Practical											
1	SPPB-101	Cell Biology Lab	0	0	2			25	25	50	2
2	SPPB-102	Principles of Genetics Lab	0	0	2			25	25	50	2
3	SPPB-103	Diversity of Prokaryotes & Eukaryotes Lab	0	0	2			25	25	50	2
4	SPPB-104	Basics of Medical Biotechnology & Molecular Medicine lab /seminar	0	0	2			25	25	50	2
Total										**700**	**26**
Note: List of Practical will be supplied at the Start of every Semester											

NOIDA INTERNATIONAL UNIVERSITY

M.Sc. Biotechnology 1st Year

SEMESTER-II

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
									External Exam		
			L	T	P	CA	TA	Total			
1	STPB-201	Molecular Biochemistry	4	0	0	20	20	40	60	100	4
2	STPB-202	Molecular Biology	4	0	0	20	20	40	60	100	4
3	STPB-203	Immunotechnology	4	0	0	20	20	40	60	100	4
4	STPB-204	Biostatistics, Computer Applications and Bioinformatics	4	0	0	20	20	40	60	100	4
5	STPB-205	"Seminar" Modern research in biotechnology	2	0	0	15	10	25	75	100	2
Practical											
1	SPPB-201	Molecular Biochemistry	0	0	2			25	25	50	2
2	SPPB-202	Molecular Biology	0	0	2			25	25	50	2
3	SPPB-203	Immunotechnology	0	0	2			25	25	50	2
4	SPPB-204	Biostatistics, Computer Applications and Bioinformatics	0	0	2			25	25	50	2
Total										**700**	**26**
Note: List of Practical will be supplied at the Start of every Semester											

M.Sc. Biotechnology 2nd Year
SEMESTER-III

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
									External Exam		
			L	T	P	CA	TA	Total			
1	STPB-301	Enzymology & Bioprocess Technology	4	0	0	20	20	40	60	100	4
2	STPB-302	Plant and Animal Biotechnology	4	0	0	20	20	40	60	100	4
3	STPB-303	Recombinant DNA Technology	4	0	0	20	20	40	60	100	4
4	STPB-304	Host-pathogen interaction	4	0	0	20	20	40	60	100	4
5	STPB-305/STPB-306	CBCS Genomics and Proteomics /Bioinformatics	2	0	0	20	20	40	60	100	2
Practical											
1	SPPB-301	Enzymology & Bioprocess Technology	0	2				25	25	50	2
2	SPPB-302	Plant and Animal Biotechnology	0	2				25	25	50	2
2	SPPB-303	Recombinant DNA Technology	0	2				25	25	50	2
3	SPPB-304	Host-pathogen interaction Lab	0	2				25	25	50	2
Total										**700**	**26**
Note: List of Practical will be supplied at the Start of every Semester											

M.Sc. Biotechnology 2nd Year
SEMESTER-IV

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
									External Exam		
			L	T	P	CA	TA	Total			
1	STPB-401	Environmental Biotechnology	4	0	0	20	20	40	60	100	4
2	STPB-402	Clinical research and Entrepreneurship	4	0	0	20	20	40	60	100	4
Total										**200**	**8**
Note: List of Practical will be supplied at the Start of every Semester											

S.No	Course Code	Subject	Project Report	Report Presentation	Viva Voce	Subject Total	Credit
1	STPB-403	Project	100	50	50	**200**	**8**

OVERALL CREDIT SCHEME

S. No.	SEMESTER	Theory Total	Practical Total	Subject Total	Total Credit
1	I	400	200	700	26
2	II	500	200	700	26
3	III	500	200	700	26
4	IV	200	200	400	16
			Grand Total	**2500**	**94**

Assessment method:

Assessment method	Theory					Practical	
	Internal assessment	Mid-term examination	End-term examination	Maximum Mark		Practical examination	Maximum Mark
Mark	20	20	60	100		50 Mark	50 Mark
%	20%	20%	60%	100%		100%	100%

M.Sc. Biotechnology 1st Year

SEMESTER-I

CELL BIOLOGY (STPB-101)

L	T	P
4	0	2

Course Name: Cell Biology
Course Credit Hour: 4 hrs

Course Code: STPB-101
Total Contact hour: 60 hrs

Course Objective:

The aim of the course is to provide students with in depth knowledge of cell as a functional unit of life. The intra and intercellular interactions among the various cellular organelles, their structure and function communication that facilitates optimal function and development of any organism.

Course Description:

This course consists of theoretical as well as practical approach to understand cellular mechanism that are involved in maintenance proper cellular homeostasis. This includes cell structure and function at molecular level, cell cycle and developmental mechanisms involved in division of cell, interaction of cell with the outside environment and internal cellular communication and immune mechanism.

Course Contents:

Unit I: Membrane structure and function. Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

Unit II: Structural organization and function of intracellular organelles. Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

Unit III: Organization of genes and chromosomes. Operon, unique and repetitive DNA, interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons. Cell division and cell cycle (Mitosis and meiosis, their regulation, Steps in cell cycle, Regulation and control of cell cycle).

Unit IV: Cell Signaling: Cell signaling Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.

Unit V: Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.

Course Learning Outcomes (CLOs):

At the end of this course the postgraduate student:

CLO1: Will have understanding of Cell membrane as a dynamic entity with numerous functions that facilitates normal cellular function as well as cellular transport.

CLO2. Will have a clear understanding of the structural organization and function of all intracellular organelles.

CLO3. Insight on regulation of cell cycle and organization gene and chromosomes.

CLO4. How pathogens interact with their host in higher eukaryotes. Deciphering disease mechanisms.

CLO5. Basic concept of all the pathways and mechanisms involved in cell signalling and communication

Text Books:

- GM Cooper, Cell: A Molecular approach, 8th edition, Oxford University Press, 9781605358635, 1605358630, 2018
- deRobertis and deRobertis, Cell and Molecular Biology, 8th edition, Lea & Febiger, 9780812110128

Reference Books:

- G. Karp, Cell and Molecular, Biology, 6th Edition, John Wiley & Sons, 9780470578858, 0470578858
- B Alberts et al Molecular Biology of the Cell. 6th edition, Garland Science, Taylor and Francis group, 9781317563754, 1317563751

Online links for study and reference materials:
www.biologydiscussion.com
www.khanacademy.org
https://www.ncbi.nlm.nih.gov/pmc

PRINCIPLES OF GENETICS-(STPB-102)

L	T	P
4	0	2

Course Name: Principles of Genetics **Course Code:** STPB-102
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The objective of this course is to build knowledge on the fundamentals of genetics, heredity, or inheritance. To build the foundation on the understanding of biological principles.

Course Description:

This course provides a detailed understanding of Mendelian and non-Mendelian inheritance; various techniques and methodologies that decipher genetic recombination and gene mapping.

Course Contents:

Unit I: Mendelian principles & Extensions: Dominance, segregation, independent assortment. Co-dominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

Unit II: Concept of gene and Gene mapping methods : Gene Concept, Allele, Multiple alleles, Pseudoallele, Complementation tests, Benzer's work on rII locus in T4 phases. Linkage maps, Tetrad analysis, Three- Point Test cross, Cytological basis of crossing over, Interference and Coincidence, Crossing over and Chiasma formation, Factor affecting recombination frequencies, Mapping with molecular markers, Mapping by using somatic cell hybrids, Development of mapping population in plants.

Unit III: Genetics of Sex Determination and Differentiation: Sex-linked, Sex- limited and Sex-influenced traits in Drosophila and Human beings, Theories of Sex-determination- Chromosomal theory, environmental theory and genic balance theory, Sex- determination in dioeciously plants, Sex reversal and Gynandromorphs, Human sex anomalies (Klinefelter's Syndrome and Turner's Syndrome), brief idea of Dosage Compensation and Lyon's hypothesis.

Unit IV: Extra chromosomal inheritance and Biochemical Genetics: Criteria for extra-chromosomal inheritance, Inheritance of Mitochondrial and chloroplast genes, plastid inheritance in Mirabilis, iojapa in corn, Kappa particles in Paramecium, Coiling in snails, male sterility in plants. Inborn errors of Metabolism in man, eye transplantation in Drosophila, Biochemical mutations in *Neurospora*, Biosynthetic pathways and Biochemical mutations.

Unit V: Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

Course Learning Outcomes (CLOs):
After successful completion of the course the students:

CLO 1. Will have knowledge of Mendelian, non- Mendelian inheritance and an insight of Gene concept and alleles

CLO 2. Will have an understanding of various methods employed in Gene mapping

CLO 3. Insight of differentiation of sex in plants and animals and various diseases associated with improper differentiation of sex. Evaluate difference between extra-chromosomal inheritances from chromosomal inheritance.

CLO 4. Biochemical changes that lead to difference in inheritance of characters & their expression

CLO 5. Various techniques involved in studying human genetics and their quantification

Text Books:

- P. K. Gupta, GENETICS. Rastogi Publication. 9788171338429, 8171338429
- Strickberger M. W., Genetics. Mac Millan Publishing Co., 9780024180902

Reference Books:

- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R., "Molecular Biology of the Gene", 5th Ed., Pearson Education, 9780321762436, 0321762436

Online links for study and reference materials:
www.biologydiscussion.com
www.khanacademy.org
https://www.ncbi.nlm.nih.gov/pmc

DIVERSITY OF PROKARYOTES AND EUKARYOTES - (STPB-103)

L	T	P
4	0	2

Course Name: Diversity of Prokaryotes and Eukaryotes **Course Code:** STPB-103
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The primary objective of the course is to build a strong foundation in the area of prokaryotic cell structure, division, survival and propagation. The course will enable students to understand the taxonomical classification, phenotypic and biochemical identification of food associated molds, yeasts, yeast-like fungi and bacteria.

Course Description:

This course introduces students to the diversity among prokaryotes and eukaryotes. It will make student familiar with various aseptic techniques and isolation methods. This course will introduce the host pathogen interaction.

Course Contents:

Unit I: Beginnings of Microbiology; Contributions of Lister, Koch and Pasteur; Microscopy-brief account of various types and their applications.

Methods in microbiology: Pure culture techniques, theory and practice of sterilization, Principles of microbial nutrition, culture media.

Unit II: Microbial Systematics and Taxonomy: Approaches to bacterial taxonomy, Classification including ribotyping; Ribosomal RNA sequencing, characteristics of primary domains; taxonomy, nomenclature and Bergey's manual (Introduction).

Unit III: Prokaryotic diversity: Bacteria: Purple and green bacteria, cyanobacteria, Mycobacteria, rickettsias, chlamydias and mycoplasms. Archaea: Archaea as earliest life forms: halophiles, methanogens, hperthermomphilic archaea, thermoplasma. Eukarya: An introduction to protista, algae, fungi and slime molds.

Unit IV: Metabolic diversity among microorganisms: Pathways of glucose dissimilation in aerobic and anaerobic microbes, fermentation (alcoholic and acidic), nitrogen metabolism, nitrogen fixation.

Unit V: Microflora of human (skin, oral cavity, gastrointestinal tract) entry of pathogens into the host, types of toxins (exo-, endo-) and their structure, mode of actions-infectious disease transmission; virulence and pathogenesis. Chemotherapy/antibiotics: antimicrobial agents, sulfa drugs, antibiotics: broad-spectrum antibiotics, mode of action.

Course Learning Outcomes (CLOs):

CLO1. Demonstrate theory and practical skills in microscopy and their handling techniques and staining.
CLO2. Procedures and understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea.
CLO3. Know various Culture media and their applications and also understand various physical and chemical means of sterilization and general bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae.
CLO4. Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively.
CLO5. Understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and heterotrophy and know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

Text Books:

- J. Willey, L. Sherwood, C. J. Woolverton, Prescott's Microbiology. 10th edition. McGraw Hill Education. 2017. ISBN No. 9780073375267, 0073375268
- M. Madigan, K. Bender, D. Buckley, W. Sattley, D. Stahl. Brock Biology of Microorganisms. 15th Edition. Pearson Education. 2018. ISBN No. 9781292018317, 1292018313

Reference Books:

- Ricardo Cavicchioli, Archaea Molecular and Cellular Biology. American Society of Microbiology. 2007. ISBN No. 1555813917, 9781555813918
- D. White, J. Drummond, C. Fuqua, The Physiology and Biochemistry of Prokaryotes. 4 th Edition. Oxford University Press. 2011. ISBN No. 9780195393040, 019539304X.

Online links for study & reference materials:
https://www.khanacademy.org/
https://swayam.gov.in/
https://nptel.ac.in/

BASIC OF MEDICAL BIOTECHNOLOGY & MOLECULAR MEDICINE (STPB-104)

L	T	P
4	0	2

Course Name: Basic of Med. Biotechnology & Mole. Medicine **Course Code:** STPB-104
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

It is intended to impart basic knowledge in the area of Medical Biotechnology & Molecular Medicine. This course will introduce the students with basic concept of biotechnology, medical genetics and Medical oncology and therapeutics.

Course Description:

This course is mainly focused on the Biotechnology and Molecular Medicine which includes Different classes of Biotechnology and its application, DNA Mapping, DNA Marker, Cloning of DNA, Medical Genetics and Genetic Diseases. This course also includes medical oncology, Tumour and Cytogenetic Markers, rDNA derived Drugs, Gene Therapy, Hybridoma Technology and Bioethics & Biosafety in Research

Course Contents:

Unit 1: Medical Biotechnology & Molecular Technology

Introduction to Biotechnology, Different classes of Biotechnology and its application: Medical Biotechnology, DNA Mapping, DNA Marker, Cloning of DNA, DNA Sequencing, Recombinant DNA technology, Mutation & Polymorphism.

Unit 2: Medical Genetics

Introduction of Medical Genetics and Genetic Diseases. Thalassaemia – Model for Molecular Genetics, Chromosomal Disorders, Heterogeneity, Genetic counseling, Stem cell and its application.

Unit 3: Medical Oncology

Introduction of medical oncology, Tumour and Cytogenetic Markers, Gene regulation in cancer: Oncongenes and Tumour Suppressor genes, Genetic Models and Cancer, Diagnostic Application & Therapeutics.

Unit 4: Therapeutics

rDNA derived Drugs, Gene Therapy, Hybridoma Technology, Monitoring & Response to Therapy Immunotherapy.

Unit 5: Bioethical issues and Forensic Medicine

Introduction to Bioethics & Biosafety in Research, Human Genome Project, Introduction to Forensic Medicine, Tissue identification and DNA profiling.

Course Learning Outcomes (CLOs):

CO1. Basic concept of Medical Biotechnology and its scope.
CO2. Develop an understanding of medical genetics and chromosomal disorder.
CO3. Understand basic concept of Molecular Oncology, and Gene regulation in cancer development.
CO4. Explain the basic concept of gene therapy and its application
CO5. Discuss the basic introduction to Bioethics & Biosafety in Research and concept of forensic medicine.

Text Books:

- An Introduction to Molecular Biotechnology: Molecular Fundamentals, Methods and Applications in Modern Biotechnology, Wiley, ed. 2, 2011
- Campbell, M.A and Heyer L.J., Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition, CSHL Press, Pearson/Benzamin Cummings San Francisco, USA, 2007.
- Andrew Read and Dian Donnai, New Clinical Genetics, Scion Publishing Ltd, Oxfordshire, UK, 2007.

Reference Books:

- S.R. Maloy, J.E. Cronan, D. Friefelder, Microbial Genetics, 2nd Edition, Jones and Bartlett Publishers, 1994.
- New Clinical Genetics, Scion Publishing Ltd, Oxford shire, UK, 2007
- Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition, CSHL Press, Pearson/Benzamin Cummings San Francisco, USA, 2007
- Strachan T and Read A P, Human molecular genetics, 3rd Edition Wiley Bios, 2006.

Online links for study & reference materials:
http://www.onlinebiologynotes.com
http://www.ornl.gov/TechResources/Human_Genome/home.html
https://www.biotecharticles.com

CBCS** BIOETHICS, BIOSAFETY & IPR - (STPB-105)

L	T	P
2	0	0

Course Name: Bioethics, Biosafety and IPR
Course Code: STPB-105
Course Credit Hour: 2 hrs
Total Contact hour: 30 hrs

Course Objective:

To apprise the students of the various societal, governance and regulatory issues in biotechnology with special emphasis on ethics, safety and intellectual property rights. Through this course, the students develop a perspective on the importance of these aspects in the success of biotechnology products and services in the market. At the end of the course, they should be able to apply this perspective and the specific principles, laws, regulations etc., in academic and industrial settings for regulatory oversight and enforcement.

Course Description:

This course is mainly focused on the Bioethics, Biosafety and Intellectual Property Rights which includes basic concept of patents, patent regime (in India and abroad) registration aspects and other details.

Course Contents:

Unit I

Biotechnology and social responsibility, public acceptance issues in biotechnology, issues of access, ownership, monopoly, traditional knowledge, biodiversity, benefit sharing, environmental sustainability, public vs private funding, biotechnology in international relations, globalization and development divide.

Unit II

Introduction to bioethics: Social and ethical issues in biotechnology. Principles of bioethics. Ethical conflicts in biotechnology- interference with nature, unequal distribution of risk and benefits of biotechnology, bioethics vs business ethics.

Unit III

Biosafety: Definition of bio-safety, Biotechnology and bio-safety concerns at the level of individuals, institutions, society, region, country and world with special emphasis on Indian concerns.

Unit IV

Biosafety in laboratory institution: laboratory associated infection and other hazards, assessment of biological hazards and level of biosafety. Bio safety regulation: handling of recombinant DNA products and process in industry and in institutions (Indian context).

Unit V

Introduction to IPR: IPR, forms of IPR and Intellectual property protection. Concept of property with respect to intellectual creativity, Tangible and Intangible property. WTO: agency controlling trade among nations, WTO with reference to biotechnological affairs, TRIPs. WIPO, EPO.

Course Learning Outcomes (CLOs):

CLO1. The students shall get an adequate knowledge on patent and copyright. This provide further way for developing their idea or innovations.

CLO2. Identify the role of regulatory committees in controlling the risk.

CLO3. Students should get enough information on ethical issues linked to research on animal models, transgenics, clinical trials.

CLO4. Students to consider Intellectual Property (IP) as a career option as IP Counsel/Patent Examiner/Patent agent.

Text Books:

- Singh K K (2015). Biotechnology and Intelectual Property Rights: Legal and Social Impliocations, Springer India.
- Senthil Kumar Sadhasivam and Mohammed Jaabir, M. S. 2008. IPR, Biosafety and biotechnology Management. Jasen Publications, Tiruchirappalli, India.

Reference Books:

- Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
- Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
- V Sreekrishna, 2017. Bioethics and Biosafety in Biotechnology by New Age International publishers.

Online links for study & reference materials:
http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

M.Sc. Biotechnology 1st Year
SEMESTER-II

MOLECULAR BIOCHEMISTRY (STPB-201)

L	T	P
4	0	2

Course Name: Molecular Biochemistry **Course Code:** STPB-201
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

This course deals with characteristics, properties and biological significance of the biomolecules of life.

Course Description:

This course introduces students to the general families of biomolecules that comprise the science of biochemistry and to the principles that integrate biochemistry with other chemical and biological disciplines. They acquire knowledge in the quantitative and qualitative estimation of biomolecules.

Course Contents:

UNIT I: Chemical foundations of Biology – pH, pK, acids, bases, buffers, weak bonds and covalent bonds. Classification, structure, properties and biological significance of carbohydrates. Monosaccharides, Disaccharides, and Polysaccharides. Biological role of peptidoglycans, glycosaminoglycans and Lectins. Lipids - classification, structure and properties of fatty acids, triglycerides, phospholipids, sphingolipids and cholesterol.

UNIT II: Amino acids - Classification, structure and physico-chemical properties. Chemical synthesis of peptides – solid phase peptide synthesis. Proteins - classification, purification and criteria of homogeneity. Structural organization, sequence determination and characterization of proteins. Confirmation of proteins – Ramachandran plots. Denaturation of proteins. Hetero cyclic compounds – Heme and Chlorophylls.

UNIT III: Structure and properties of purines, pyrimidines, nucleosides, and nucleotides. Covalent structure of DNA and different forms of DNA - A, B and Z. DNA super coiling. Types of RNA and covalent structure of t-RNA. Classification, structure and physiological roles of Vitamins.

UNIT IV: Hormones- classification and mechanism of action of steroid and protein hormones. Signal transduction cascade by cyclic AMP, Phosphoinositate and calcium (Ca+), G-proteins, growth factors and membrane receptor tyrosine kinases. Phytohormones and their physiological roles.

Course Learning Outcomes:
After studying this paper, Postgraduate students will be able to:

CLO1: Understand biochemistry at the atomic level, draw molecules and reaction mechanisms perfectly and detail about amino acid structures, types of amino acids, classifications, structure of proteins and types of proteins

CLO2: Recognize the structural levels of organization of proteins,3D structure of proteins, its functions, denaturation (hemoglobin, myoglobin etc.) and be able to describe/recognize lipid and porphyrin structures, lipoproteins and functions of porphyrins (heme, chlorophyll etc.).

CLO3: Learn how amino acids and proteins are metabolized, emphasizing the role of few intermediates of their metabolism, monitoring the deficiency and abundance disorders of amino acid metabolisms and the role of enzymes in the regulation of the pathways

CLO4: Understand the structure and function of genetic material.

Text Books:

- A.L., Lehninger, PRINCIPLES OF BIOCHEMISTRY (1982), Worth Publishers, Inc. New York, ISBN: 9780716743392, 0716743396
- L. Stryer , BIOCHEMISTRY (1995) W.H. Freeman Press, San Francisco, USA, ISBN: 9781319248086, 131924808X.

Reference Books:

- Voet, D. and Voet, J.G., Biochemistry, (2004). 3rd Edition, John Wiley & Sons, Inc.USA,
- U. Sathyanarayana, Biochemistry by Books and Allied (P) Ltd. Kolkata, ISBN 0-87893- 214-3, (2014), ISBN: 9788187134800, 8187134801

Online links for study & reference materials:
https://www.khanacademy.org/test-prep/mcat/biomolecules
https://nptel.ac.in/courses/104/105/104105076/

MOLECULAR BIOLOGY (STPB-202)

L	T	P
4	0	2

Course Name: Molecular Biology
Course Code: STPB-202
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

To acquaint the students with basic and advanced knowledge of molecular biology. Course objectives is focus discuss the better understanding of molecular Biological processes like DNA replication, transcription and repair systems, different genes regulation and replication.

Course Description:

This course presents the genetics at molecular level Goals: On successful completion of the subject the student should have understood the molecular aspects of Molecular biology

Course Contents:

Unit I: Organization of genetic material - Packing of DNA in to chromatin - protein components of chromatin, histones, nucleosome organization. Solenoids loops, domains & scaffolds. Gene amplification, polytene chromosomes. DNA replication – apparatus, enzymes involved and mechanism. Replication at telomeres. DNA damage and repair mechanism. Nuclear genome.C - value paradox. Mitochondrial & plastid genomes and genes. Fine structure of the eukaryotic gene. Split genes. Different kinds of genes: overlapping, assembled, polyprotein & nested genes.

Unit II: Transcription in prokaryotes and eukaryotes. Mechanism of transcription, enzymes and transcription factors, zinc finger, leucine zipper mechanism. Maturation and processing of mRNA, splicing, 5' end capping & 3' end tailing. RNA editing and transport. RNAi and small RNAs.

Unit III: Translation in prokaryotes and eukaryotes: Genetic code - properties of the genetic code, deciphering of the genetic code. Ribosome as a translation factory. t - RNA as an adaptor, its mode of function. Post translational modifications. Leader sequences & protein targeting.

Unit IV: Regulation of gene expression in prokaryotes - The operon concept, lac &tryp operons. Transcriptional control. Post translational control. Regulation in eukaryotes - Control by promoter, enhancer and silencers. Cis-trans elements. Environmental & developmental regulation. DNA methylation & gene expression. Chromatin structure & gene expression.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept molecular biology especially organization of genetic material.
CLO2. Describe the basic knowledge of transcription in prokaryotes and eukaryotes.
CLO3. Describe the basic knowledge of translation in prokaryotes and eukaryotes.
CLO5. Discuss the basic concept of regulation of gene expression in prokaryotes and eukaryotes.

Text Books:

- Jeff Hardin, Gregory Bertoni, Lewis J. Kleinsmith, Wayne M. Becker. Becker's World of the Cell, 8th edition, Benajmin Cummings, 9780321689634, 0321689631, (2012).
- EDP De Robertis and EMF De Robertis. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, 9780781734936, 0781734932, (2006)

Reference Books:

- Gerald Karp, Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc, 9780470483374, 0470483377 (2010)
- G.M. Cooper, and R.E. Hausman. The Cell: A Molecular Approach. 5th Edition. ASM Press 780878931064, 0878931066 (2009)

Online links for study and reference materials:
http://www.open2study.com/cellbiology
https://nptel.ac.in/courses/102103012/

IMMUNOTECHNOLOGY (STPB-203)

L	T	P
4	0	2

Course Name: Immunotechnology
Course Credit Hour: 4 hrs

Course Code: STPB-203
Total Contact hour: 42 hrs

Course Objective:

This course is mainly focused on the host immune system which includes concept of immunology, Type of immune system, Classes of immune cells, Antigen-Antibody interaction immune cell tolerance, vaccine technology, and other immunotechnology related topics. Basic of immunology and molecular biological techniques are usually two major courses form the essential prerequisites for Immunotechnology.

Course Description:
This course is mainly focused on the host immune system which includes basic concept of immunology, Type of immune system, Classes of immune cells, Antigen-Antibody interaction immune cell tolerance, vaccine technology and other relevant topics. It also discuss the basic concept of Vaccine technology including DNA vaccines, immunodiagnosis of Infectious diseases.

Course Contents:

Unit I: Introduction to immunology: History and scope of immunology; types of immunity; anatomy of lymphoid organs- primary and secondary lymphoid organs; immunoglobulin structure and function; memory cells, lymphocyte differentiation.

Unit II: Biology of complement systems: Structure and function of MHC class I and II molecules; antigen recognition and presentation; humoral and Cell mediated immune responses; hypersensitivity reaction; immune suppression and immune tolerance; auto immune disorders.

Unit III: Antigen & Antibodies: Antigen- isolation, purification and characterization of various antigens and haptens; antibodies- production, purification and quantification of immunoglobulins; antigen - antibody reaction; hybridoma and monoclonal antibody production; immuno-diagnosis and applications; human monoclonal antibodies; complement fixation.

Unit IV: Immunotechnology: Purification of mononuclear cells from peripheral blood; isolation and characterization of T cells subsets; Antigen processing and presentation; fluorescent activated cell sorter (FACs); mitogen and antigen induced lympho-proliferation assay; mixed lymphocyte reaction (MLR); Assay of macrophage activation; Macrophage & Dendritic cells culture.

Unit V: Vaccine Technology: Introduction to Vaccine technology including DNA vaccines - identification of T and B epitopes for vaccine development. immunodiagnosis of Infectious diseases.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept immune system, types of immunity and immunoglobulin structure and function.
CLO2. Discuss Structure and function of MHC class I and II molecules, antigen recognition and presentation.
CLO3. Describe the Basic characteristics of an antigen and Structure, Types, Functions and Properties of antibodies.
CLO4. Explain the isolation and characterization of different immune cells, Antigen processing and presentation.
CLO5. Discuss the basic concept of Vaccine technology including DNA vaccines, immunodiagnosis of Infectious diseases.

Text Books:

- Immunology, V Edition - Richard A.Goldsby, Thomas. J. Kindt, A. Osborne, JanisKuby, 2003. W.H. Freeman and company.
- Topley and Wilson principles of bacteriology, Virology and immunology, G. Wilson, A.Miles, M.T.Paker, 2004.
- Arnold, HeinemanAbbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
- Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition WileyBlackwellScientific Publication, Oxford.

Reference Books:

- Basic and Clinical Immunology, 2010, D.P. Stities and J.D. Stobo.
- Vaccines, New Approaches to immunization, F.Brown, KA Lerner, 1986. Cold spring Harborolab.Goldsby RA, Kindt TJ, Osborne BA. (2007).
- Kuby's Immunology. 6th edition W.H. Freeman andCompany, New York.
- Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.
- Immunology, Richard A. Goldsby, Thomas J. Kindt. Barbara, A. Osborne, Janis Kuby 5th Edition, 2003. W. H. Freeman & Company.

Online links for study & reference materials:

https://nptel.ac.in/courses/102103038/
https://nptel.ac.in/courses/102103041/18

BIOSTATISTICS, COMPUTER APPLICATIONS AND BIOINFORMATICS (STPB-204)

L	T	P
4	0	2

Course Name: Biostatistics, Computer Applications and Bioinformatics **Course Code:** STPB-204
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The objective of this course is to impart fundamental knowledge of computers, and biostatistics which is used in population genetics and evolutionary studies and understand how the biological data generated through various biological branches can be assimilated and studied using computer application.

Course Description:

This course provides students with in depth knowledge Bioinformatics, its application and various tools and their usage. It also provides information regarding the various algorithms used in the bioinformatics tools that enable easier processing of biological data and also enables to identify interaction across various or subbranches of bioinformatics like genomics, proteomics, drug designing, chemical interactions between molecules etc.

Course Contents:

Unit I Introduction to Bioinformatics – Genomics and Proteomics. Bioinformatics – Online tools and offline tools. Biological databases. Types of data bases – Gen bank, Swiss port, EMBL, NCBL, and PDB. Database searching using BLAST and FASTA.

Unit II Sequence and Phylogeny analysis - Sequence Alignments, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.

Unit III Dynamic programming- Gene and Genome annotation – Tools used. Physical map of genomes. Molecular phylogeny - Concept methods of tree construction.

Unit IV: Bioinformatics tools in proteomics: Introduction, strategies and methods. Bioinformatics tools in proteomics. Application of proteomics. Protein-protein interactions. Basic introduction of Proteomics technologies: 2D-electrophoresis, MALDI-TOF mass spectrometry. Biological Protein Databases: PDB, SWISSPROT, TREMBL. Protein secondary structure prediction. Protein 3D structure prediction.

Unit V: Basics of Biostatistics: Brief description and tabulation of data and its graphical representation. Measures of central tendency and dispersion - mean, median, mode, range, standard deviation, variance. Simple linear regression and correlation. Types of errors and level of significance. Tests of significance – F & t tests, chi-square tests, ANOVA.

Course Learning Outcomes (CLOs):
After successful completion of the course the students:

CLO1. Outlines the basic background of Bioinformatics, terminology, history and introduction to various databases

CLO2. Describe in detail the various mechanisms involved sequence similarity, algorithm matrices MSA and Phylogenetic analysis

CLO3. Introduces various programming and software tools involved in genome annotation, mol. Phylogeny.

CLO4. Discuss the basic background of proteomic and various tools and their application in understanding the proteome and its analysis

CLO5. Describes the mathematical tools involved in evaluation of the various dataset generated and their evaluation via statistics.

Text Books:

- D. Mount, Bioinformatics – Sequence and Genome Analysis, 2nd Ed. Cold Spring Harbor Laboratory Press, 9780879697129, 0879697121
- William Mendenhall, Robert J. Beaver, Barbara M. Beaver, Introduction to Probability & Statistics, 14th Edition, Cengage Learning,1133103758, 9781133103752,

Reference Books:

- Arthur M.Lesk, Introduction to Bioinformatics, 4th Ed. Oxford press, 9780199651566, 0199651566

Online links for study and reference materials:
https://nptel.ac.in/courses/102/106/102106065/
www.ncbi.nlm.gov

"SEMINAR" (STPB-205)
MODERN RESEARCH IN BIOTECHNOLOGY

L	T	P
2	0	0

Course Name: Modern Research in Biotechnology
Course Code: STPB-205
Course Credit Hour: 2 hrs
Total Contact hour: 30 hrs

Course Objective:

Develop an ability to understand and present a seminar on the latest scientific and technological developments in the field of biotechnology which enhances writing as well as oral communication skills.

Course Contents:

Every student, who has been enrolled in M. Sc. (Biotechnology) course, shall have to deliver a Seminar on a Recent Topic related to Recent and Applied Developments in Biotechnology. Seminar will be of 45-minute duration during which the presentation will be followed by questions session by the audience comprising of faculty and students. Every student shall be required to submit the topic of his/her seminar in consultation with the Head of the Department/Faculty members well in advance so that the same may be displayed on the notice board. The speaker has to write an Abstract to be distributed during Seminar in addition to two copies of write-up giving relevant details of the background of the subject, methods used and references/List of sources from where the material for presentation has been collected.

Course Learning Outcomes (CLOs):

After completion of the course, students will understand about the Modern Research in Biotechnology and develop presentation skill during the discussion and presentation. Additionally, Student will develop a drafting and writing skill.

NOIDA INTERNATIONAL UNIVERSITY

M.Sc. Biotechnology 2nd Year
SEMESTER-III

ENZYMOLOGY AND BIOPROCESS TECHNOLOGY (STPB-301)

L	T	P
4	0	2

Course Name: Enzymology and Bioprocess Technology
Course Code: STPB-301
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

This course focus on the basis of Enzymology, bioprocess technology and their techniques. It basically covers the Bioprocess parameters, spoilage of food stuffs and food processing.

Course Description:

This is a specialized branch of life sciences that deals with the biochemical nature and activity of enzymes and is a subject that has relevance to students from a wide range of disciplines. In addition, it will serve as an individual reference for students pursuing their post graduate degree programmes in life sciences and it could be recommended to anyone wishing to get an idea of the present day scope and applications of enzymology. The present course opens the door to all of the abundant careers in and out of the area of biological sciences including health/medical/ Environmental Sciences.

Course Contents:

Unit I: Isolation, preservation and maintenance of industrial microorganisms, kinetics of microbial growth and death, product decomposition, effect of environmental conditions. Bioreactors; Media for industrial fermentation, types of fermentation processes; Analysis of batch, Fed-batch and continuous bioreactions, stability of microbial reactors, analysis of mixed microbial populations, specialized bioreactors (pulsed, fluidized, photobioreactors etc.).

Unit II: Measurement and control of bioprocess parameters, basic principles of feedback control, proportional, integral and derivative control; Downstream Processing: introduction, removal of microbial cells and solid matter, foam preparation, precipitation, filtration, centrifugation, cell disruptions, liquid-liquid extraction, chromatography, membrane process, drying and crystallization.

Unit III: Enzyme and cell immobilization and their industrial applications; Use of microbes in mineral beneficiation and oil recovery; Industrial production of chemicals: Alcohol (ethanol), acids (citric, acetic and gluconic), solvents (glycerol, acetone, butanol), antibiotics (penicillin, streptomycin, tetracycline), amino acids (lysine, glutamic acid). Effluent treatment: DOC and COD treatment and disposal of effluents.

Unit IV: Introduction to Food Technology- elementary idea of canning and packing, sterilization and Pasteurization, technology of typical Food/Food products (bread, cheese, idli), food preservation, fermented foods and probiotics.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept preserving and maintenance of industrial microorganisms.
CLO2. Discuss the bioprocess parameters and their feedback control.
CLO3. Describe the basic characteristics of enzyme and cell immobilization and their industrial applications.
CLO4. Explain the Major Food Preserving techniques and their implimentations.

Text Books:

- Stanbury, A.H., A. Whittaker and Hall S.J. 1995. Principles of fermentation technology 2nd edition, Pergamon Press.
- Lehninger, Nelson, D. L. and Cox, M. M 2000. Principle of Biochemistry, Worth Publishers.

Reference Books:

- Stanburry P.P. and Whitaker, A. 1984. Principles of Fermentation Technology. Pergamon Press, OxfordUK.
- R2. Steinkraus, K.H. 1983. Handbook of Indigenous Fermented Foods. Marcel Dekker, New York.

Online links for study & reference materials:
www.bioprocessingsummit.com
https://biopharmaceutics.pharmaceuticalconferences.com

PLANT AND ANIMAL BIOTECHNOLOGY (STPB-302)

L	T	P
4	0	2

Course Name: Plant and Animal Biotechnology **Course Code:** STPB-302
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The course will include an introduction to theoretical aspects in Plant Biotechnology (Genomics) with emphasis on practical application. Theory and Applications of biotechnological techniques in the laboratory will provide students with the basic understanding of the molecular mechanisms that underlie cellular processes in plants, with reference examples on important Mediterranean cultivars utilized in advanced Agricultural / Horticultural and Pharmaceutical Industry. The subject covers animal molecular biology, recombinant DNA technology, production of transgenic animals, reproductive biotechnology, biotechnology in animal breeding and ethics.

Course Description:

This course are to introduce students to the principles, practices and application of animal biotechnology, plant tissue culture, plant and animal genomics, genetic transformation and molecular breeding of plants and animals.

Course Contents:

Unit I: Introduction Plant and Animal Biotechnology: Animal Tissue and Organ Culture, Plasma clot method, Raft method, Agar-gel method, Grid method, cyclic exposure to medium and Gas phase, advantages, limitations and applications, artificial skin. In Plant: Somaclonal variation and its use in crop improvement, embryo culture and its utility in hybridization programmes, Anther culture, haploid production and their uses, micro propagation in horticultural crops and forestry and its uses, artificial seeds, techniques of protoplast culture, regeneration and somatic cell hybridization, achievements , limitations, utility in improvement of crop plants.

Unit II: Cell Culture: Substrate and suspension culture, Culture Media, natural and artificial, initiation of cell culture, sub-cultures, Evaluation and Maintenance of cell culture lines, Large scale culture of cell lines, Monolayer, Suspension culture, Immobilized cultures, Somatic cell fusion, mechanism and applications, cell culture products and their applications, Interferons

Unit III: Transgenic Plants in dicots and monocots: Utility of Transgenic in basic studies and in crop improvement (resistance for herbicides, viruses, insects and abiotic stresses, Barnase and Barstar for hybrid seed production), Biosafety issues including risks associated with transgenic crops, biosafety regulations.

Unit IV: Plant Genetic Resources: Different kinds of PGR, Taxonomical Classification of PGR, Basic, derived and molecular, core collections, principles of germplasm characterization, evaluation, maintenance and regeneration, Plant quarantine aspects- Sanitary and Phytosanitary Systems, Techniques for conservation of plant germplasm, Role of IPGRI, NBPGR, FAO and CGIAR: in conservation of PGR.

Unit V: PGR and IPRs (Intellectual Property Rights): Patents, copyrights, Trademarks, GATT and TRIPs, Terminator and Traitor Techniques (v-GURT and t- GURT), Biodiversity Bill 2002, Geographic indicator bill.

Course Learning Outcomes (CLOs):

CLO1. Understand the basics of sterile techniques, media preparation, DNA extraction methods, gene isolation and nucleotide sequence analysis and acquaint with principles, technical requirement, scientific and commercial applications in Plant Biotechnology.
CLO2. Support methodologies in plant tissue/cell culture to plant improvement, as well as DNA handling with PCR-based detection diagnostic tools, and become motivated to set goals towards pursuing graduate school and higher level positions, such as lab manager and key scientist in plant biotechnological research institutes and industries.
CLO3. Be able to describe the structure of animal genes and genomes, describe how genes are expressed and what regulatory mechanisms contribute to control of gene expression.
CLO4: Be able to describe basic principles and techniques in genetic manipulation and genetic engineering, describe gene transfer technologies for animals and animal cell lines.
CLO5: Be able to describe techniques and problems both technical and ethical in animal cloning and the contribution 'functional genomics' is making and is likely to make in animal biotechnology now and in the future.

Text Books:
- Razdan, M. K. (2003). Introduction to Plant Tissue Culture. Enfield, NH: Science. ISBN: 9781578082377, 1578082374
- Gordon, I. (2005). Reproductive Techniques in Farm Animals. Oxford: CAB International.ISBN: 9781780646022, 178064602X

Reference Books:
- Glick, B. R., & Pasternak, J. J. (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. Washington, D.C.: ASM Press. ISBN: 9781555811365, 1555811361
- Pörtner, R. (2007). Animal Cell Biotechnology: Methods and Protocols. Totowa, NJ: Humana Press. ISBN: 9781493963188, 149396318X

Online links for study & reference materials:
https://www.khanacademy.org/
https://nptel.ac.in/courses/
https://swayam.gov.in/

RECOMBINANT DNA TECHNOLOGY (STPB-303)

L	T	P
4	0	2

Course Name: Recombinant DNA Technology
Course Code: STPB-303
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

Following are the key course objectives:

- To make the students familiar about the translation machinery and concept of r-DNA technology and their application in advanced research
- To make the student to understood the concept of gene manipulation and gene transfer technologies
- To make aware the students about manipulation of genes, Transfer techniques, Expression systems and methods of selection

Course Description:

Course basically helps in getting basic concept about genetics principles and also to be aware of the tools for genetic engineering such as PCR, Restricting mapping and other relevant topics.

Course Contents:

Unit I: Genetic Engineering and Recombinant DNA technology: Introduction to the scope of genetic engineering. Overview of the principles and progress in genetic engineering. Basic steps involved in recombinant DNA technology: Isolation of DNA from various sources, fragmentation methods, ligation strategies, introduction of the chimeric DNA into various host cells and selection and screening of recombinant clones. Basic enzymes used in RDT.

Unit II: Cloning and expression vectors: Introduction to Plasmids; Lambda based vectors and derivatives (Insertion vectors, replacement vectors, cosmids, phasmids, phagemids, in-vitro packaging, selection schemes); high-cloning capacity vectors: single stranded DNA vectors (M13); YACs, BACs.

Unit III: Polymerase Chain Reaction: Basic principles and its modifications, designing of primers, Different schemes of PCR, application of PCR, Brief introduction to RT- PCR and Real-Time PCR.

Unit IV: Gene Sequencing methods: Introduction to Nucleic acid sequencing methodologies, Sequencing techniques: Maxam & Gilbert degradation method, Sanger's Dideoxy method, Organo-chemical gene synthesis mechanism, cDNA using reverse transcriptase.

Unit V: cDNA Libraries and molecular techniques: Construction and Screening of genomic and cDNA libraries, Different blotting techniques: Southern, Northern, Western blotting, DNA Fingerprinting, RFLP, VNTR, STR and its applications.

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Course Learning Outcomes (CLOs):

CLO1. The students will have knowledge of tools and strategies used in genetic engineering
CLO2. Understanding of applications of recombinant DNA technology and genetic engineering (from academic and industrial perspective)
CLO3. Apply the knowledge of genetic engineering in problem solving and in practice
CLO4. Students will understand the basics of gene cloning, role of enzymes and vectors for genetic engineering.
CLO5. Students will be aquainted with Gene transfer methods, Techniques and safety measures of genetic engineering, genome mapping and gene therapy.

Text Books:

- Principles of Gene Manipulation by S.B. Primrose, RM Twyman and RW Old (6thEdition)
- Recombinant DNA: A Short Course by JD Watson, J. Tooze and DT Kurtz.
- Principles of Gene Manipulation and Genomics SEVENTH EDITION S.B. Primrose and R.M. Twyman

Reference Books:

- Molecular Cloning: a Laboratory Manual, J Sambrook, E F Fritsch and T Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
- Principles of Gene manipulation (1994) Old R.N. and Primrose S.B.
- Recombinant DNA (1992) Watson J.D., Witreowski J., Gilman M. and Zooller M.

Online links for study & reference materials:
www.microbenotes.com
www.nptel.ac.in
www.byjus.com

Host-pathogen interaction (STPB-304)

L	T	P
4	0	2

Course Name: Host-pathogen interaction **Course Code:** STPB-304
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

This course will enable students to acquire knowledge on the fundamentals of Host-pathogen interaction. It enables them to understand emerging and advanced concept in host pathogen interaction and this course also focuses on the host parasite interaction which include etiology, pathogenicity, life cycle, lab diagnosis and treatment. This program will facilitate the students to acquire knowledge in fields various aspects and molecular tools used in clinical application in alleviation of human disease.

Course Description:

This course is mainly focused to understand emerging and advanced concept in molecular pathogenesis of disease and role of biotechnology in diagnosis, prevention and therapeutics. An understanding of the basic biology and life cycles of human parasites; human parasitic infections, including epidemiology, clinical features, laboratory diagnosis, treatment and prevention.

Course Contents:

Unit I: Introduction: Basic concept of Host-pathogen interaction, Basic concept of Parasites, Classification of Parasites, Host, Types of host, Relationship between host and parasites.

Unit II: Protozoan infection and host response: (introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment): Amoeboids (*Entamoeba histolytica*), Flagellates (*Giardia* spp), Sporozoans (*Plasmodium* spp), Leishmania, Trypanosoma

Unit III: Platyhelminthes infection and host response: (Introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment): Taenia, Echinococcus

Unit IV: Nemathelminthes infection and host response: (introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment): Ascaris, Ancylostoma, Necator, Enterobius, Wuchereria

Unit V: Lab Diagnosis: Different specimens of parasitology, Collection & transportation. Processing of parasitological specimens

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept Parasitology and its importance.
CLO2. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of protozoan parasite.
CLO3. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of Platyhelminthes.
CLO4. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of Nemathelminthes.
CLO5. Explain the method for collection and processing of parasitological specimens.

Text Books:

- Textbook of Microbiology' by CP Baveja, 2nd edition, 1998, Arya longman Pvt. Ltd
- Textbook of Medical Lab Technology' 2010, by Praful Godkar
- Text book of Medical Laboratory' by Satish Gupta, Edition - latest, 2006, J.P. Bros.

Reference Books:

- Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.
- Medical parasitology' by Chatarjee, 3th edition
- Medical Microbiology and Immunology' by Warren Levinson, eighth Edition, Lange Medical books/ McGraw-Hill Publication

Online links for study & reference materials:
https://www.cdc.gov/parasites/about.html
http://www.onlinebiologynotes.com/
http://www.biologydiscussion.com/parasites/classification-of-parasites-parasitology/62036

CBCS GENOMICS AND PROTEOMICS (STPB-305A)**

L	T	P
2	**0**	**0**

Course Name: Genomics and Proteomics
Course Code: STPB-305A
Course Credit Hour: 2 hrs
Total Contact hour: 30 hrs

Course Objective:

It is intended to impart basic postgraduate-level knowledge in the area of Genomics and Proteomics. It also aims to familiarize them with the developments in the experimental approaches used by researchers to understand the complexity and diversity of genomes. Recent advances in genomics have transformed the way in which biologists study cells and biological systems. Furthermore, this course also provides knowledge of the use of high throughput techniques to study the entire range of proteins present in any cell/tissue/organism under specific conditions, to obtain a global view of cellular processes at the protein level.

Course Description:
This course is mainly focused on the Genomics and Proteomics and discuss the basic concept of genomics, such as origin, evolution and application of genomics and proteomics. This course also focuses to elaborates the Genomic and Proteomics techniques; from basic to advance level. It covers basic understanding of Genomics, Annotation of whole genome sequence & functional genomics, Pharmacogenomics and Proteomics.

Course Contents:

Unit I: Origin and Evolution of genomics: Introduction to genomics, type of genome exist in nature, DNA Marker & microsatellite, DNA based phylogenetic trees, genomes and human evolution, Introduction to Shotgun Sequencing methods, evolution of mitochondrial and Chloroplast genome, Anticipated Benefits of Genome Research

Unit II: Annotation of whole genome sequence and functional genomics: Whole genome shotgun sequencing*, In silico* methods, insertion mutagenesis (T-DNA and transport insertion), gene expression and transcript profiling, EST contigs and unigene sets, use of DNA chips and microarrays.

Unit III: Pharmacogenomics: Introduction to Pharmacogenomics, Use in biomedicine involving diagnosis and treatment of diseases, genomics in medical practice, personalized medicine, DNA polymorphism and treatment of diseases, use of SNP in pharmacogenomics, future of pharmacogenomics.

Unit VI: Proteomics: Introduction, definition concepts and approaches of proteomics studies and activities. Introduction proteome analysis tool and technique: Western blotting technique, Separation technique- Polyacrylamide gel electrophoresis (PAGE), 2DPAGE, Mass-spectrophotometery.

Course Learning Outcomes (CLOs):

CLO1. Gain an understanding of the basic concepts of genomics and its scope.
CLO2. Outline the fundamental of DNA based phylogenetic trees.
CLO3. Discuss the Annotation of whole genome sequence and functional genomics.
CLO4. Describe the basic concepts of pharmacogenomics and its future prospective.
CLO5. Explain the fundamentals of proteomics and advance molecular biology techniques.

Text Books:

- Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Campbell AM & Heyer LJ, Benjamin Cummings 2007; CSH Press, NY.
- Introduction to Proteomics: Tools for the New Biology. Daniel C. Liebler, 2002 Humana Press Inc.
- Primrose SB and Twyman RM. Genomics: Applications in human biology. Blackwell Publishing, 2008 Oxford, U.K

Reference Books:

- Genome III – T.A. Brown Garland Science Publ. June 08, 2006
- Bioinformatics and Functional Genomics – Jonathan Pevsner - 2nd edition, Wiley-Blackwell, 2009.
- Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press

Online links for study & reference materials:
http://www.genomenewsnetwork.org/resources
http://www.pss.co.jp/english/sc_bio/contents4.html
http://www.premierbiosoft.com/tech_notes/microarray.html

CBCS BIOINFORMATICS (STPB-305B)**

	L	T	P
	2	**0**	**0**

Course Name: Bioinformatics
Course Code: STPB-305B
Course Credit Hour: 2 hrs
Total Contact hour: 30 hrs

Course Objective:

It is intended to impart basic postgraduate-level knowledge in the area of Bioinformatics. This course is beneficial for students to understand the principles of analyzing biological data, building models and testing hypotheses using computer science algorithms. This course is a survey of algorithms and tools in biological sequence analysis, genome-wide disease association, and precision medicine. Basic concept machine learning and its application in the analysis of biological data are also included in this course.

Course Description:

This course is mainly focused on the basic concept of bioinformatics and discuss the basic overview of various information repositories widely used in biological sciences; and tools for searching or querying those databases. This course will build the foundation of sequence alignment techniques and find evolutionary connections. It will help students to analyze genome data and mRNA expression data and gene annotations.

Course Contents:

Unit I: Introduction to computers and bioinformatics- Types of operating systems, concepts of networking and remote login, basic fundamentals of working with unix.

Unit II: Biological databases- Overview, modes of database search , mode of data storage (Flat file format, db-tables), flatfile formats of GenBank, EMBL, DDBJ, PDB.

Unit III: Sequence alignment –Concept of local and global sequence alignment, Pairwise sequence alignment, scoring an alignment, substitution matrices, multiple sequence alignment. **Phylogenetic analysis-** Basic concepts of phylogenetic analysis, rooted/uprooted trees, approaches for phylogenetic tree construction (UPGMA, Neighbour joining, Maximum parsimony, Maximum likelihood).

Unit VI: Generation and analysis of high throughput sequence data- Assembly pipeline for clustering of HTGS data, format of ".ace" file, quality assessment of genomic assemblies, International norms for sequence data quality, Clustering of EST sequences, concept of Unigene.

Unit V: Annotation procedures for high through-put sequence data- Identification of various genomic elements (protein coding genes, repeat elements, strategies for annotation of whole genome, functional annotation of EST clusters, gene ontology (GO) consortium.

Course Learning Outcomes (CLOs):

CLO1. Basic concept of computational analyses of biological sequences, genome-wide studies and relate the results to core principles of biology; use computational methods to help execute a biological research plan.
CLO2. Outline the fundamental of DNA based phylogenetic trees.
CLO3. Discuss the Annotation of whole genome sequence and functional genomics.
CLO4. Describe the basic concepts of pharmacogenomics and its future prospective.
CLO5. learn to align sequences using dot matrices, dynamic programming and heuristic approach; understand the notion of similarity, identity, and gaps in the context of sequence alignment and deduce evolutionary relationships among sequences.

Text Books:

- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by Baxevanis A.D. and Ouellette, Third Edition. John Wiley and Son Inc., 2005.
- Bioinformatics Sequence and Genome Analysis by Mount D.W., CSHL Press, 2004
- Jonathan Pevsner. Bioinformatics and Functional Genomics, 2nd Edition. ISBN: 978-0-470-08585-1.
- Greg Gibson and Spencer V. Muse. A Primer of Genome Science, Third Edition. ISBN: 978-0-87893-309-9.

Reference Books:

- Bioinformatics and Functional Genomics – Jonathan Pevsner - 2nd edition, Wiley-Blackwell, 2009.
- Introduction to Bioinformatics by Tramontano A., Chapman & Hall/CRC, 2007.
- Understanding Bioinformatics by Zvelebil, M. and Baum, Chapman & Hall/CRC, 2008.

Online links for study & reference materials:
http://www.genomenewsnetwork.org/resources
http://www.pss.co.jp/english/sc_bio/contents4.html
http://www.ncbi.nic

M.Sc. Biotechnology 2nd Year
SEMESTER-IV

ENVIRONMENTAL BIOTECHNOLOGY (STPB-401)

L	T	P
4	0	0

Course Name: Environmental Biotechnology
Course Code: STPB-401
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

The course provides the students with a conceptual and experimental background in the broad discipline of environmental biotechnology. The students will be introduced to the major groups of microorganisms and their diversity in structure and functions and microbial interactions. Emphasis has been laid on Microorganisms and their Habitats. The course also introduces the students to the scope of Biogeochemical Cycling, Waste Management and Microbial Bioremediation.

Course Description:

This course is mainly focused on the Environmental Microbiology which includes basic concept of patents, patent regime (in India and abroad) registration aspects and other details.

Course Contents:

Unit I: Introduction: Environmental components. Environmental pollution and its types. Non-renewable and renewable energy resources.

Unit II: Conventional fuels and their major impacts: Global warming and greenhouse effect. Global Ozone Problem. Acid rain. Eutrophication, Bio magnifications. Concept of clean fuel technology. Biomass energy and biofuels.

Unit III: Cleaning of Environment: Biodegradation and bioremediation of major pollutants, Biomineralisation, Use of microbial technology for mining.

Unit IV: Pollutant Treatment: Waste water treatment. Methods of water treatment.Treatment of municipal solid and liquid wastes. Environmental impact assessment and Environmental audit.

Unit V: Environmental Laws: Environmental laws. Policies and Practices. Protection of Environment. Bio-assessment of Environmental Quality. Bio fertilizers and Bio pesticides.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept immune system and its importance.

CLO2. Discuss Structure, Functions and Properties of different type of Immune Cells and immune organs.
CLO3. Describe the Basic characteristics of an antigen and Structure, Types, Functions and Properties of antibodies.
CLO4. Explain the Major Histocompatibility Complex I & II molecules, basics of Components of the Complement system.
CLO5. Discuss the basic concept of Generation of Immune Response, in particular Generation of Humoral Immune and Cell Mediated Immune Response.

Text Books:

- Cromwell, L. and Weibell, F.J. and Pfeiffer, E.A., Biomedical Instrumentation and Measurement, Dorling Kingsley (2006) 2nd ed.
- Carr, J.J. and Brown, J.M., Introduction to Biomedical Equipment Technology, Prentice Hall (2000) 4th ed.
- Bioinstrumentation by Joh G webster ISBN: 978-0-471-26327-2 August 2003

Reference Books:

- Geddes, L.A., and Baker, L.E., Principles of Applied Biomedical Instrumentation, Wiley InterScience (1989) 3rd ed.
- Khandpur, R.S., Handbook of Biomedical Instrumentation, McGraw Hill (2003) 2nd ed.
- Webster, J.G., Medical Instrumentation Application and Design, John Wiley (2007) 3rd ed.
- Biophysical Techniques By Iain Campbell • 2012, 9780199642144, 0199642141, QUP Oxford.

Online links for study & reference materials:
https://microbenotes.com/category/instrumentation/
https://lecturenotes.in/download/material/18824-note-of-bioinstrumentation-by-nithya-biotech.
http://biomedikal.in/2009/12/lecture-notes-on-biomedical-instrumentation/

CLINICAL RESEARCH AND ENTREPRENEURSHIP (STPB-402)

L	T	P
4	0	0

Course Name: Clinical Research and Entrepreneurship **Course Code:** STPB-402
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

To enrich the understanding of clinical data management procedure in clinical research which sponsor, CRO and Hospital use for clinical trials. To know the latest technology of clinical data management used in clinical trials.

Course Description:

This course provides students with insight into the issues, challenges and opportunities involved in the creation and management of a new venture over its full life cycle. Typically, entrepreneurs are consumed with their product or service and are not prepared to strategically nor tactically lead the venture.

Course Contents:

Unit I: Clinical Research: Basic conventional drug design approaches, Drug development process (Preclinical, clinical and toxicological studies). Past, Present and future Importance, Mile stones of regulations. FDA, US, Indian clinical research, global scenario of clinical research, Regulatory agency. Designing clinical trials- History, principles, scheme for conducting clinical trials, planning defining, objectives, variables, study populations, testable hypothesis.

Unit II: Ethical Issues in clinical research- Introduction, codes, declaration and guidelines, informed concent, special issues, Roles and responsibilities of IRBS, issues with ethics review

Unit III: Introduction of Entrepreneurship: definition, history and scope of Biotechnology Entrepreneurship. **Biotechnology Marketing & Companies:** Biotechnology in capital market; Initial Public Offering (IPO) in the capital market; examples of success and failure of biotechnology companies and the possible reasons.

Unit IV: Patenting, licensing and partnership in biotechnology industry: Patents on biological inventions, licensing revenue, selection of right partner; negotiations of the terms of the terms of the deal.

Unit IV: Entrepreneurship Skills: Entrepreneurship Skills of bio-entrepreneur, bio-entrepreneurial training; research experience, creativity, communication skills and other attributes; participation in conferences, training and educational courses; institutes offering entrepreneurship courses.

Course Learning Outcomes (CLOs):

After completion of the course the students will be able to:
CLO1. Learn how to build a business in healthcare based on their own research, demonstrate an understanding of the opportunities of health innovation and entrepreneurship for utilization of research.
CLO2. Apply scientific background and new knowledge of health innovation to address challenges and develop services and products within a clinical setting and a biopharma/medtech setting and use various business tools for ideation and feasibility studies; to develop, prototype and test solutions in response to user needs.
CLO3. Develop a business plan based upon a novel idea and communicate a business plan to people within the startup world and demonstrate an understanding of how Tech Transfer Offices and other innovation support actors can support the commercialization process.
CLO4. Discuss and argue for different types of intellectual property and intellectual assets, and understand different patent strategies and apply the basics in financing a startup company from private and governmental funding bodies.
CLO5. Discuss and argue for different types of intellectual property and intellectual assets, and establish patent strategies and assess their skills in health innovation and reflect on the exploitation of their own research combine being a scientist and a health innovator/entrepreneur.

Text Books:

- Richard K. Rondel, Sheila A. Varley, Colin F. Webb, Clinical Data Management, 2nd Edition ISBN No. 9780471983293, 0471983292
- Susanne Prokscha, Practical Guide to Clinical Data Management, Taylor & Francis, ISBN no. 9781439848296, 1439848297

Reference Books:

- Raymond G Hill, Drug Discovery and Development , 2nd Edition by, ISBN No. 9780443064203, 0443064202
- Hisrich, Robert D., Michael P. Peters, and Dean A. Shepherd. Entrepreneurship. McGraw-Hill Education, 2017, ISBN No. 9783319487014, 3319487019

Online links for study & reference materials:
https://www.khanacademy.org/
https://swayam.gov.in/
https://nptel.ac.in/

PROJECT (STPB-403)

L	T	P
0	0	8

Course Name: Research Project in Biotechnology **Course Code:** STPB-403
Course Credit Hour: 8 hrs **Total Contact hour:** 120 hrs

Course Objective:

Develop an ability to understand the basic requirement to conduct a research project. Student also develop skill of writing and presentation on the assigned research topics in the field of biotechnology.

Course Contents:

Every student will be required to undertake a research project based on any of the areas of biotechnology. The research project should have applied significance. The project report will be submitted in the form of dissertation duly certified by the supervisor of the Department of Biotechnology or at national institutes and Universities in India, by seeking the placement. The project will be presented for evaluation at the end of semester by external experiments.

Course Learning Outcomes (CLOs):

After completion of the course, students will understand about the Research in Biotechnology and develop presentation skill during the conduction of research, discussion and presentation. Additionally, Student will develop a drafting and writing skill.

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF PHYSICS

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

POSTGRADUATE PROGRAMME

Choice Based Credit System (CBCS)

(Academic Year 2020-21)

CURRICLUM DEVELOPMENT COMMITTEE

1.	Dr. Lomas Tomar Associate Professor & Director School of Sciences, NIU Greater Noida	Chairperson
2.	Dr. B K Das Professor & Head Department of Physics, NIU Greater Noida	Member Secretary
3.	Dr. Rajneesh Tripathi Professor Galgotia College of Engineering and Technology, Greater Noida	Member
4.	Dr. Tanveer Ahmad Wani Associate Professor Department of Physics, NIU Greater Noida	Member

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So, it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

M. Sc. Programme Details

Programme Objectives (POs)

The objectives of the M.Sc. Physics programme are manifold and start with imparting students with an in-depth knowledge and understanding through the core courses which form the basis of Physics namely, Classical Mechanics, Quantum Mechanics, Mathematical Physics, Statistical Physics, Electromagnetic Theory, Solid State Physics, Electronics, Nuclear and Particle Physics along with Atomic and Molecular Physics. Creative thinking and problem-solving capabilities are also aimed to be encouraged through tutorials. The elective and open elective courses are designed for more specialized and/or interdisciplinary content to equip students with a broader knowledge base. The core and elective labs are designed to develop an appreciation for the fundamental concepts and working of devices used in everyday life employing scientific methods/tools of physics. Computational physics course is aimed to equip the students to use computers as a tool for scientific investigations/understanding. The dissertation(s) in both theory and experimental stream are expected to give a flavor of how research leads to new findings. In addition, the M.Sc. course is to lay a solid foundation for a doctorate in Physics/allied subjects later.

Programme Specific Outcomes (PSOs)

1) Understanding the basic concepts of physics particularly concepts in classical mechanics, quantum mechanics, statistical mechanics and electricity and magnetism to appreciate how diverse phenomena observed in nature follow from a small set of fundamental laws through logical and mathematical reasoning.

2) Learn to carry out experiments in basic as well as certain advanced areas of physics such as nuclear physics, condensed matter physics, nanoscience, lasers and electronics.

3) Understand the basic concepts of certain sub fields such as nuclear and high energy physics, atomic and molecular physics, solid state physics, and plasma physics, and astrophysics, general theory of relativity, nonlinear dynamics and complex system.

4) Gain hands on experience to work in applied fields.

5) Gain a through grounding in the subject to be able to teach it at college as well as school lever.

6) Viewing physics as a training ground for the mind developing a critical attitude and the faculty of logical reasoning that can be applied to diverse fields.

Course Structure

Details of Courses under M.Sc. Physics

Courses	Credits
I. Core Course (12 papers of 4 Credits Each)	**12x4 = 48**
II. Discipline Specific Elective Course (DSE) (Minimum 5 papers of 4 Credits Each)	**5x4 = 20**
III. Ability Enhancement Course (AEC) (Minimum 2 papers of 2 Credits Each)	**2X2 =04**
IV. Generic Elective Course (GE) (2 papers of 4 Credits Each)	**2x4 = 08**
Total Credit (Minimum)	**80**

***Dissertation/Project (Credits 2) as an additional AEC in Semester IV**

SCHEME FOR CHOICE BASED CREDIT SYSTEM
M. SC. IN PHYSICS

	Papers			
Semester	**CORE** (4 Credits each)	**DSE** (Minimum one each for Sem I, Sem II and Sem III and two for Sem IV) (4 Credits each)	**GE** (Minimum one each for Sem II and Sem III) (4 Credits each)	**AEC (AECC/SEC)** (Minimum one each in Sem I and Sem III) (2 Credits each)
I	Mathematical Physics	DSE I		AEC I
	Quantum Mechanics			
	General Lab-I			
II	Classical Mechanics	DSE II	GE I	
	Condensed Matter Physics			
	General Lab-II			
III	Electronics	DSE III	GE II	AEC II
	Electrodynamics			
	Computational Methods			
IV	Nuclear Physics	DSE IV		Dissertation/ Project (Additional)
	Statistical Mechanics	DSE V		
	Atomic & Molecular Physics			

* Student can opt for Dissertation/Project (Credits 2) as an additional AEC in Semester IV.

Semester	Course Structure	Course Name	Credits
I	Core course-I	Mathematical Physics	4
	Core Course-II	Quantum Mechanics	4
	Core course-III	General Lab-I	4
	Discipline Specific Elective –I	DSE I	4
	Ability Enhancement Course – I	AEC I	2
II	Core course-IV	Classical Mechanics	4
	Core course-V	Condensed Matter Physics	4
	Core course-VI	General Lab-II	4
	Discipline Specific Elective –II	DSE II	4
	Generic Elective – I	GE I	4
III	Core course-VII	Electronics	4
	Core Course-VIII	Electrodynamics	4
	Core course-IX	Computational Methods	4
	Discipline Specific Elective –III	DSE III	4
	Generic Elective – II	GE II	4
	Ability Enhancement Course – II	AEC II	2
IV	Core course-X	Nuclear Physics	4
	Core course-XI	Statistical Mechanics	4
	Core course-XII	Atomic & Molecular Physics	4
	Discipline Specific Elective –IV	DSE IV	4
	Discipline Specific Elective –V Additional AEC	DSE V Dissertation/Project	4 2

***Additional AEC: Dissertation/Project (Credits 2) in semester IV**.

Core Papers (C): (Credit: 04 each)

I. Mathematical Physics
II. Quantum Mechanics III.
III. General Lab I
IV. Classical Mechanics
V. Condensed Matter Physics
VI. General Lab II
VII. Electronics
VIII. Electrodynamics
IX. Computational Methods
X. Nuclear Physics
XI. Statistical Mechanics
XII. Atomic & Molecular Physics

Discipline Specific Elective Papers (DSE): (Credit: 04 each)
(Minimum 5 papers to be selected)- DSE I to V

DSE I (Minimum one):

A. Theory of Relativity
B. Atmospheric Physics

DSE II (Minimum one):

A. Plasma Physics
B. Advanced Quantum Mechanics

DSE III: (Minimum one)

A. High Energy Physics I
B. Condensed Matter Physics I
C. Communication Electronics
D. Advanced Mathematical Physics
E. Laser Spectroscopy I

DSE IV: (Minimum one)

A. High Energy Physics II
B. Condensed Matter Physics II
C. Digital and Optical Electronics
D. Space Physics
E. Laser Spectroscopy II

DSE V: (Minimum one)

A. Condensed Matter Physics Lab
B. Electronics Lab
C. Space Physics Lab
D. Laser Spectroscopy Lab

Generic Elective Papers (GE): (Credit: 04 each)
(Minimum 2 papers to be selected)- GE I and II

GE I: (Minimum one)

A. Basic Quantum Mechanics
B. Foundation of Electronics
C. Fundamentals of Material Science

GE II: (Minimum one)

A. Thermal Physics
B. Classical Mechanics
C. Meteorology
D. Elements of Modern Physics

Ability Enhancement Course Papers (AEC): (Credit: 02 each)
(Minimum 2 papers to be selected)- AEC I and II

AEC I: (Minimum one)

A. Experimental Techniques
B. Observational Astronomy

AEC II: (Minimum one)

A. Nano Structured Materials
B. Vacuum Technique
C. Meteorological Fundamentals

Additional AEC II: (2 credits)

D. Dissertation/Project

Abbreviations:

L: Lecture, T: Tutorial

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for M.Sc. Physics
Effective from the Session: 2020-21

SEMESTER-I

S. No	Course Name	Course Code	Course Type	Period			Evaluation Scheme				Subject Total	Credit
				L	T	P	CA	TA	Total	External Exam		
1	Mathematical Physics	PH-C-I	Core	3	1	0	20	20	40	60	100	4
2	Quantum Mechanics	PH-C-II	Core	4	0	0	20	20	40	60	100	4
3	General Lab-I	PH-C-III	Core	0	0	4	25	25	50	50	100	4
4	Theory of Relativity Atmospheric Physics (Minimum one to be Opted)	PH-DSE-IA PH-DSE-IB	DSE	4	0	0	20	20	40	60	100	4
5	Experimental Techniques Observational Astronomy (Minimum one to be Opted)	PH-AEC-IA PH-AEC-IB	AEC	2	0	0	20	20	40	60	100	2
Total											**500**	**18**

SEMESTER-II

S. No	Course Name	Course Code	Course Type	Period			Evaluation Scheme				Subject Total	Credit
				L	T	P	CA	TA	Total	External Exam		
1	Classical Mechanics	PH-C-IV	Core	4	0	0	20	20	40	60	100	4
2	Condensed Matter Physics	PH-C-V	Core	4	0	0	20	20	40	60	100	4
3	General Lab-II	PH-C-VI	Core	0	0	4	25	25	50	50	100	4
4	Plasma Physics Advanced Quantum Mechanics (Minimum one to be Opted)	PH-DSE-IIA PH-DSE-IIB	DSE	3 4	1 0	0	20	20	40	60	100	4
5	Basic Quantum Mechanics Foundation of Electronics Fundamentals of Material Science (Minimum one to be Opted)	PH-GE-IA PH-GE-IB PH-GE-IC	GE	4	0	0	20	20	40	60	100	4
Total											**500**	**20**

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Study & Evaluation Scheme for M.Sc. Physics
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SEMESTER-III

S. No	Course Name	Course Code	Course Type	Period			Evaluation Scheme				Subject Total	Credit
										External Exam		
				L	T	P	CA	TA	Total			
1	Electronics	PH-C-VII	Core	3	1	0	20	20	40	60	100	4
2	Electrodynamics	PH-C-VIII	Core	4	0	0	20	20	40	60	100	4
3	Computational Methods	PH-C-IX	Core	3	0	1	20	20	40	60	100	4
4	High Energy Physics I Condensed Matter Physics I Communication Electronics Advanced Mathematical Physics Laser Spectroscopy I (Minimum one to be Opted)	PH-DSE-IIIA PH-DSE-IIIB PH-DSE-IIIC PH-DSE-IIID PH-DSE-IIIE	DSE	4 4 4 3 3	0 0 0 1 1	0	20	20	40	60	100	4
5	Thermal Physics Classical Mechanics Meteorology Elements of Modern Physics (Minimum one to be Opted)	PH-GE-IIA PH-GE-IIB PH-GE-IIC PH-GE-IID	GE	4	0	0	20	20	40	60	100	4
6	Nano Structured Materials Vacuum Technique Meteorological Fundamentals (Minimum one to be Opted)	PH-AEC-IIA PH-AEC-IIB PH-AEC-IIC	AEC	2	0	0	20	20	40	60	100	2
Total											**600**	**22**

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SEMESTER-IV

S. No	Course Name	Course Code	Course Type	Period			Evaluation Scheme				Subject Total	Credit
				L	T	P	CA	TA	Total	External Exam		
1	Nuclear Physics	PH-C-X	Core	4	0	0	20	20	40	60	100	4
2	Statistical Mechanics	PH-C-XI	Core	3	1	0	20	20	40	60	100	4
3	Atomic & Molecular Physics	PH-C-XII	Core	4	0	0	20	20	40	60	100	4
4	High Energy Physics II Condensed Matter Physics II Digital and Optical Electronics Space Physics Laser Spectroscopy II (Minimum one to be Opted)	PH-DSE-IVA PH-DSE-IVB PH-DSE-IVC PH-DSE-IVD PH-DSE-IVE	DSE	4 4 4 4 3	0 0 0 0 1	0	20	20	40	60	100	4
5	Condensed Matter Physics Lab Electronics Lab Space Physics Lab Laser Spectroscopy Lab (Minimum one to be Opted)	PH-DSE-VA PH-DSE-VB PH-DSE-VC PH-DSE-VD	DSE	0	0	4	25	25	50	50	100	4
6	Dissertation/ Project (Additional)	PH-AEC-IID	AEC	0	0	2			50	50	100	2
Total											**600**	**22**

CORE COURSES

Course Code: PH-C-I
Course Title: Mathematical Physics
Nature of the Course: Core
Total credits assigned: 04
Distribution of credits: Theory-3, Tutorial-1

Course Objectives:
At the completion of this course, a student will be able to
(1) Write a. problem in higher level Physics in the language in Mathematics.
(2) Identify a range of diverse mathematical techniques to formulate and solve a problem in higher level physics.
(3) Analyze various mathematical concepts and methods.
(4) Apply the knowledge and understanding of these mathematical techniques to gain insight into a number of branches of physics like Quantum Mechanics, Electromagnetic Theory, Condense Matter Physics, Atomic and Molecular Physics, Nuclear Physics, Particle and High Energy Physics, Physics of Gravity etc.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Linear Vector Spaces (L 15, T 8, Marks 23)
Review of vector analysis; definition of vector spaces; finite dimensional vector spaces: linear independence, basis and dimensionality, inner product of vectors and norm of vector, Schmidt's orthogonalization method, Schwarz's and Bessel's inequalities; matrices: orthogonal, Hermitian, unitary and normal matrices; linear operators: matrix representation of linear operators; linear transformation: similarity transformation, orthogonal and unitary transformations; eigenvectors and eigenvalues, diagonalization of matrices (or operators); infinite dimensional vector space: Hilbert space, Fock space.

Unit II: Partial Differential equations (L 10, T 5, Marks 15)
Partial differential equations and boundary conditions: coordinate systems, cartesian, cylindrical, spherical polar, boundary value problems on Laplace equation, Poisson equation and diffusion equation; Green's function method of solving partial differential equations.

Unit III: Group Theory (L 7, T 3, Marks 10)
Groups, subgroups, classes and characters, cosets, factor group, normal subgroup, point symmetry group, direct and semidirect product of groups, homomorphism and isomorphism, representation of a group, Lie groups, generators of continuous group, rotation groups, unitary groups, special unitary groups.

Unit IV: Tensor Analysis (L 8, T 4, Marks 12)
Basics of tensor algebra, line element and metric tensor, associated tensors, Christoffel's symbols, geodesics, covariant derivatives, Riemannian Christoffel's tensor or curvature tensor, Bianchi identities.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.: 20
Written Test: 20
End Semester: 60
Written Test: 60

Expected Learning Outcome:
After the completion of this course, it is expected that this course will
(1) Equip students with required mathematical skills to succeed in Physics.
(2) Develop the analyzing ability of the students to solve problems in Physics.
(3) Enable the students to pursue a research career in Physics and will ultimately help to contribute new knowledge.

Suggested Readings:
1. Mathematical Methods for Physicists, G. B. Arfken and H. J. Weber, Elsevier Academic Press.
2. Mathematical Method for Physics and Engineering, K. F. Riley, M. P. Hobson and S. J. Bence, Cambridge University Press.
3. Essential Mathematical Methods for the Physical Sciences, K. F. Riley and M. P. Hobson, Cambridge University Press.
4. Mathematical Methods in the Physical Sciences, Mary L. Boas, John Wiley & Sons.
5. Mathematical Physics: Basics, S. D. Joglekar, Universities Press.
6. Mathematical Physics: Advance, S. D. Joglekar, Universities Press.
7. Mathematical Physics with Application, Problems and Solution, U. Balakrishnan, Ane Books Pvt. Ltd.
8. Elements of Group Theory for Physicists, A.W. Joshi, New Age International.
9. Group Theory in Physics, J. F. Cornwell, Academic Press.
10. Group Theory in a Nutshell for Physicists, A. Zee, Princeton University Press.
11. Tensor Calculus, Barry Spain, Radha Publishing House (Kolkata).
12. General Theory of Relativity, P. A. M. Dirac, Prentice-Hall of India.
13. Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity, S. Weinberg, Wiley and Sons.

Course Code: PH-C-II
Course Title: Quantum Mechanics
Nature of the Course: Core
Total credits assigned: 04
Distribution of credits: Theory – 04

Course Objectives:
(a) Acquaint the learners with fundamental concepts of Quantum Mechanics.
(b) Acquaint the learners with Dirac notation.
(c) Enable the learners to solve simple quantum mechanical problems.
(d) Introduce the concepts of symmetry and conservation laws
(e) Introduce the techniques of angular momentum algebra

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Fundamental Concepts (L 20, Marks 20)
Overview of wave mechanics, Schrödinger equation, application to some important physical problems: particle in a box, simple harmonic oscillator, hydrogen atom, the Stern Gerlach Experiment, Kets, Bras and Operators, Base Kets and Matrix Representations, Measurements, Observables and Uncertainty Relations, Change of basis, Position, momentum and translation Wave functions in Position and Momentum Space.

Unit II: Quantum Dynamics (L 30, Marks 30)
Time evolution and the Schrödinger equation, the Schrödinger versus the Heisenberg picture, time evolution of the simple harmonic oscillator**,** Time independent perturbation theory: Non degenerate case, Time independent perturbation theory: Degenerate case, Hydrogen like atoms: Fine structure and Zeeman Effect, Variational methods, Time dependent potentials: the Interaction picture, Time dependent perturbation theory, Applications to Interactions with Classical Radiation field, WKB Approximation

Unit III: Symmetry in Quantum Mechanics (L 10, Marks 10)
Symmetries, Conservation laws and Degeneracy, Space and Time displacements, Rotation, Angular Momentum and Unitary groups, commutation relations, Density operators and Pure versus Mixed Ensembles, Eigenvalues and Eigenstates of Angular Momentum, Addition of Angular momentum, Clebcsh Gordon Coefficients

Mode of Assessment/ Assessment Tools (%)

In Semester:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester:	**60**
Written Test:	60

Expected Learning Outcome:

1. Understand the basic concepts of quantum mechanics
2. Solve simple quantum mechanical problems
3. Understand quantum dynamics
4. Write down eigen values and eigen states of angular momentum

Suggested Readings:

1. Modern Quantum Mechanics, J.J. Sakurai, Addison Wesley
2. Quantum Mechanics, L.I. Schiff, McGraw Hill
3. Quantum Mechanics, Bransden and Joachain, Pearson Education
4. Quantum Mechanics, Powell and Craseman, Narosa Publishing House
5. Quantum Mechanics, R. Shankar, Kluwer Academic
6. Quantum Mechanics, D.J. Griffiths, Pearson Education
7. Quantum Mechanics, Mathews and Venkatesan, McGraw Hill
8. Quantum Mechanics, Richard L. Liboff, Pearson Education

Course Code: PH-C-III
Course Title: General Lab I
Nature of the Course: Core
Total credits assigned: 04
Distribution of credits: Lab-4

Course Objectives:

1. To develop practical knowledge by applying the experimental methods and to correlate with the Physics theory.
2. To learn the usage of electrical and optical systems for various measurements.
3. To apply the analytical techniques and graphical analysis to interpret the experimental data.
4. To learn error propagation and its role in making conclusions.

List of Experiments:

1. To draw the calibration curve of the Jamin's interferometer and then to find the refractive index of air at room temperature and pressure
2. To determine the wavelength of light from a monochromatic source using Michelson's interferometer and then to determine the difference of wavelength for Sodium D lines.
3. To determine the wavelength of light from a monochromatic source using Fabry-Perot interferometer and then to determine the difference of wavelength for Sodium D lines.
4. To determine the wavelength of He-Ne laser light.
5. To study the normal and anomalous Zeeman Effect.
6. To determine the value of e/m by bar magnet method.
7. To determine the value e/m by magnetron method.
8. To determine the energy band gap of a semiconductor using p-n junction diode.
9. To draw the frequency response curve of a CE transistor amplifier and also to find the input impedance of the amplifier.
10. To draw the characteristics of a Zener diode and find the breakdown voltage & to study the Zener diode as a voltage regulator under (a) input variation & (b) load variation.
11. To determine the velocity of sound using CRO.
12. To determine the plateau and optimal operating voltage of a Geiger-Müller counter.
13. To measure the half-life of meta-stable Barium-137.

Mode of Assessment/ Assessment Tools (%)

In Semester: 50	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	25
Viva Voce:	25
End Semester: 50	
Laboratory experiments:	50
(One experiment from the list of experiments to be performed)	

Expected Learning Outcome:

On successful completion of this course, students should be able to:

1. Learn to minimize contributing variables and recognize the limitations of equipment.
2. Describe the methodology of science and the relationship between observation and theory.
3. Participate in the methodology by performing laboratory exercises.

Suggested Readings:

1. B.L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House.

2. Optics, A.K. Ghatak, Tata McGraw Hill
3. Fundamentals of Optics Jenkins and White McGraw Hill
4. Optics A. R Ganesan, Eugune Hecht

Course Code: PH-C-IV
Course Title: Classical Mechanics
Nature of the Course: Core
Total credits assigned: 04
Distribution of credits: Theory-4

Course Objectives:

1. Acquaint the learners with the subject of classical mechanics in the context of the language and methods of modern nonlinear dynamics.
2. Enable the learners to make a smooth transition from classical mechanics to quantum mechanics and nonlinear dynamics.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: (L 8, Marks 8)
Review of Newtonian mechanics, Mechanics of a system of particles, Constraints of motion and their classification, Generalised co-ordinates, D' Alembert's principle, Lagrange's equations of motion, Hamilton's principle, Symmetries and conservation theorems, Cyclic coordinates. Flows in phase space, solvable integrable, equilibria and linear stability theory, bifurcations in Hamiltonian systems.

Unit II: (L 15, Marks 15)
Motion in a central potential, Maps, winding numbers and orbital stability, Hidden symmetry in the Kepler problem, Small Oscillations, Solution of one-dimensional harmonic oscillator problem, Forced oscillations in one dimension, Damped harmonic motion in one dimension- general solution of the problem, Displacement as a function of time, Systems with many degrees of freedom, Eigen value equation and normal co-ordinates. Integrable and chaotic oscillations, return maps, area preserving maps, deterministic chaos.

Unit III: (L 12, Marks 12)
Lagrangian dynamics and transformations in configuration space, geometry of motion in configuration space, canonical moment and covariance of Lagrange's equation in configuration space. Hamiltonian dynamics and transformations in phase space, Generating functions, Poisson brackets, Integrable canonical flows, Hamilton-Jacobi equation, Action-angle variables.

Unit IV: (L 15, Marks 15)
Linear transformations, rotations and rotating frames, similarity transformations, linear transformations and eigen value problem, dynamics in rotating reference frames.
Rigid Body Dynamics, Definition of Rigid body, Eulerian Angles, Euler's theorem, Angular momentum and kinetic energy, Moment of inertia tensor, Euler's equation of motion, Symmetrical top, Integrable and non-integrable problems.

Unit V: (L 10, Marks 10)
Noncanonical flows, flows on spheres, local vs complete integrability, globally integrable noncanonical flows, attractors, Damped driven Euler-Lagrange dynamics, Liapunov exponents, geometry and integrability. Damped driven Newtonian systems, period doubling, fractal and multifractal orbits in phase space, strange attractors, the two-frequency problem.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20

End Semester: 60

Written Test:	60

Expected Learning Outcome:

1. Understand the basic concepts of Lagrangian and Hamiltonian dynamics
2. Understand the basic concepts of modern nonlinear dynamics
3. Understand canonical and noncanonical flows
4. Make a smooth transition from classical to quantum mechanics

Suggested Readings:

1. Classical Mechanics, Joseph L. McCauley, Cambridge University Press.
2. Classical Mechanics, H. Goldstein, Addison Wesley.
3. Classical Mechanics, N.C. Rana& P.S. Joag, Tata McGraw Hill.
4. Classical Mechanics of Particles and Rigid Bodies, Kiran C Gupta, Wiley Eastern Limited.
5. Introduction to Classical Mechanics, R.G. Takwale & P.S. Puranic, Tata McGraw Hill.

Course Code: PH-C-V
Course Title: Condensed Matter Physics
Nature of the Course: Core
Total credits assigned: 04
Distribution of credits: Theory – 04

Course Objectives:

At the completion of this course, a student will be able to

1. Familiarize with fundamentals of Condensed Matter Physics.
2. Know about different lattice structures, behavior and importance of crystalline state, contribution of X-Ray Diffraction in Crystallography, importance of defects and imperfections in a crystal etc.
3. Understand the behavior in solids that depend primarily on the motion of electrons inside the solid.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Crystallography (L 12, Marks 12)

Bravais lattices (two and three dimensions), typical crystal structures (sc, fcc, bcc, closed-packed structures), reciprocal lattice.

Interaction of X-Rays with matter, absorption of X-Rays, Elastic scattering from a perfect lattice, X-Ray diffraction, Bragg's law, Laue, Powder and Rotating Crystal method, Scattering Factor, Structure Factor.

Unit II: Imperfections in Crystalline solids (L 10, Marks 10)

Introductory concepts, Point defect; Schottky, Frenkel defects, Color centers, Dislocations, Diffusion, Fick's law.

Unit III: Conduction electrons in crystalline solids (L 12, Marks 12)

Periodic potential, Bloch theorem, Kronig Penney model, electronic energy bands, E-k diagram, Brillouin zone, Effective mass, metals, insulators and semiconductors.

Unit IV: Magnetic Properties of Materials (L 14, Marks 14)

Introductory concepts, Langevin diamagnetism, Paramagnetism due to free ions (Quantum Theory) and conduction electrons (Pauli paramagnetism), Molecular field theory of Ferromagnetism, Domains, Hysteresis loop, Antiferromagnetism, Ferrimagnetism.

Unit V: Superconductivity (L 12, Marks 12)

Introductory concepts, Meissner Effect, Type-I & Type-II superconductors, London equations, Thermodynamics of superconducting transition, Isotope effect, introduction to BCS theory, Cooper pair, Basic idea on High temperature superconductivity.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

Expected Learning Outcome:
The course will
1. Equip a student with basic concepts of Condensed Matter Physics so that the knowledge can be applied for further development of the subject.
2. Enable a student to work in both theoretical and experimental aspects of Condensed Matter Physics.
3. Help the students in thorough learning of the concepts associated to the course through the numerical, quizzes, assignments, projects etc.

Suggested Readings:

1. Introduction to Solid State Physics, C. Kittel, John Wiley & Sons.
2. Solid State Physics, A. J. Dekker, Macmillan India Ltd.
3. Elementary Solid-State Physics, M. A. Omar, Pearson Education.
4. Crystallography Applied to Solid State Physics, A.R. Verma and O.N. Srivastava, New Age International.
5. Solid State Physics, N. W. Ashcroft and N. D. Mermin, Brooks/cole.

Course Code: PH-C-VI
Course Title: General Lab II
Nature of the Course: Core
Total Credit assigned: 4
Distribution of Credits: Lab - 04

Course Objectives:
At the completion of this course, a student will be able to
1. Understand the basic techniques of design and analysis of simple transistor and OPAMP circuit.
2. Apply the knowledge to design and study different electronic circuits.

List of Experiments:
1. To realise the Network theorems. (Thevenins, Norton and superposition)
2. To study a stable, monostable and bistable multivibrator and to obtain the value of the unknown capacitors.
3. To design and study D/A converter using R-2R Ladder network.
4. (a)To design and study OPAMP as an inverting and non inverting amplifier.
   (b)To design and study OPAMP as a differentiator and integrator.
5. To draw the frequency response curve of an RC coupled amplifier with and without negative feedback and compare the bandwidth.
6. To design a transistor amplifier for a gain of 7 using Voltage divider biasing method.
7. To design a RC Oscillator and Wien Bridge Oscillator for generating Sinusoidal oscillation of frequency 200 Hz and 3 KHz.
8. To design square wave generator for a frequency of 500Hz and 2 KHz.
9. To design and construct basic flip-flops R-S, J-K, J-K Master slave flip-flops using gates and verify their truth tables.
10. To realize One- & Two-Bit Comparator and study of 7485 magnitude comparator.
11. To realize and study of Shift Register.
    a) SISO (Serial in Serial out)
    b) SIPO (Serial in Parallel out)
    c) PIPO (Parallel in Parallel out)
    d) PISO (Parallel in Serial out)
12. To design and test 3-bit binary asynchronous counter using flip-flop IC 7476 for thegiven sequence.
13. To study the characteristic curves of (i) FET (ii) MOSFET

Mode of Assessment/ Assessment Tools (%)

In Semester:	**50**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	25
Viva Voce:	25
End Semester:	**50**
Laboratory experiments:	50

(One experiment from the list of experiments to be performed)

Expected Learning Outcome:
This course will enable the students to
1.Design electronic circuits using various electronic components.
2.Analyze the circuits and understand their behaviours.

Suggested Readings:

1. Electronic Principles by Albert Malvino, McGraw Hill Education
2. Digital Principals and applications by Leach and Malvino, McGraw Hill Education

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Course Code: PH-C-VII
Course Title: Electronics
Nature of the Course: Core
Total credits assigned: 04
Distribution of credits: Theory – 04

Course Objectives:

1. To disseminate working knowledge of electronic principle using semiconductor devices
2. To allow students to learn the fundamentals of both analog and digital electronic devices
3. To allow students to apply their knowledge for designing small electronic systems.
4. To introduce students to advanced digital systems like microprocessor and microcontroller
5. To imbibe the spirit of application-oriented learning

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Transistor Fundamentals: (L 20, Marks20)

Introduction to voltage and current source and measuring devices, Concept of source loading, implication and mitigation of source loading, BJT fundamentals and biasing techniques, β independence, Early effect, load line, amplifying action, Emitter follower, impedance matching application, ac models: T and π, analysis and design of small signal amplifier, IC circuit current mirror, open collector, pull up resistor. Bootstrapped and Darlington amplifier

Field effect transistors: JFET, MESFET and MOSFET, structure, working, derivation of the equations of IV characteristics under different conditions, active load, introduction to CMOS and FINFET technology.

Unit II: Integrated Circuits: Operational Amplifier (L 15, Marks15)

Differential amplifier: circuit configuration, dual input, balanced output differential amplifier, DC-AC analysis, inverting and non-inverting inputs, operational amplifiers, CMRR, Slew rate etc open loop configuration-comparators, inverting and non-inverting amplifiers, OPAMP with feedback, negative, voltage-series feedback, voltage follower, applications of OPAMS-summing, integrator, differentiator, logarithmic amplifier, zero crossing detector etc to analog computation.

Unit III: Digital Electronics (L 15, Marks 15)

Review of Sequential circuits: flip flops: RS, JK, D-,T-, M/S JK, Clock: level and edge triggered, preset and clear signals, race around and toggling condition and mitigations, counters: ring, synchronous, asynchronous, module of counter: decade counter, registers: shift register: parallel and serial input/output, multiplexer, demultiplexer, encoder, decoder, ADC: SA method, counter etc DAC: weighted resistor, R-2R ladder etc, RAM and ROM as memory element.

Unit IV: Introduction to Microprocessor and Microcontroller (L 10, Marks 10)

Introduction to microprocessor: Architecture of digital computer system, Von Neumann and Harvard architecture, different microprocessors, architecture, pin diagram, different bus, programming model using intel 8085, register set, memory organization, instruction set, simple programming: addition, subtraction, multiplication etc. Introduction to 8051 microcontroller and embedded systems.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

Expected Learning Outcome:

The student will be able to

1. Critically analyze analog and digital electronic circuits
2. Design small electronic systems as per design specifications
3. Write assembly language programs for doing simple arithmetic operation in microprocessor and microcontroller.
4. Apply their knowledge for real life problems solving in electronic

Suggested Readings:

1. Electronic Principles A.P. Malvino Tata McGraw Hill
2. Op amps and Linear Integrated Circuits R.K. Gaekwad Prentice Hall of India
3. Integrated Electronics: Analog and Digital Circuit Systems J. Millman and C. Halkias McGraw Hill
4. Digital Principles and Applications D.P. Leach and A.P. Malvino Tata McGraw Hill
5. Semiconductor Materials and Devices M.S. Tyagi John Wiley and Sons
6. Physics of Semiconductor Devices S.M. Sze Wiley Eastern Ltd.
7. The Art of Electronics P. Horowitz and W. Hill Cambridge University Press
8. Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.

Course Code: PH-C-VIII
Course Title: Electrodynamics
Nature of the Course: Core
Total credits assigned: 04
Distribution of credits: Theory-03, Tutorial-1

Course Objectives:

1. This course utilizes physical and mathematical principles to provide in-depth analysis of the behaviour of electricity and magnetism in matter.
2. To apprise the students regarding the concepts of electrodynamics and Maxwell equations and use them in various situations.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: (L 9, T 4, Marks 13)
Propagation of electromagnetic waves in different media, Dispersion, Frequency dependence of σ, μ and ε, dispersion in non-conductors, anomalous dispersion, free electrons in conductors and plasma, Wave Guides, TE waves in rectangular wave guide. Coaxial transmission lines
Boundary value problems in spherical coordinate

Unit II: (L 12, T 10, Marks 22)
Electromagnetic radiation: Retarded potentials, electric dipole radiation, radiation from an arbitrary distribution of charges and current, Lienard-Wiechert potentials, fields due to uniformly moving charge, and accelerated charge, Linear and circular acceleration, angular distribution of radiated power, Bremhstrahlung and Synchrotron radiation, Radiation reaction, Abraham-Lorentz formula.

Unit III: (L 15, T 10, Marks 25)
Structure of space-time, Four vectors and Lorentz transformation, Proper time and velocity, Relativistic energy and momentum.
Magnetism as relativistic phenomena, Potential formulation of relativistic electrodynamics Electromagnetic field tensor, Dual tensor, Covariant formulation of electrodynamics.

Mode of Assessment/ Assessment Tools (%)

In Semester: **40**	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: **60**	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
After completion of the course, students will be able to:

1. Describe the nature of electromagnetic wave and its propagation through different media and interfaces.
2. Explain charged particle dynamics and radiation from localized time varying electromagnetic sources.
3. Understand potential formulation and magnetism in relativistic case.

Suggested Readings:

1. Introduction to Classical Electrodynamics, D.J. Griffiths, Prentice Hall of India.
2. Classical Electrodynamics, J.D. Jackson, John Wiley.
3. Electromagnetic waves and Radiating systems, Edward C Jordan and Keith G. Balmain, PHI Pvt. Ltd.
4. ‘Electromagnetic Wave and radiating systems’, Jordan, E.C. and Balmain, K.G., Prentice Hall of India

Course Code: PH-C-IX
Course Title: Computational Methods
Nature of the Course: Core
Total credits assigned: 04
Distribution of credits: Theory-03, Lab-1

Course Objectives:
After successful completion of the course, the student will

1. Get hands on training in problem solving using FORTRAN language in LINUX operating system.
2. Learn various numerical methods to solve physical problems as well as programming of such methods.

Unit-wise distribution of Course contents with Unit-wise distribution of Weightage and Contact hours:

Unit I: **(L 3, Practical 2, Marks 5)**
Windows and Unix user commands

Unit II: **(L 15, Practical 5, Marks 20)**
FORTRAN programming, flow chart, integer and floating-point arithmetic, expressions, built-in functions, executable and non-executable statements, assignment, control and input, output elements, subroutines and functions, operation with files, programming examples of numerical methods.

Unit III: **(L 7, Practical 3, Marks 10)**
Significant digits, Approximations and errors in computing: introduction, data errors, round off error, truncation error, modeling error, significant digits, absolute and relative error, general formula of errors, error estimation.

Unit IV: **(L 18, Practical 7, Marks 25)**
Elementary probability theory, random variables, binomial, Poisson and Normal distributions, central limit theorem, chi-square test.
Determination of root of functions, roots of nonlinear equations: Bisection method, method of false position, Newton-Raphson method, numerical integration by trapezoidal and Simpson's rule, numerical differentiation: Finite difference methods, central difference formula, extrapolation.
Solution of first order ordinary differential equation: Runge-Kutta method.
Linear and non-linear curve fitting: Lagrange interpolation polynomial, Newton-Gregory method.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

This course will enable the students to

1. Apply their knowledge on computer programming and numerical analysis in solving real physical problems.
2. Deal with scientific computing in different research areas of Physics.

Suggested Readings:

1. Numerical Recipes in C/Fortran Press et al. Cambridge University Press
2. Fortran 77 V. Rajaraman Prentice Hall of India
3. Fortran 77 and numerical methods, C. Xavier
4. How to Solve it by Computer H. Drowmey Prentice Hall of India

Course Code: PH-C-X
Course Title: Nuclear Physics
Nature of the Course: Core
Total credits assigned: 04
Distribution of credits: Theory – 04

Course Objectives:
After successful completion of the course, the student will

1. Have a basic knowledge of the nuclear force and its properties
2. Be able to visualize the nature of interaction of nucleons inside deuteron nucleus as well as in general nucleon-nucleon scattering
3. Be acquire knowledge about different theoretical models regarding nucleus as well as to apply those in determining nuclear properties
4. Grasp knowledge about nuclear reactions and their various mechanisms along with a wide understanding of the decay process
5. Understand the basic forces in nature and classification of particles and study in detail conservations laws and quark models in detail
6. Know about the basic working principles of various nuclear detectors

Unit-wise distribution of Course contents with Unit-wise distribution of Weightage and Contact hours:

Unit I: (L 10, Marks 10)
Review of nuclear properties, Nuclear Forces: properties of nuclear forces, exchange forces, isotopic spin formalism, generalized Pauli's exclusion principle, meson theory of nuclear forces.

Unit II: (L 18, Marks 18)
Two body problem: General form of nucleon-nucleon forces, the deuteron problem (ground states and excited states), central and tensor forces, nucleon-nucleon scattering at low energies. Nuclear models: Review of liquid drop model and its applications, shell model, L-S coupling, magnetic moment and Schmidt lines, limitations of the shell model.

Unit III: (L 15, Marks 15)
Nuclear reactions: Reaction channels, nuclear reaction mechanisms, scattering cross-section, compound nucleus, partial wave analysis of nuclear reaction, resonance, Breit-Wigner single level formula, B-W formula incorporating spin, nuclear fission, neutrino hypothesis and general features of β-ray spectrum, Fermi's theory of β-decay, Curie plot, selection rules.

Unit IV: (L 12, Marks 12)
Elementary Particle Physics: Fundamental forces, Elementary particles and their classification, characteristics of the elementary particles, quantum numbers, behaviour under charge conjugation, time reversal and parity operation, Isotopic multiplet and Gellmann-Nishijima scheme, SU (3) classification and Quark model, Standard model.

Unit V: (L 5, Marks 5)
Detection of radiations: gas filled counters, scintillation detectors, semiconductor detectors.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

This course will enable the students to

1. Develop knowledge regarding nucleus, its properties, nuclear force, nuclear reactions and mechanisms, nuclear detectors as well as elementary particles and the properties related to them
2. Successfully apply the same knowledge in solving problems in the field of nuclear and particle Physics.

Suggested Readings:

1. Nuclear Structure Vol. 1(1969), A. Bohr and B.R Motteison
2. Nuclear Structure Vol. 2(1975), Benjamin and Reading A
3. Introductory Nuclear Physics, Kenneth S. Krane, Wiley, New York,1988
4. Atomic and Nuclear Physics Vol. 2, S.N. Ghosal, S. Chand and Co
5. Introduction to High Energy Physics, P.H. Perkins, Addison Wesley London,1982
6. Nuclear Physics Vol. 1 & 2, Shirokov Yudin, Mir Publishers Moscow 1982
7. Introduction Elementary Particles, D.J. Griffiths, Harper and Row New York,1987
8. Introduction to Nuclear Physics, H.A. Enge Addison-Wesley,1975
9. Nucleon-Nucleon Interaction, G.E. Brown and A.D. Jackson North- Holland, Amsterdam, 1976
10. Theory of Nuclear Structure, M.K. Pal, Afflilliated East-West Madras,1982
11. Introductory Nuclear Physics, Y.R. Wagmare, Oxford University Press, Bombay,1981
12. Elementary Particles, J.N. Longo, McGraw Hill, New York,1971
13. Atomic Nucleus, R.D. Evans, McGraw Hill, New York, 1955
14. Nuclear Physics 2nd ed., I. Kaplan, Narosa, Madras,1989
15. Concepts of Nuclear Physics, B.L. Cohen, Tata McGraw Hill, Bombay,1971
16. Nuclear Physics, R.R. Roy and B.P. Nigam, New Age International

Course Code: PH-C-XI
Course Title: Statistical Mechanics
Nature of the Course: Core
Total credits assigned: 04
Distribution of credits: Theory-03, Tutorial-1

Course Objectives:
The Statistical Mechanics is one of the most important branches of physics which is required to understand the properties matter in bulk on the basis of the dynamical behaviors of its microscopic constituents. As such the objectives of this course are:
(1) To introduce the advance concepts of Statistical Mechanics so that students will be equipped with a sufficient knowledge of the subject.
(2) To develop the critically thinking ability of students to understand the diverse physical phenomena.
(3) To develop the interest and ability among students to solved challenging physical problems by the application of techniques of Statistical Mechanics in future.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Introduction and formulation of quantum Statistics (L 9, T 3, Marks 10)
Historical introduction of statistical mechanics, ergodic hypothesis, ensembles, partition function, grand partition function, postulates of quantum statistical mechanics, density matrix, pure and mixed states, density matrix and partition function of a system of free particles, classical limit of the partition function, BE and FD statistics.

Unit II: Ideal Bose and Fermi systems (L 10, T 3, Marks 15)
Ideal Bose gases, Bose-Einstein condensation, thermodynamic behaviour of an ideal Fermi gas, Pauli paramagnetism, Landau diamagnetism.

Unit III: Statistical Mechanics of Interacting systems (L 11, T 4, Marks 18)
Clusters, classical cluster expansion, formalism of second quantization, creation and annihilation operators and their properties for bosons and fermions, Hamiltonian in terms of second quantized operators, imperfect Bose and Fermi gases.

Unit IV: Phase transitions (L 8, T 2, Marks 10)
Dynamical model of phase transition, the Ising model (one dimension), liquid helium, He-4and He-3, the lambda-transition, Tisza's two-fluid model, the theories of Landau and Feynman, equilibrium properties near absolute zero, superfluidity.

Unit V: Fluctuations (L 7, T 3, Marks 7)
Mean square deviation, fluctuation in ensembles, thermodynamic fluctuations, spatial correlation in a fluid, Einstein-Smoluchowski theory of Brownian motion, approach to equilibrium: the Fokker-Planck equation.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.: 20

Written Test: 20

End Semester: 60

Written Test: 60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

After the completion of this course, it is expected that:

(1) The students will be equipped with a sufficient knowledge of the Statistical Mechanics and hence will be able to look critically for analyzing any physical phenomena.

(2) May motivate students to solve any challenging physical problem in future.

(3) Will draw interest to the subject to pursue further higher study in future and will ultimately help to contribute new knowledge.

Suggested Readings:

1. Statistical Mechanics, R. K. Patharia, Butterwork Heinemann.
2. Statistical Mechanics, K. Huang, John Wiley and Sons.
3. Statistical Mechanics, K. M. Khanna, Today and Tomorrow, New Delhi.
4. Statistical Mechanics, B. K. Agarwal, M. Eisner, New Age International Publishers.
5. Fundamentals of Statistical Mechanics, B.B. Laud, New Age International Publishers.
6. A Primer of Statistical Mechanics, R. B. Singh, New Age International Publishers

Course Code: PH-C-XII
Course Title: Atomic and Molecular Physics
Nature of the Course: Core
Total credits assigned: 04
Distribution of credits: Theory-04

Course Objectives:

The objective of this course is to make a student

1. Learn the physics of the atoms and molecules
2. Become familiar with various branches of spectroscopy and their applications
3. Equip with basic spectroscopic techniques and instrumentation
4. Learn to use spectroscopic techniques to identify materials
5. Learn theoretical background of laser and its application in various disciplines

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Atomic Spectroscopy (L 23, Marks 23)

Fine structure of hydrogen atom, relativistic correction, Lamb shift, Spectra of alkali atoms, spin-orbit interaction and fine structure in alkali atoms, level scheme of two electron atoms-equivalent and nonequivalent electrons, ground and excited states of two electron atoms, interaction energy in L-S and j-j coupling for two electrons, Zeeman effect, Paschen-Back effect, Stark effect, hyperfine structure of hydrogen and alkali atoms, spectra of multi electron atoms, X-ray spectra, width and shape of spectral lines

Unit II: Molecular Spectroscopy (L 25, Marks 25)

Regions of the spectrum, types of molecules, Rotational Spectra for rigid and non-rigid rotators, isotopic effect in rotational spectra, intensity of spectral lines, information derived from rotational spectra, microwave spectrometer, Vibrational spectra for anharmonic oscillator, vibration-rotation spectra, Infra-red spectrometer, Electronic spectra of molecules-Born-Oppenheimer approximation, vibrational analysis of electronic band spectra, fine structure of electronic band spectra, Fortrat Diagram, Raman spectra, Raman spectrometer, Photoelectron spectroscopy, Spin resonance spectroscopy- NMR, ESR, Mössbauer spectroscopy, Fourier Transform Spectroscopy

Unit III: Laser Spectroscopy (L 12, Marks 12)

Fundamentals of Lasers-properties, basic elements, threshold condition, rate equation, population inversion, Laser resonator and modes, types of laser- solid state laser, gas laser, semi-conductor laser, applications of laser spectroscopy, Laser Cooling, Ammonia Masers-two level and three level

Mode of Assessment/ Assessment Tools (%)

In Semester: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
After completing this course, a student can
1. Determine the atomic and molecular structures
2. Analyze and demonstrate a spectra to identify and quantify information about atoms and molecules
3. Demonstrate the interaction of electromagnetic spectra with matter and the associated type of spectroscopy
4. Identify elements present in a sample and in the universe using spectroscopic techniques
5. Apply knowledge of spectroscopy or laser spectroscopy in various disciplines of Physics, Chemistry, Atmospheric Science, Astronomy, Laser Communication, remote sensing etc

Suggested Readings:

1. Physics of Atoms and Molecules, B. H. Bransden and C. J. Joachain, 2rd Edition, Dorling Kindersley (India) Pvt. Ltd. Pearson Education in South Asia.
2. Atomic Spectra, H.E. White McGraw Hill.
3. Atomic Physics, Max Born, Dover Publications, Inc., New York.
4. Molecular spectroscopy, Banwell and McCash Tata McGraw Hill
5. Molecular Structure and Spectroscopy G. Aruldhas Prentice Hall of India
6. Molecular Spectra and Molecular Structure G. Herzberg, McGraw Hill
7. Lasers and Nonlinear Optics, B.B. Laud New Age International
8. Laser Spectroscopy-Basic Concepts and Instrumentation, Wolfgang Demtröder, Springer
9. Modern Spectroscopy, J M Hollas, John wiley & Sons
10. Elements of Laser and Non-Linear Optics, G D Baruah, Prakashan, Meerut

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DISCIPLINE SPECIFIC ELECTIVE COURSES

Course Code: PH-DSE-IA
Course Title: Theory of Relativity
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Theory – 04

Course Objectives:
The objective of this course is to
1. Acquaint the learners with the special theory of relativity, space time continuum.
2. Introduce the basic concepts of tensor calculus
3. Introduce the learners to the general theory of relativity

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Special Theory of Relativity (L 20, Marks 20)
Galilean transformation, Michelson-Morley experiment, Einstein's postulates, Lorentz Transformations and basic kinematical results of special relativity, addition of velocities, relativistic momentum and energy of a particle, four vectors, mathematical properties of the space-time of Special Relativity, matrix representation of Lorentz transformation, transformation of electromagnetic fields.

Unit II: Tensor Calculus (L 20, Marks 20)
Tensors, Tensors as geometrical objects, covariant, contravariant and mixed tensors, contraction, covariant differentiation, the metric tensor, Christoffel symbols, Riemann curvature tensor, metric tensor and gravity, geodesics, parallel transport, Lie Transport and Killing vectors.

Unit III: General Theory of Relativity (L 20, Marks 20)
Curvature of space time, properties of the curvature tensor, Bianchi identity, Ricci Tensor, physics in curved space time, Einstein field equation, general properties of gravitational field equations, spherically symmetric geometry, Schwarzschild metric, Freidman space-time, de Sitter space-time, Gravitational waves, generation of gravitational waves and properties.

Mode of Assessment/ Assessment Tools (%)

In Semester:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester:	**60**
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

After successful completion of the course the student will be able to

1. Understand the ideas of space time continuum, four vectors.
2. Understand tensors as geometrical objects, understand coordinate free formulation of physical laws.
3. Understand the basic ideas of geometrical formulation of gravity.
4. Understand basic ideas of cosmology.

Suggested Readings:

1. Special Theory of Relativity, R. Resnick, McGraw Hill
2. Tensor Calculus, D.C. Kay, Schaum's Outlines
3. Tensor Calculus, P. A. M. Dirac, Prentice-Hall of India
4. Gravitation and Cosmology, S. Weinberg, McGraw Hill
5. Gravitation, T. Padmanabhan, Cambridge University Press
6. Gravitation, J. A. Wheeler, C. W. Misner and K. S. Thorne, Princeton University
7. Cosmology, J. V. Narlikar, Cambridge University Press

Course Code: PH-DSE-IB
Course Title: Atmospheric Physics
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Theory – 04

Course Objectives:
The objective of this course is to
1. Introduce the physics and chemistry of the Earth's neutral atmosphere.
2. Give an in-depth introduction to the atmospheric thermodynamics.
3. Introduce atmospheric aerosols and analyse its impact on the global climate.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Introduction to Earth's Atmosphere (L 15, Marks 15)
State of the earth's atmosphere: main constituents of dry air, CO2, Ozone, water vapor, aerosols; vertical thermal structure of the atmosphere: Troposphere, stratosphere, mesosphere, thermosphere and exosphere; Environmental lapse rate, hydrostatic equilibrium, hydrostatic equation

Unit II: Atmospheric Thermodynamics (L 15, Marks 15)
Gas laws, ideal gas law, Dalton's law, first law of thermodynamics, equivalence between heat and work, thermal capabilities, isothermal, isochoric, isobaric transformation, adiabatic transformation, Poisson relation, thermodynamic properties of water, latent heat, Clausius-Clapeyron's relation, Approximation and consequences of Clausius-Clapeyron relation, moist air, mean molecular weight of dry and moist air

Unit III: Chemistry of the Troposphere and Stratosphere (L 15, Marks 15)
Ozone photochemistry, Chapman cycle, limitations of Chapman model, O3 photolysis, altitude, latitude, diurnal and seasonal variation of ozone, heterogeneous reaction, ozone distribution, HOx, NOx, CLOx cycles, Tropospheric ozone

Unit IV: Atmospheric Aerosols (L 15, Marks 15)
Aerosols: optical and physical properties, chemical composition, size distribution, vertical distribution
Radiative transfer: Introduction to radiative transfer, radiative transfer equation, Beer-Bougher-Lambert law, Schwarzschild's equation and solution, equation of radiative transfer for plane parallel atmosphere and for 3D inhomogeneous media, Scattering of solar radiation: Rayleigh and Mie scattering

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
This course will enable the students to
1. Acquainted with the different layers of the atmosphere and the related physical phenomena.
2. Develop simple models of the atmosphere.
3. Understand the optical and microphysical properties of aerosol.
4. Understand the atmospheric chemistry of trace gases.

Suggested Readings:
1. Meteorology for Scientists and Engineers, R Stull, Brooks/Cole, Thomson Learning
2. Atmospheric Chemistry and Physics, J H Seinfeld and S N Pandis, John Wiley and Sons
3. Introduction to Atmospheric Physics, D G Andrews, Cambridge University Press
4. Fundamentals of Atmospheric Modelling, M Z Jacobson, Cambridge University Press
5. An Introduction to Atmospheric Radiation, K N Liou, Academic Press

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Course Code: PH-DSE-IIA
Course Title: Plasma Physics
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Theory-03, Tutorial-01

Course Objectives:
The objective of the course is to
1. Understand collective nature of plasma dynamics.
2. Describe the motion of charged particles in varying electric and magnetic fields.
3. Derive fluid description of collective plasma motion.
4. Learn foundations of plasma waves and instabilities.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: (L 8, T 4, Marks 12)
Definition of plasma, Concept of temperature, Debye shielding, plasma parameters, criterion for plasma, Classification of Plasma, Applications of Plasma Physics.

Unit II: (L 8, T 6, Marks 14)
Motion of charged particles in electromagnetic fields uniform E and B fields, non-uniform fields, diffusion across magnetic fields, varying E and B fields, Adiabatic invariants, Magnetic mirror

Unit III: (L 10, T 7, Marks 17)
Plasma as fluids: Introduction, relation of plasma physics to ordinary electromagnetics, Fluid equation of motion, Fluid drifts perpendicular and parallel to B, Plasma approximation. Plasma confinement

Unit IV: (L 10, T 7, Marks 17)
Wave phenomena in plasma: phase and group velocities, plasma oscillation, electron plasma waves, ion-acoustic waves, propagation parallel and perpendicular to the magnetic field, propagation through ionosphere and magnetosphere; Space and Astrophysical Plasma, Van Allen Belts

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
On completion of the course, the student shall be able to:

1. Define plasma and its fundamental parameters, distinguish the single particle approach, fluid approach and kinetic statistical approach to describe different plasma phenomena
2. Determine the velocities (drift velocities) of charged particles moving in electric and magnetic fields that are either uniform or vary slowly in space and time
3. Classify the electrostatic and electromagnetic waves that can propagate in magnetised and non-magnetised plasmas, and describe the physical mechanisms generating these waves
4. Define and determine the basic transport phenomena such as plasma resistivity, diffusion (classical and anomalous) and mobility as a function of collision frequency and of the fundamental parameters for both magnetised and non-magnetised plasmas

Suggested Readings:

1. Introduction to plasma physics, F. F. Chen, Springer.
2. Fundamentals of plasma physics, R. A. Bittencourt, Springer-Verlag NY Inc.
3. Principles of plasma diagnostics, I. H. Hutchinson, Cambridge University Press.

Course Code: PH-DSE-IIB
Course Title: Advanced Quantum Mechanics
Nature of the Course: DSE
Total credits assigned: 04
Distribution of Credits: Theory - 4

Course Objectives:
The objective of the course is to
1. Acquaint the learners with the approximation methods in Quantum Mechanics.
2. Introduce the quantum mechanical treatment of scattering
3. Introduce the learners to the relativistic quantum mechanics

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Scattering Theory (L 10, Marks 10)
The Lipmann-Schwinger Equation, the Born Approximation, Optical Theorem, Eikonel Approximation, Free Particle States: Plane versus Spherical waves, Method of partial waves, Low-energy scattering and Bound states, Resonance scattering, Identical Particles and Scattering

Unit II: Path Integral Approach (L 25, Marks 25)
Quantum mechanical law of motion: Classical Action, quantum mechanical amplitude, the sum over paths, examples: the free particle, diffraction through a slit. Path integral as a functional, evaluation of path integrals, perturbation method in quantum mechanics, transition elements.

Unit III: Relativistic Quantum Mechanics (L 25, Marks 25)
Brief overview of Special Theory of Relativity, Four vectors, Klein Gordon Equation, Dirac Equation, Spin angular momentum, Dirac matrices, covariant form of Dirac equation, Zitterbewegung, Ideas of Second Quantization, Quantization of Klein Gordon and Dirac fields.

Mode of Assessment/ Assessment Tools (%)

In Semester:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester:	**60**
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
After completion of the course the student will be able to
1. Understand the idea of different approximation techniques in quantum mechanics
2. Understand the quantum mechanical approach to scattering
3. Understand the consequences of incorporating special theory of relativity in quantum mechanics.

Suggested Readings:

1. Modern Quantum Mechanics, J.J. Sakurai, Addison Wesley.
2. Quantum Mechanics, L.I. Schiff, McGraw Hill.
3. Quantum Mechanics, Bransden and Joachain, Pearson Education.

4. Quantum Mechanics and Path Integrals, R.P. Feynman, Dover Publications.
5. Advanced Quantum Mechanics, J. J. Sakurai, Prentice Hall of India.
6. Quantum Mechanics, R. Shankar, Kluwer Academic/Plenum Publishers.
7. Relativistic Quantum Mechanics, J. D. Bjorken and S. D. Drell, McGraw Hill.

Course Code: PH-DSE-IIIA
Course Title: High Energy Physics I
Nature of the Course: DSE
Total credits assigned: 04
Distribution of Credit: Theory - 4

Course Objectives:
At the completion of this course, a student will be able to
1. Express physical quantities in natural units.
2. Explain the physics of relativistic wave equations.
3. Use the formulation of quantum field theory in a number of fields.
4. Apply the concepts of quantum field theory to quantum electrodynamics.

Unit wise distribution of course contents with unit wise distribution of weight age and contact hours:

Unit I: Relativistic Wave Equations (L 10, Marks 10)
Natural units, Lorentz covariance and four vector notation; Klein-Gordon equation; Dirac equation and its covariant form, Dirac gamma matrices, adjoint equation and conserved current, solution of the Dirac equation (free particle spinors), negative energy states, antiparticles, normalization of spinor and the completeness relations, Lorentz covariance of Dirac equation, bilinear covariants, Dirac equation for zero mass particles (the two-component neutrino), helicity states.

Unit II: Quantum Field theory (L 25, Marks 25)
Concept of field and quantization, Lagrangian of a field, Schwinger's action principle, Fock space states and their eigenvalues, method of second quantization, canonical quantization of scalar, vector and spinor fields, energy, momentum and charge of the field, vacuum in field theory, propagators; C, P, T transformation properties of scalar and vector fields.

Unit III: Quantum Electrodynamics (L 25, Marks 25)
S-matrix, covariant perturbation theory, path integral formalism, Feynman diagram (rules in momentum space), Wicks theorem, calculation of second order process, electron interaction with electromagnetic field, Mott scattering, Compton scattering (Klein-Nishima formula), Møller scattering, Bhaba scattering, bremsstrahlung, vacuum polarization, self-energy of electron.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
1. After the completion of this course, it is expected that this course will
2. Enable a student to acquire the basics of quantum field theory and realize its importance.
3. Enable a student to apply the framework of field theory to quantum electrodynamics.
4. Prepare a student for advanced topics in field theory and particle physics.

5. Motivate a student to pursue a career in high energy physics.

Suggested Readings:

1. Introduction to Elementary Particles, D. J. Griffiths, John Wiley & Sons.
2. Quarks and Leptons, Francise Halzen and Alan D. Martin, John Wiley & Sons.
3. Introduction to High Energy Physics - Donald H. Perkings, Cambridge University Press.
4. Gauge Theory of Elementary Particle Physics, T.P. Cheng and L.F. Li Oxford Univ. Press.
5. Physics of Elementary Particles, H. Muirhead, Pergamon Press.
6. Quantum Field Theory, Lewis H. Ryder, Cambridge University Press.
7. An Introduction to Quantum Field Theory, M. E. Peskin and D.V. Scroeder, Levant Books.
8. Field Quantization, W. Greiner and J. Reinhardt, Springer.
9. A First Book of Quantum Field Theory, A. Lahiri and P.B. Pal, Narosa.
10. QFT Lecture Notes I and II- David Tong, Cambridge University Press.

Course Code: PH-DSE-IIIB
Course Title: Condensed Matter Physics I
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Theory – 04

Course Objectives:
At the completion of this course, a student will be able to
1. Gather a broader knowledge of Electronic Properties of Solids.
2. Understand the chronology in the Development of the Electron theory in Metals.
3. Understand comparatively the Polarisation and Magnetisation behavior in a solid.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Electron theory (L 16, Marks 16)
Free electron theory, Energy levels and density of states, Fermi energy, Boltzmann equation, relaxation time, electrical and thermal conductivity of metals, Wiedmann Franz law, nearly free electron model, tight binding method.

Unit II: Dielectric and Ferroelectric Properties (L 16, Marks 16)
Polarization, Langevin's theory, Clausius- Mossotti relation, static dielectric constant of solids, complex dielectric constant & dielectric loss, dielectric relaxation, Debye equation.
dipole theory of ferroelectricity, thermodynamics of ferroelectricity, first and second order transitions, anti-ferroelectricity.

Unit III: Magnetic Properties of a System (L 14, Marks 14)
Hartree and Hartree-Fock approximation, Hartree exchange and Heisenberg Hamiltonian, the ground state and excited states in Hartree-Fock approximation, Heisenberg ferromagnet and spin waves.

Unit IV: Superconductivity (L 14, Marks 14)
Isotope effect, electron-phonon interaction, BCS theory, flux quantization in a superconducting ring, superconducting tunneling, AC and DC Josephson effects, Ginsberg – Landau theory, SQUIDS.

Mode of Assessment/ Assessment Tools (%)

In Semester:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester:	**60**
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
The course will
1. Equip a student with quantum mechanical tools for the solution of Condensed Matter Physics problems.
2. Enable a student to work in both theoretical and experimental aspects of Electronic Behavior of Solids.
3. Enable the students for further study and contribution towards the development of the subject.

Suggested Readings:

1. The Theory of transport phenomena in solids, J. M. Ziman, Oxford University Press
2. Solid State Physics, N.W. Ashcroft and N.D. Mermin, Brooks/Cole
3. Intermediate Quantum Theory of Crystalline Solids, A.O.E. Animallu, Prentice Hall
4. Quantum Theory of Solids, C. Kittel, John Wiley International
5. Elements of Solid State Physics, J.P. Srivastava, Prentice Hall India
6. Introduction to Solid State Theory, O. Madelung, Springer-Verlag
7. Quantum Theory of Solid State, J Callaway, Academic Press
8. Theoretical Solid State Physics, A. Huang, Elsevier

Course Code: PH-DSE-IIIC
Course Title: Communication Electronics
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Theory – 04

Course Objectives:
At the completion of this course, a student will be able to
1. Understand the basic techniques of electronic communication like modulation, multiplexing etc.
2. Apply the knowledge to understand the current generation communication technologies.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Modulation Techniques (L 8, Marks 8)
Sampling theorem, quantization, pulse code modulation (PCM), Dynamic range, companding, Delta modulation, granular noise, slope overloading, adaptive delta modulation, differential PCM, Noise in communication system-representation of noise and signal-to-noise ratio at output, white noise.

Unit II: Digital modulation technique (L 10, Marks 10)
Concept of bit rate, baud, bandwidth, ASK, FSK, BPSK, QPSK, 8PSK, 16PSK, QAM, probability of error and bit error, data communication codes, bar codes, error detection, error correction.

Unit III: Spread spectrum and Multiple accessing (L 6, Marks 6)
Frequency hopping, DSSS.CDMA, TDM, FDM, WDM

Unit IV: Microwave Communication (L 10, Marks 10)
Loss in free space, microwave frequencies and bands, propagation of microwaves, effective height of antenna in LOS communication, field strength of tropospheric waves, atmospheric effects on propagation, Fresnel zone problem, ground reflection, fading sources.

Unit V: Antennas (L 7, Marks 7)
Basic antenna theory, beam-width, directivity, antenna efficiency, gain, Hertzian dipole, antenna parameters, dipole arrays, folded dipole, log-periodic antenna, loop antenna, UHF and microwave antennas, microstrip antenna, scattering parameters and their measurements, vector network analyser

Unit VI: Radar Systems (L 5, Marks 5)
Radar block diagram and operation, radar frequencies, pulse considerations, radar range equation and derivation, pulsed and CW radar, minimum detectable signal, pulse repetition frequency.

Unit VII: Cellular Communication (L 7, Marks 7)
Cell splitting, frequency reuse, roaming and hand off, architecture of cellular mobile communication network, AMPS, IS, GSM system of communication, GPRS, EDGE, 3G and 4G systems.

Unit VIII: Satellite Communication (L 6, Marks 6)
Satellite orbits, geostationary satellites, antenna look angles, frequency allocations, satellite system link models, up link, down link, cross link, transponders, satellite system parameters, satellite system link equation.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.: 20
Written Test: 20
End Semester: 60
Written Test: 60
(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
This course will enable the students to
1. Identify the basic techniques of communication like modulation, multiplexing.
2. Analyze the modulations schemes and their applicability.
3. Analyze present generation systems related to microwave communication, cellular communications, satellite communication.

Suggested Readings:

1. Advanced Electronic Communication Systems, W. Tomasi, Pearson Education India.
2. Principles of electronic communication systems, L E Frenzel, McGraw Hill Education
3. Electronic Communication Systems, G. Kennedy, McGraw Hill Education
4. Microwave Devices and Circuits, S Y Liau, Pearson Education India.
5. Introduction to RADAR Systems, M Skolnik, McGraw Hill Education.
6. Data and Computer Communications, W. Stallings, Pearson Education India
7. Antenna and Wave Propagation, J D Kraus, McGraw Hill Education

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Course Code: PH-DSE-IIID
Course Title: Advanced Mathematical Physics
Nature of the Course: DSE
Total credits assigned: 04
Distribution of Credit: Lecture - 3, Tutorial - 1

Course Objectives:
At the completion of this course, a student will be able to

1. Write a complex problem in higher level Physics in the language in Mathematics.
2. Identify a range of diverse mathematical techniques to formulate and solve a complex problem in higher level Physics.
3. Analyze various mathematical concepts and methods required in higher level Physics.
4. Apply the knowledge and understanding of these mathematical techniques to gain insight into a number of advance branches of physics like Theoretical Physics, Particle and High Energy Physics, Physics of Gravity, Cosmology etc.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Nonlinear Dynamics (L 16, T 5, Marks 20)
Overview: Significance of nonlinearity; one-dimensional flows: flows on the line and the circle, fixed points and stability, existence and uniqueness, impossibility of oscillation, potentials; bifurcations: saddle-node bifurcation, trans critical bifurcation, pitchfork bifurcation, imperfect bifurcations and catastrophes, ghosts and bottlenecks, applications to physical problems; two-dimensional flows: linear systems, classification of linear system; phase plane: phase portraits, fixed points and linearization; chaos: strange attractors, chaos on a strange attractor, Lorentz map, Logistic map, Henon map, Liapunov exponent; Fractals: countable and uncountable sets, self-similarity, dimension of self-similar fractals, applications to physical problems.

Unit II: Topology (L 13, T 5, Marks 18)
Overview: topology and geometry in physics, maps, linear maps, images and kernels, dual vector space; topological spaces: definition and types, compactness, connectedness; homeomorphisms and topological invariants; Nielsen-Olensen vortex, topological excitations; homology and homotopy groups; fibre, vector and principal bundles; anomaly, abelian and non-abelian anomaly; some examples and applications.

Unit III: Differential Geometry (L 16, T 5, Marks 22)
Manifolds: definition, calculus of manifolds; Killing vectors: definition, Killing vector fields, conformal Killing vector fields; non-coordinate bases, differential forms, duality transformation; sub manifolds; complex manifolds: definition, calculus on complex manifolds, complexifications, complex differential forms; Hermitian manifolds: definition, Hermitian differential geometry, Kahler form, torsion and curvature; Kahler manifolds: definition, Kahler geometry, Kahler differential geometry; moduli space; matter fields and covariant derivatives; some examples and applications.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

After the completion of this course, it is expected that this course will

1. Equip students with required mathematical skills to succeed in Physics.
2. Develop the analyzing ability of the students to solve critical problems in Physics.
3. Enable the students to pursue a research career in Physics and will ultimately help to contribute new knowledge.

Suggested Readings:

1. Nonlinear Dynamics and Chaos, S. H. Strogatz, Perseus Books Publishing.
2. Stability, Instability and Chaos: An Introduction to the Theory of Nonlinear Differential Equations, P. Glendinning, Cambridge University Press.
3. Introduction to Applied Nonlinear Dynamical Syatem and Choas, Stephen Wiggins, Springer.
4. Geometry, Topology and Physics, M. Nakahara, IOP Publishing.
5. Calculus on Manifolds, M. Spivak, Addition-Wesley Publishing.
6. Topology, Geometry and Gauge Fields, G. L. Naber, Springer.
7. Topology and Geometry in Physics, E. Bick and F. D. Steffen (Eds.), Springer.

Course Code: PH-DSE-IIIE
Course Title: Laser Spectroscopy I
Nature of the Course: DSE
Total credits assigned: Theory-04
Distribution of credits: (L 3, T 1)

Course Objectives:

1. Familiarize with various branches of spectroscopy
2. Equip with the knowledge on spectroscopic techniques and instrumentation
3. Learn to use spectroscopic techniques to apply in wide range of areas
4. Learn theoretical background of laser, its importance as spectroscopic light source and different types

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Matter-radiation interaction (L 15, T 5 Marks 20)
Overview of different Spectroscopic techniques, absorption and emission of radiation, Einstein's coefficients, Coherent properties of radiation fields, Transition probabilities- weak and strong field approximation, Cavity radiation-counting the number of cavity modes, Plank's law for cavity modes, basic photometric quantities, widths and profiles of spectral lines, overview of spectroscopic instrumentations-detection of light, interferometers, photo emissive detectors

Unit II: Lasers as spectroscopic light source (L 20, T 5 Marks 25)
Basic elements of lasers, development and growth of a laser beam, saturation intensity, growth factor , properties of lasers- coherency, directionality, monochromaticity light amplification, threshold condition for laser oscillation, laser amplifiers, spectral characteristics, laser rate equations- three and four level systems, laser resonators-longitudinal and transverse cavity modes, Types of lasers with examples: solid state, gas laser, Dye laser, and semiconductor lasers, liquid and chemical lasers, free-electron lasers, excimer lasers, X-ray laser, Advantages of Lasers in spectroscopy

Unit III: Time resolved laser spectroscopy (L 10, Marks 10)
Generation of short laser pulses-Q-switched lasers, mode locking of lasers, laser amplifiers, femtosecond pulses, measurement of ultrashot pulses, life time measurements with lasers, pump and probe techniques, gamma ray lasers

Unit IV: Applications of laser spectroscopy (L 10, T 5 Marks 15)
Applications of lasers- Physics, Chemistry, Environmental Research, Material Science, Biology, Medical Science, communication, Atmospheric optics, industry, Holography

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
On completion of the course, the student will be able to:

1. Understand and explain fundamental concepts in laser spectroscopy
2. Compare the function and properties of different types of lasers
3. Use laser spectroscopic instruments in practice in physics and allied disciplines
4. Demonstrate the production mechanism of conventional as well as ultrafast lasers

Suggested readings:

1. Molecular Spectra and Molecular Structure G. Herzberg McGraw Hill
2. Molecular Structure and Spectroscopy, G Aruldhas, PHI Learning Pvt Ltd, Delhi
3. Fundamental of Molecular Spectroscopy, Banwell and McCash,Tata McGraw Hill
4. Laser Spectroscopy, W. Demtrider, Springer
5. Laser Fundamentals, W T Silfvast, Cambridge University press
6. Lasers and Non-linear Optics, B B Laud, New age international limited, publishers
7. Elements of Laser and Non-Linear Optics, G D Baruah, Prakashan, Meerut

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Course Code: PH-DSE-IVA
Course Title: High Energy Physics II
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Theory – 04

Course Objectives:
At the completion of this course, a student will be able to
1. Classify the elementary particles and their interactions.
2. Explain the physics of fundamental particles and their interactions.
3. Analyze the formulation of group theory.
4. Apply group theory to quark model and different interactions.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Introduction to Elementary Particles (L 20, Marks 20)
Historical introduction and classification of elementary particles, intrinsic properties of elementary particles, behaviour of elementary particles under: charge conjugation (C), parity (P), time reversal (T) and G-parity; Gell-Mann-Nakano-Nishijima law, eightfold way (Gell-Mann and Ne'eman classification).

Unit II: Group Theory and The Quark Model (L 20, Marks 20)
Symmetries in physics, Lie groups, unitary and special unitary groups (U(1), SU(2) and SU(3)), Tensor method in SU(n), Young tableaux, Isospin symmetry the quark model, quark-mass formulas, Zweig rule and charm quark, heavy quarks beyond charm, quark color, hadron wave functions, quark model predictions: magnetic moment, hadron masses.

Unit III: Particle Interactions (L 20, Marks 20)
Fundamental interactions (electromagnetic, weak, strong and gravitational) and their characteristics, conservation laws and decay modes, charged leptonic weak interactions,

decays of muon, neutron and charged pions, neutral weak interactions, Fermi theory of weak interaction, V-A interaction, Cabibbo angles, weak mixing angles, CP violation, CPT theorem.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
After the completion of this course, it is expected that this course will
1. Enable a student to acquire the basic knowledge of elementary particles and their interactions.
2. Enable a student to apply the framework of group theory to particle physics.
3. Prepare a student for advanced topics in field theory and particle physics.
4. Motivate a student to pursue a career in high energy physics.

Suggested Readings:

1. Introduction to Elementary Particles, D. J. Griffiths, John Wiley & Sons.
2. Quarks andLeptons,FranciseHalzen and Alan D. Martin, John Wiley & Sons.
3. Introduction to High Energy Physics, Donald H. Perkings, Cambridge University Press.
4. Gauge Theory of Elementary Particle Physics, T.P.Cheng and L.F. Li, Oxford Univ. Press.
5. Physics of Elementary Particles, H. Muirhead, Pergamon Press.
6. Quantum Field Theory, Lewis H. Ryder, Cambridge University Press.
7. An Introduction to Quantum Field Theory, M. E. Peskin and D.V. Scroeder, Levant Books.
8. Field Quantization, W. Greiner and J. Reinhardt, Springer.
9. A First Book of Quantum Field Theory, A. Lahiri and P.B. Pal, Narosa.
10. QFT Lecture Notes I and II, David Tong, Cambridge University.

Course Code: PH-DSE-IVB
Course Title: Condensed Matter Physics II
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Theory – 04

Course Objective:
The objective of the course is to
1. Provide basic knowledge on Lattice vibration and some properties of solid related to lattice vibration.
2. Develop the basic knowledge of the thin film Physics. It will provide the knowledge of preparation and characterization of thin films and its application in devices.
3. Enhance the knowledge on semiconducting properties and optical effect in semiconductors.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Lattice vibrations (L 15, Marks 15)
Harmonic approximation, monatomic and diatomic linear lattices, dispersion relations, normal modes, phonons, infrared absorption in ionic crystals, lattice dynamics in three dimensions (harmonic& adiabatic approximation), normal modes of a monatomic 3-dimensional Bravais lattice.
quantum theory of harmonic crystal, lattice specific heat, anharmonic effects, thermal expansion, the Grueneisen parameter, normal and umklapp processes.

Unit II: Thin films (L 20, Marks 20)
Introductory concepts, methods of preparation of thin films (vacuum evaporation, chemical vapour deposition, sputtering), thickness determination, conductivity of thin films, effect of thickness on transport properties, Thomson's theory and Fuch's theory, elementary concepts of surface crystallography, surface structure analysis of thin films (SEM, TEM and AFM)

Unit III: Semiconductors (L 25, Marks 25)
Intrinsic and extrinsic semiconductors, mobility and electrical conductivity, Fermi level, Hall effect.
Rectifying properties of barriers, Schottky theory of M.S contact, surface states, p-n junction rectifiers, transistors and solar cells
Photovoltaic device principles, equivalent circuit of solar cell, temperature effects, solar cell materials, devices and efficiencies.
Optical and high frequency effects in semiconductors, optical constants, free carrier absorption, fundamental absorption, direct and indirect transitions, lattice absorption.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
After the completion of the course the student will be able to
1. Use the knowledge in fabrication of different thin film semiconductor devices.
2. Pursue some research or project work on semiconducting thin film device.

Suggested Readings:
1. Introduction to Solid State Theory, O. Madelung, Springer-Verlag
2. Quantum Theory of Solid State, J Callaway, Academic Press
3. Theoretical Solid State Physics, A. Huang, Elsevier
4. Handbook of Thin Film Technology, Michelle and Glang, McGraw Hill
5. Semiconductors, R.A. Smith, Cambridge university Press
6. Thin Film Fundamentals, A. Goswami, New Age International
7. Physics of Semiconductor Devices, S. M. Sze, Wiley

Course Code: PH-DSE-IVC
Course Title: Digital and Optical Electronics
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Theory-04

Course Objectives:
Objective of the course is to
1. Introduce students to microcontroller and programming for building digital systems.
2. Introduce students to digital signal and signal processing principles
3. Introduce students to optical electronic systems
4. Provide students with fundamental principles of optical devices
5. Introduce students to optical communication systems

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Digital system using Microcontroller/Microprocessor (L 10, Marks 12)
8085 programming, introduction to specification and architecture of microcontroller, 8051 family, instruction set, addressing mode, programming, time delay generation, look up table implementation etc.

Unit II: Introduction to digital signal processing (L 15, Marks 12)
Introduction to digital signals-discrete time signals, classification: power and energy signals, deterministic and random signals etc. digital processing systems, introduction to discrete time linear invariant signals, impulse response and convolution, digital Fourier transform and Z-transform, pole zero analysis for stability, implication of poles and zeroes location, finite duration and infinite duration impulses, FIR and IIR filters.

Unit III: Optical electronics: Review of semiconductor and optics (L 10, Marks 12)
The optical regime in electro-magnetic spectrum: characteristics, advantages/disadvantages, advantage over electronic system: faster, higher band width, economic, security etc., energy bands in solids, the E-k diagram, semiconductor optoelectronic materials, total internal reflection and scattering of light in attenuating medium, light propagation in wave guides.

Unit IV: Optical sources, medium, amplifier, transmitter (L 15, Marks15)
Source: LED, LASER, diode as lasing medium, LASER basics, LASER diode:
Device structure, materials and characteristics.

Medium: Optical fiber, classification, material and construction, properties, attenuation, dispersion (chromatic and anomalous), numerical aperture, modes of propagation, modal dispersion: Step index and graded index fibers, losses in fibers, different loss processes.
Detector: electroluminescence. photo detectors, semiconductor detectors, photo diode, P-I-N photodiode, avalanche photo diode (APD) and photo transistor, noise in photo-detection; detector performance characteristics
Semiconductor Optical Amplifiers & Modulators**:** Semiconductor optical amplifiers (SOA), SOA characteristics and some applications

Unit V: Optical communication system (L 10, Marks 9)

Basic architecture of an optical communication link, multiplexing techniques, Wavelength Division Multiplexing (WDM), components of the system: Optical couplers, tunable sources and filters, optical MUX/DEMUX, fiber grating, optical add drop multiplexer (OADM), optical circulators, attenuators, optical cross connects.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20

End Semester: 60

Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

The student will be able to

1. Critically analyze microcontroller based digital electronic circuits
2. Write assembly language programs for microprocessor and microcontroller controlled devices.
3. Analyze optical electronic devices
4. Critically analyze optical communication systems
5. Apply the knowledge of optical electronics to make innovative optical products for real life problem solving.

Suggested Readings:

1. The 8051 Microcontroller and Embedded system,Mazidi, Mazidi and McKinlay, Pearson Education
2. Optical Electronics,Ghatak and Thyagarajan, Cambridge University Press
3. Introduction to Fiber Optics, Ghatak and Thyagarajan, Cambridge University Press
4. Advanced Electronic Communication systems,W. Tomasi, PHI Learning Pvt.Ltd.
5. Microprocessor Architechture Programming and Applications with 8085, R. Gaonkar, PENRAM Publication.

Course Code: PH-DSE-IVD
Course Title: Space Physics
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Theory-04

Course Objectives:

Objective of the course is to

1. Introduce the Physics of the Earth's ionosphere.
2. Introduce the atmospheres of the solar system planets.
3. Introduce the Physics of the Sun.
4. Introduce radio astronomy.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Physics of the Earth's Ionosphere (L 15, Marks 15)

Introduction, principle of formation, Chapman's hypothesis, ionization by energetic particles, X rays, chemical recombination, vertical transport, D, E, and F layers, ionospheres of the low and middle latitudes, in situ and remote measurement techniques-Langmuir probe, ionosonde, GPS

Unit II: Planetary Atmospheres (L 15, Marks 15)

Thermosphere-thermal structure, Exosphere-atmospheric escape, density distribution, Physical properties of Planetary Atmospheres: Terrestrial planets, Jovian planets

Unit III: Physics of the Sun (L 15, Marks 15)

Structure of the Sun, solar wind, solar wind formation in the corona, solar wind interaction with the magnetosphere, solar cycle, solar flares, CME, Geomagnetic effect

Unit IV: Radio Astronomy (L 15, Marks 15)

Introduction, power, spectral power, brightness, discrete radio sources, flux density, blackbody radiation, Planck's law, radio sky, galactic radio noise, radio sources
Fundamentals of radio telescopes, GMRT

Mode of Assessment/ Assessment Tools (%)

In Semester: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20

End Semester: 60

Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

After the completion of this course the student will be able to

1. Understand the basic plasma process in the Earth's ionosphere.
2. Acquainted with planetary atmospheres.

3. Learn about Sun, Solar wind, CME, solar wind interaction with the magnetosphere, Solar - Terrestrial environment.
4. Understand the fundamentals of radio astronomy.

Suggested Readings:

1. Earth's Ionosphere, Plasma Physics and Electrodynamics, M C Kelley, Academic Press
2. The Solar Terrestrial Environment, J K Hargreaves, Cambridge University Press
3. Physics of Planetary Ionospheres, S J Bauer, Springer Verlag
4. Space Plasma Physics, A C Das, Narosa Publishing House
5. Radio Astronomy, J D Kraus, McGraw Hill

Course Code: PH-DSE-IVE
Course Title: Laser Spectroscopy II
Nature of the Course: DSE
Total Credit Assigned: 4
Distribution of credits: (L 3, T 1)

Course Objectives:
Objective of the course is to
1. Understand the basic principles of nonlinear spectroscopy
2. Familiarize with principles and instrumentations in modern nonlinear spectroscopy
3. Equip with the knowledge on different techniques of laser Raman spectroscopy and applications
4. Familiarize with recent developments in Laser Spectroscopy

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Nonlinear Spectroscopy (L 10, T 5 Marks 15)
Linear and nonlinear absorption, hole burning and lamb dips, Saturation spectroscopy, two photon and multi photon spectroscopy, polarization spectroscopy-basic principle and advantages, special techniques of nonlinear spectroscopy, Ionization spectroscopy, laser induced fluorescence

Unit II: Laser Raman Spectroscopy (L 10, T 5 Marks 15)
Tunable Raman lasers, Nonlinear Raman spectroscopy- stimulated Raman scattering, Coherent Anti-Stokes Raman Spectroscopy (CARS), hyper Raman effect, inverse Raman scattering, photo-acoustic Raman spectroscopy, spin-flip Raman spectroscopy, Applications of Laser Raman Spectroscopy

Unit III: Atom and ion optics (L 10, T 5 Marks 15)
Laser Cooling and Trapping of Atoms, slowing of atomic beams, Doppler cooling, Bose-Einstein condensation, Atom lasers, spectroscopy of single ions: ion trapping, Quantum jumps, Laser spectroscopy in storage rings, Atom interferometry

Ramsey fringes, squeezing and its application to gravitational wave detectors, Laser breakdown spectroscopy and its application

Unit IV: Coherent Spectroscopy (L 10, T 5 Marks 15)
Level crossing spectroscopy-Hanle Effect, quantum mechanical model, Quantum beat spectroscopy-basic principle and experimental technique, Photon echoes, correlation spectroscopy

Mode of Assessment/ Assessment Tools (%)

In Semester: 40
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.: 20
Written Test: 20
End Semester: 60
Written Test: 60
(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

After the completion of this course the student will be able to

1. Understand and explain concepts in non linear spectroscopy
2. Demonstrate the use of modern laser spectroscopic instruments in practice
3. Demonstrate the advantages of use of laser spectroscopy in recent discoveries in Physics and various other areas
4. Use laser spectroscopic techniques in research.

Suggested Readings:

1. Laser Spectroscopy, W. Demtroder, Springer
2. Laser Fundamentals, W T Silfvast, Cambridge University press
3. Lasers and Non-linear Optics, B B Laud, New age international limited publishers
4. Principles of Fluorescence Spectroscopy, J.R. Lakowicz, Springer
5. High Resolution Spectroscopy, J.M. Hollas, John Wiley and Sons
6. Introduction to IR and Raman Spectroscopy, N. Colthup, L. Daly, S. Wiberley, Elsevier
7. Physics of Atoms and molecules, B.H. Brasden and C.J. Joachain, Prentice Hall.

Course Code: PH-DSE-VA
Course Title: Condensed Matter Physics Lab
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Lab – 04

Course Objectives:
At the completion of this course, a student will be able to
1. Gather a broader knowledge on the experimental techniques of solid state Physics
2. Understand the basic concepts in hands on mode through the basic solid state physics experiments.

List of Experiments:
1. To Determine the Lange g-factor by Electron Spin Resonance Method
2. To determine the Curie temperature of phase transition for (a) ferroelectric materials and (b) for ferrites
3. To determine the Boltzmann Constant.
4. To determine the Stefan's Constant.
5. To determine the Neel temperature of an anti-ferromagnetic material by Gouy's method.
6. To prepare and measure the thickness of a thin film.
7. To study the thermo luminescence of an F-center.
8. To study the Hall Effect and determine the different parameters.

Mode of Assessment/ Assessment Tools (%)

In Semester: 50	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	25
Viva Voce:	25
End Semester: 50	
Laboratory experiments:	50

(One experiment from the list of experiments to be performed)

Expected Learning Outcome:
The course will

1. Equip a student with different experimental techniques used for determination of various properties of solids.
2. Enhance the laboratory skill of a student which will help a student to experimental research work in the area.
3. Enable a student to understand the subject in some more detail.

Suggested Readings:

1. Introduction to Solid State Physics, C. Kittel, John Wiley & Sons
2. Solid State Physics, A. J. Dekker, Macmillan India Ltd
3. Thin Film fundamentals, Pallav Chowdhury, New Age International
4. Solid State Physics, S.O. Pillai, New Age International

Course Code: PH-DSE-VB
Course Title: Electronics Lab
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Lab-04

Course Objectives:

1. To allow students to learn the electronic principles using hands-on philosophy
2. To allow students to design small analog circuit systems like small signal amplifier, filter comparator etc.
3. To allow students to apply their knowledge for assembly language programming to do arithmetic operations and make small data processing software.
4. To introduce students to use microprocessor and microcontroller to interface peripheral devices
5. To introduce students to radiation pattern of antenna through measurement.
6. To introduce students to optical electronics components and measurements.

List of experiments to be performed:

Guidelines: 70% experiments need to be performed for claiming 4 credits. All analog experiments except the antenna radiation pattern are to be assembled by the students in either breadboard or PCB. (No-Kit allowed for analog experiments). Each student will use Simulation software like Simulink for designing the analog circuits. The design parameter for each student would be decided by the course teacher and the students final circuit needs to perform as per the design specification. Microprocessor/microcontroller experiments can be conducted using pre-assembled kits but each student is required to write one unique program for passing the course.

1. To design a two-stage small signal amplifier using transistor for a gain of 10/15/20 etc for a bandwidth of 10/50/100KHz.

Additional experiments: Use Darlington pair/bootstrapping to improve input impedance

2. To design an RC low/high pass filter for 25/30 dB at different cut off frequencies. Ripple acceptance criteria to be changed for each set of students.
3. To design a Schmitt trigger comparator for given (e.g., 2V/3V, 1V/4V etc) LTP and UTP.
4. To use 8085 kit for arithmetic operations like addition, subtraction, division, multiplication, factoring etc. One additional experiment to be given to each student to judge his learning like (a) Calculation of factorial (b) Sorting of 5 numbers in ascending and descending order (c) Generate 1 or 2 sec delay etc.
5. To study the radiation pattern of various types of Yagi antenna elements using different number of director and reflector elements at different distances between transmitter and receiver.
6. To use 8051 kit for arithmetic operations like addition, subtraction, division, multiplication, factoring etc. One additional experiment to be given to each student to judge his learning like (a) Calculation of factorial (b) Sorting of 5 numbers in ascending and descending order (c) Look-up table creation etc.
7. Study and characterization of single mode and multi-mode of optical fiber.
8. Measurement of optical fiber numerical aperture

Mode of Assessment/ Assessment Tools (%)

In Semester: 50

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	25
Viva Voce:	25

End Semester: 50

Laboratory experiments:	50

(One experiment from the list of experiments to be performed)

Expected Learning Outcome:

The student will be able to

1. Design small electronic circuits
2. Write assembly language program to do arithmetic, logical and data processing operations
3. Analyze antenna radiation pattern and characteristics for real life application
4. Understand the working of optical electronics components

Suggested Readings:

1. The 8051 Microcontroller and Embedded system, Mazidi, Mazidi and McKinlay, Pearson Education
2. Electronic Principles A.P. Malvino Tata McGraw Hill
3. Op Amps and Linear Integrated Circuits R.K. Gaekwad, Prentice Hall of India
4. Microprocessor Architecture Programming & Applications with 8085, 2002, R.S. Goankar, Prentice Hall of India
5. Advanced Electronic Communication Systems, W. Tomasi, PHI Learning Pvt Ltd

Course Code: PH-DSE-VC
Course Title: Space Physics Lab
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Lab-04

Course Objectives:

1. To familiarise students with basic tools used in the study of Space Physics
2. To provide students with hands on training of parameters associated to Space Physics study

Lists of Experiments:

1. Measurement of Ozone using a microtops II Ozonometer and comparison with satellite observations.
2. Measurement of aerosol optical thickness using a microtops II Sunphotometer.
3. Study of aerosol optical depth using a multi wavelength radiometer.
4. Measurement of aerosol elemental (black) Carbon using an aethalometer.
5. Study of temporal and spatial variation of foF2 in the Indian zone ionosphere.
6. Measurement of total electron content at Dibrugarh using a GPS TEC and scintillation monitor.
7. Study of the temporal variation of electron density over Dibrugarh using a Canadian advanced digital ionosonde.
8. Measurement of toxic gases using a direct sense toxic gas monitoring kit.
9. Measurement of surface ozone using 2B tech surface Ozone monitor.
10. Measurement of radiative forcing at Dibrugarh using the SBDART model.
11. Development of simple models of the atmosphere.
12. Study of the variations in the earth's magnetic field.

Mode of Assessment/ Assessment Tools (%)

In Semester: 50	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	25
Viva Voce:	25
End Semester: 50	
Laboratory experiments:	50
(One experiment from the list of experiments to be performed)	

Expected Learning Outcome:

After completion of the paper

1. A student will be able to operate basic tools like Ozonometer, aethalometer, scintillation monitor etc.
2. The hands on experience will enable a student to pursue further study in experimental Space Physics curriculum

Suggested Readings:

1. Earth's Ionosphere, Plasma Physics and Electrodynamics, M C Kelley, Academic Press
2. The Solar Terrestrial Environment, J K Hargreaves, Cambridge University Press

3. Physics of Planetary Ionospheres, S J Bauer, Springer Verlag
4. Space Plasma Physics, A C Das, Narosa Publishing House
5. Radio Astronomy, J D Kraus, McGraw Hill

Course Code: PH-DSE-VD
Course Title: Laser Spectroscopy Lab
Nature of the Course: DSE
Total credits assigned: 04
Distribution of credits: Lab-4

Course Objectives:

Objective of the course is to

1. Use and handle spectroscopic instruments in laboratory
2. Understand the principles of laser spectroscopy through performance of experiments
3. Provide exposure in practical application of spectroscopic instruments.

List of Experiments:

1. Frank-Hertz Experiment
2. To study the vibrational spectra of I_2 molecule
3. To determine the value of e/m by Zeeman effect
4. To record the absorption spectra of an optically active sample and hence determine the extinction coefficient and optical depth or path length of the sample
5. To record the photoluminescence spectra of an optically active sample and hence calculate the radiative parameters

Mode of Assessment/ Assessment Tools (%)

In Semester: 50

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	25
Viva Voce:	25

End Semester: 50

Laboratory experiments:	50

(One experiment from the list of experiments to be performed)

Expected Learning Outcome:

On completion of the course, the student will be able to:

1. Handle various spectroscopic instruments in laboratory and use those in research
2. Demonstrate the uses of various laser spectroscopic instruments in the fields of interest

Suggested Readings:

1. Laser Spectroscopy II, Experimental Techniques, W. Demtröder, Springer
2. Introduction to IR and Raman Spectroscopy, N. Colthup, L. Daly, S. Wiberley, Elsevier
3. Topics in Applied Physics, Vol-14, Laser Monitoring of the Atmosphere, Editor- E. D. Hinkley, Springer Berlin Heidelberg.
4. Physics of Atoms and molecules, B.H. Brasden and C.J. Joachain, Prentice Hall.

GENERIC ELECTIVE COURSES

Course Code: PH-GE-IA
Course Title: Basic Quantum Mechanics
Nature of the Course: GE
Total Credit assigned: 4
Distribution of Credit: Theory-4

Course Objectives:
At the completion of this course, a student will be able to

1. Know about the development of modern Physics and the theoretical formulation of quantum mechanics.
2. Know the applications of quantum mechanics in solving physical problems.

Unit-wise distribution of Course contents with Unit-wise distribution of Weightage and Contact hours:

Unit I: Origin of Quantum Physics (L 12, Marks 12)
Blackbody radiation, Planck's quantum hypothesis; photo-electric effect; Compton scattering; De Broglie hypothesis, matter waves, Davisson-Germer experiment; wave-particle duality, two-slit experiment with electrons; Heisenberg's uncertainty principle; description of particles by wave packets, group and phase velocities, wave amplitude and wave functions.

Unit II: Formulation of Quantum Mechanics (L 18, Marks 18)
Properties of wave function, probabilistic interpretation; conditions for physical acceptability of wave functions; normalization; position, momentum and energy operators, Hamiltonian operator, expectation values; Schrodinger equation and dynamical evolution of a quantum state, stationary states, time independent Schrodinger equation, energy eigenvalues and eigenfunctions; superposition principle

Unit III: Quantum theory of Physical Systems (L 20, Marks 20)
One-dimensional infinite square well potential, bound states, energy eigenvalues and eigenfunctions; potential barrier, one-dimensional finite square well potential, Tunneling effect; one-dimensional harmonic oscillator problem; time independent Schrodinger equation in spherical co-ordinates, separation of variable method; theory of Hydrogen atom

Unit IV: Angular Momentum (L 10, Marks 10)
Quantum theory of orbital angular momentum; Stern-Gerlach experiment, spin angular momentum

Mode of Assessment/ Assessment Tools (%)

In Semester: 40
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.: 20
Written Test: 20
End Semester: 60
Written Test: 60
(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
The student will be able to
1. Understand the applications of quantum mechanics in other areas of science.
2. Apply quantum theory to physical problems.

Suggested Readings:
1. Introduction to Quantum Mechanics, David J. Griffiths, Pearson
2. Quantum Mechanics Concepts and Applications, NouredineZettili, Wiley
3. Quantum Mechanics, Robert Eisberg and Robert Resnick, Wiley.
4. Quantum Mechanics, Leonard I. Schiff, Tata McGraw Hill.
5. Quantum Mechanics, G. Aruldhas, PHI

Course Code: PH-GE-IB
Course Title: Foundation of Electronics
Nature of the Course: GE
Total Credit assigned: 4
Distribution of Credit: Theory-4

Course Objectives:
At the completion of this course, a student will be able to

1. Know about the basics of semiconductor PN junction, its various types and its application to different electronic circuits.
2. Understand bipolar junction transistor and its applications as amplifier and oscillators.
3. Familiarize with operational amplifiers, its applications and analysis.
4. Develop knowledge about analog to digital and digital to analog conversion techniques

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Semiconductor Diodes (L 10, Marks 10)
P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity.PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width and Current for Step Junction. Current Flow Mechanism in Forward and Reverse Biased Diode.

Unit II: Two-terminal Devices and their Applications (L 6, Marks 6)
(1) Rectifier Diode: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, C-filter (2) Zener Diode and Voltage Regulation Principle and structure of (1) LEDs, (2) Photodiode and (3) Solar Cell.

Unit III: Bipolar Junction transistors (L 6, Marks 6)
n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β Relations between α and β. Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and Saturation Regions.

Unit IV: Amplifiers (L 20, Marks 20)
Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers.
Two stage RC coupled Amplifier and its frequency response.
Effect of positive and negative feedback on Input impedance, Output impedance, Gain, Stability, Distortion and noise.

Unit V: Sinusoidal Oscillators (L 5, Marks 5)
Barkhausen's Criterion for self-sustained oscillations. RC Phaseshift oscillator, determination of Frequency. Hartley &Colpitts oscillators.

Unit VI: Operational Amplifiers (Black Box approach) (L 13, Marks 13)
Characteristics of an Ideal and Practical Op-Amp. (IC 741) Open-loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and concept of Virtual ground. Inverting and non-inverting amplifiers, Adder, Subtractor, Differentiator, Integrator, Log amplifier, Zero crossing detector, Wein bridge oscillator.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20

End Semester: 60

Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
This course will enable the students to

1. Learn the foundation knowledge of analog electronic systems.
2. Learn the working and applications of PN junction and bipolar junction transistors (BJT).
3. Learn to analyze circuits containing PN junction and BJT along with the application of BJT as amplifiers and oscillators.
4. Develop basic knowledge of operational amplifier and its applications

Suggested Readings:

1. Electronic Principles, A Malvino, Tata Mc-Graw Hill
2. Electronic devices and circuit theory, Robert Boylested, Prentice Hall.
3. Electronics: Fundamentals and Applications, J.D. Ryder, Prentice Hall.
4. Solid State Electronic Devices, B.G.Streetman & S.K.Banerjee, PHI Learning
5. Electronic Devices & circuits, S. Salivahanan & N.S.Kumar, Tata Mc-Graw Hill
6. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, Prentice Hall

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Course Code: PH-GE-IC
Course Title: Fundamentals of Material Science
Nature of the Course: GE
Total Credit assigned: 4
Distribution of Credit: Theory-4

Course Objectives:
This course is intended to provide an introduction to
1. The structure of crystalline materials
2. The behaviour of conduction electrons in crystalline materials and the formation of energy bands
3. Various types of phenomena like magnetism and super-conductivity
4. Nanomaterials and their interesting properties

Unit-wise distribution of Course contents with Unit-wise distribution of Weightage and Contact hours:

Unit I: Crystallography (L 15, Marks 20)
Crystal structure, idea of a lattice, unit cell, Bravais lattices (two and three dimensions), typical crystal structures (SC, FCC, BCC, closed-packed structures), introduction to reciprocal lattice, Wigner-Seitz cell, Miller indices, introduction to reciprocal lattice, Brillouin zone.
X-ray spectra: Characteristic X-ray spectrum, Continuous X-ray spectrum, Moseley's law, X-ray Diffraction, Bragg's equation.

Unit II: Conduction electrons in Crystalline Solids (L 15, Marks 10)
Periodic potential, Bloch theorem, Kronig Penney model, electronic energy bands, E-k diagram, effective mass, metals, insulators and semiconductors.

Unit III: Magnetic Properties of Materials (L 10, Marks 8)
Introductory concepts of magnetic materials, para-, dia-, and ferromagnetic materials.

Unit IV: Superconductivity (L 10, Marks 10)
Introductory concepts, Meissner effect, type-I & type-II superconductors, London equations, thermodynamics of superconducting transition, idea of BCS theory.

Unit V: Nanostructured materials (L 10, Marks 12)
Introduction to nanomaterials, history and scope, interdisciplinary nature, surface to volume ratio, electronic structure, types of nanomaterials, applications of nanomaterials.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
This course will enable the students to
1. Differentiate between different lattice types and explain the concepts of reciprocal lattice and crystal diffraction
2. Predict electrical and thermal properties of solids and explain their origin
3. Explain the concept of energy bands and effect of the same on electrical properties
4. Explain various types of magnetic phenomenon
5. Explain superconductivity
6. Gather knowledge on the underlying principles governing the fascinating behavior of nanomaterials

Suggested Readings:
1. Solid State Physics, N. W. Ashcroft, N. David Mermin, Brooks/Cole
2. Introduction to Solid State Physics C. Kittel, John Wiley & Sons
3. Solid State Physics, A. J. Dekker, Macmillan India Ltd
4. Elementary Solid State Physics, M.A. Omar, Pearson Education
5. Crystallography Applied to Solid State Physics, A.R. Verma and O.N. Srivastava New Age International
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Course Code: PH-GE-IIA
Course Title: Thermal Physics
Nature of the Course: GE
Total Credits assigned: 04
Distribution of credit: Theory-04

Course Objectives:
At the completion of this course, a student will be able to

1. Develop knowledge of thermodynamical properties of matter.
2. Understand the thermodynamics present in allied fields like Materials science, Condensed matter Physics, Atmospheric Physics, Solar Physics, etc.

Unit-wise distribution of Course contents with Unit-wise distribution of Weightage and Contact hours:

Unit I: Zeroth and First Law of Thermodynamics (L 15, Marks 15)
Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient.

Unit II: Second Law of Thermodynamics (L 15, Marks 15)
Reversible and Irreversible process with examples, Conversion of Work into Heat and Heat into Work, Heat Engines, Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, 2^{nd} Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale.

Unit III: Entropy (L 15, Marks 15)
Concept of Entropy, Clausius Theorem. Second Law of Thermodynamics in terms of Entropy, Entropy of a perfect gas, Entropy Changes in Reversible and Irreversible processes with examples. Principle of Increase of Entropy. Temperature–Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero.

Unit IV: Distribution of Velocities (L 15, Marks 15)
Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification, Mean, RMS and Most Probable Speeds, Degrees of Freedom, Law of Equipartition of Energy (No proof required). Specific heats of Gases, Mean Free Path. Transport Phenomenon

Mode of Assessment/ Assessment Tools (%)

In Semester: 40
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.: 20
Written Test: 20
End Semester: 60
Written Test: 60
(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

This course will enable the students to

1. Develop critical and analytical thinking on thermodynamics and allied disciplines.
2. Use the concept of thermodynamics in real world experiences.

Suggested Readings:

1. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1958, Indian Press
3. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2^{nd} Edition, 1993, Tata McGraw-Hill
4. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
5. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
6. Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2^{nd} Ed., 2012, Oxford University Press
7. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications.

Course Code: PH-GE-IIB
Course Title: Classical Mechanics
Nature of the Course: GE
Total Credit assigned: 4
Distribution of Credit: Theory-4

Course Objectives:
1. Acquaint the learners with the Lagrangian and Hamiltonian formulation of mechanics
2. Enable the learners to understand the idea of normal modes and normal coordinates.
3. Introduce the students to rigid body dynamics

Unit-wise distribution of Course contents with Unit-wise distribution of Weightage and Contact hours:

Unit I: (L 15, Marks 15)
Review of Newtonian mechanics, Mechanics of a system of particles, Constraints of motion and their classification, Generalised co-ordinates, D' Alembert's principle, Lagrange's equations of motion, Hamilton's principle, Symmetries and conservation theorems, Cyclic coordinates.

Unit II: (L 15, Marks 15)
Motion in a central potential, equation of orbits, the Kepler problem, Small Oscillations: Solution of one-dimensional harmonic oscillator problem, Forced oscillations in one dimension, Damped harmonic motion in one dimension-general solution of the problem, coupled oscillation, normal modes and normal coordinates.

Unit III: (L 15, Marks 15)
Hamilton's equations of motion, Legendre's dual transformation, canonical transformations, generating functions, Poisson brackets

Unit IV: (L 15, Marks 15)
Linear transformations, rotations and rotating frames, similarity transformations, linear transformations and eigen value problem, dynamics in rotating reference frames.
Rigid Body Dynamics: Definition of Rigid body, Eulerian Angles, Euler's theorem, Angular momentum and kinetic energy, Moment of inertia tensor, Euler's equation of motion, Symmetrical top.

Mode of Assessment/ Assessment Tools (%)

In Semester:	**40**
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester:	**60**
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

1. Understand the basic concepts of Lagrangian and Hamiltonian dynamics
2. Understand the idea of normal coordinates and normal modes
3. Understand rigid body dynamics

Suggested Readings:

1. Classical Mechanics, R. D. Gregory, Cambridge University Press
2. Classical Mechanics, H. Goldstein, Addison Wesley
3. Classical Mechanics, N.C. Rana& P.S. Joag, Tata McGraw Hill
4. Classical Mechanics of Particles and Rigid Bodies, Kiran C Gupta, Wiley Eastern Limited
5. Introduction to Classical Mechanics, R.G. Takwale& P.S. Puranic, Tata McGraw Hill

Course Code: PH-GE-IIC
Course Title: Meteorology
Nature of the Course: GE
Total Credit assigned: 4
Distribution of Credit: Theory-4

Course Objectives:

1. Familiarize with the structure and composition of the atmosphere of Earth and other planets
2. Provide basic knowledge on the weather, climate and other aspects of atmosphere
3. Provide knowledge on meteorological parameters and their measurement techniques
4. Familiarize with weather forecasting

Unit-wise distribution of Course contents with Unit-wise distribution of Weightage and Contact hours:

Unit I: Physical Meteorology (L 22, Marks 22)

Introduction to Planetary Atmosphere, structure and composition of the Atmosphere and other planets, Atmospheric thermodynamics- heat transfer in the atmosphere, warming and cooling of the Earth and its atmosphere, temperature controls, atmospheric stability, overview of meteorological parameters-wind speed and direction, temperature, humidity, pressure, solar radiation, rainfall, meteorological instruments, meteorological convention, graphical representation of the meteorological parameters, world climate systems

Clouds development and precipitation: Formation mechanism, classification and microphysics of Clouds, Fog, dew, mist, haze, forms and mechanism of Precipitation, role of clouds in climate system

Unit II: Dynamic Meteorology (L 20, Marks 20)

Atmospheric circulation-scales of atmospheric motion, vorticity, boundary layer and turbulence, wind types-local and global, factors affecting wind- pressure gradient force, Coriolis force, Friction, global circulation of the atmosphere, monsoons, atmospheric waves-gravity waves, Rossby waves, westerlies, Ocean- Atmosphere interaction-El Nino-La Nina,

Thunderstorms and tornados: types and formation mechanism, weather patterns: cyclone, typhoon, tornados

Unit III: Synoptic Meteorology (L 10, Marks 10)

Weather observations, weather maps, weather prediction tools and methods, numerical weather prediction, time range of forecasts, satellites and radars in weather prediction, weather forecasting using surface charts.

Unit IV: Environmental Meteorology (L 8, Marks 8)

Effect of meteorology on air pollution and climate-dispersion of air pollutants, air quality, climate variability and climate change, concept of chemical weather, urban impacts on meteorological parameters

Mode of Assessment/ Assessment Tools (%)

In Semester: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

A learner will be able to

1. Demonstrate the various atmospheric phenomena and their evolution
2. Use meteorological parameters to explain observations in Atmospheric Physics, Life Sciences, Environmental Science etc.
3. Apply the laws of Physics to explain Atmospheric phenomena
4. Opt for interdisciplinary research

Suggested Readings:

1. Meteorology for Scientists and Engineers, R Stull, Brooks/Cole, Thomson Learning
2. The Atmosphere: An Introduction to Meteorology, Frederick K. Lutgens, Edward J. Tarbuck, Illustrated by Dennis Tasa, PHI Learning Private Limited, Delhi
3. Basics of Atmospheric Science, A Chandrasekar, PHI Learning Private Limited, Delhi
4. Meteorology Today: An Introduction to Weather, Climate, and the Environment, C. Donald Ahrens, Cengage Learning
5. Environmental Meteorology, B Padmanabha Murty, I.K. International Publishing House Pvt. Ltd., Delhi
6. The Physics of Atmospheres, J Houghton, Cambridge University Press
7. Essentials of Meteorology, An invitation to the Atmosphere, C D Ahrens and R Henson, Cengage Learning

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Course Code: PH-GE-IID
Course Title: Elements of Modern Physics
Nature of the Course: GE
Total Credits Assigned: 04
Distribution of credits: Theory-04

Course Objectives:

At the completion of this course, a student will be able to

1. Understand the theoretical basis for the understanding of quantum Physics as the basis for dealing with microscopic phenomena.
2. Apply concepts of 20th Century Modern Physics to deduce the structure of atoms.
3. Explain the wave-particle duality of the photon.
4. Analyze the structure of matter at its most fundamental.
5. Develop insight into the key principles and applications of Nuclear Physics
6. Learn about different types of fundamental particles along with various elementary particles
7. Understand the basic principle of Laser

Unit-wise distribution of Course contents with Unit-wise distribution of Weightage and Contact hours:

Unit I: (L 15, Marks 15)

Quantum theory of Light, Blackbody Radiation; Photo-electric effect, Compton scattering. De Broglie hypothesis and matter waves, Wave-particle duality, Heisenberg uncertainty principle. Schrodinger equation for non-relativistic particles; physical interpretation of a wave function, probabilities and normalization of wave function; Particle in a box problem in one dimension - energy eigen values and eigen functions.

Unit II: (L 15, Marks 15)

Quantum numbers, Bohr's atomic model, spectral terms arising from L-S coupling and j-j coupling, selection rules and intensity rules, Doublet spectra of Na-atom.

X-ray spectra: Characteristic X-ray spectrum, Continuous X-ray spectrum, Moseley's law, X-ray Diffraction, Bragg's equation.

Unit III: (L 20, Marks 20)

Size and structure of atomic nucleus; Absence of electron in the nucleus as a consequence of the uncertainty principle, Nature of nuclear force, N-Z graph, Liquid Drop model: semi-empirical mass formula and binding energy, nuclear shell structure and magic numbers.

Radioactivity; Law of radioactive decay; Mean life and half-life; Qualitative ideas on Alpha decay; Beta decay; Gamma ray emission. Nuclear reactions, Fission and fusion, Nuclear reactor; Fusion and thermonuclear reactions driving stellar energy (brief qualitative discussions).

Elementary particles: classification, fundamental interactions.

Unit IV: (L 10, Marks 10)

Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40

Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:

This course will enable the students to

1. Gather knowledge about various concepts of Modern Physics such as quantum physics, atomic, nuclear physics and particle physics, Laser etc.
2. Successfully apply the same knowledge in solving problems in the field of Modern Physics.

Suggested Readings:

1. Concepts of Modern Physics, Arthur Beiser, McGraw-Hill.
2. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, Tata McGraw Hill
3. Introduction to Quantum Mechanics, David J. Griffith, Pearson Education.
4. Physics for scientists and Engineers with Modern Physics, Jewett and Serway, Cengage Learning.
5. Modern Physics, G. Kaur and G.R. Pickrell, McGraw Hill
6. Quantum Mechanics: Theory & Applications, A.K. Ghatak &S. Lokanathan, Macmillan
7. Lasers and Nonlinear Optics, B. B. Laud, New Age International

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ABILITY ENHANCENENT COURSES

Course Code: PH-AEC-IA
Course Title: Experimental Techniques
Nature of the Course: AEC
Total Credit assigned: 2
Distribution of Credit: Theory 2

Course Objectives:
At the completion of this course, a student will be able to
1. Understand the basic concepts of errors in measurements and techniques of data analysis.
2. Understand the principle of sensors and transducers and OPAMP

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Data analysis techniques (L 8, Marks 8)
Data interpretation and analysis. systematic and random errors in measurement, expression of uncertainty, propagation of errors, Precision and accuracy, Error analysis, Least squares fitting, Linear and nonlinear curve fitting, chi-square test

Unit II: Transducers, Sensors and detectors (L 12, Marks 12)
Resistive (Potentiometer, Strain gauge-Theory, types, temperature compensation and applications), Capacitive (Variable Area Type-Variable Air Gap type-Variable Permittivity type), Inductive (LVDT) and piezoelectric transducers. Measurement of displacement, velocity and acceleration (translational and rotational), Particle detectors.

Unit III: Electronic instrumentation (L 10, Marks 10)
Impedance matching, amplification (Op-amp based, instrumentation amp, feedback), shielding and grounding. Fourier transforms, lock-in detector, box-car integrator.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
This course will enable the students to
1. Identify the errors in measurement.
2. Analyze the working of various sensors and transducers.

Suggested Readings:

1. Instrumentation, Measurements and Analysis by BC Nakra and KK Choudhary, McGraw Hill Education India Pvt. Ltd.
2. Electronic Instrumentation and Measurement Techniques by W.D. Cooper and A. D. Helfrick, Prentice-Hall.
3. Electronic Instrumentation by H. S. Kalsi, Tata McGraw Hill.
4. Nuclear Radiation Detectors, by S.S. Kapoor, V. S. Ramamurthy, Wiley-Eastern Limited, Bombay)

Course Code: PH-AEC-IB
Course Title: Observational Astronomy
Nature of the Course: AEC
Total Credit assigned: 2
Distribution of Credit: Theory-2

Course Objectives:
1. Introduction to observational astronomy.
2. Familiarisation of Coordinate systems, telescopes and observational instruments (CCDs, filters, spectrographs)
3. Familiarisation of Observational methods and techniques.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Fundamentals of Astronomy (L 15, Marks 15)
Introduction to astronomy and astrophysics, stellar luminosity (apparent and absolute) and surface temperature, spectral classification, mass and their correlations, Hertzsprung-Russell diagram

Unit II: Distance Measurements and Observational Techniques (L 15, Marks 15)
Trigonometric parallax, magnitude system and scale, celestial coordinates, concept of time, astronomical telescopes, photometry, spectrophotometry, Modern image processing devices, multiwavelength astronomy (radio, x-ray, gamma-ray).

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
On successful completion of this course, students should be able to:
1. Develop the knowledge of handling telescopes and other modern image processing devices.
2. Describe the effects of the properties of light and Earth's atmosphere on astronomical observations, coordinate system for stars
3. Acquire the knowledge of photometry and multi wave astronomy

Suggested Readings:

1. Observational Astronomy, D. Scott Birney, Cambridge University Press.
2. The Cosmic Perspective, J. Bennettt, M. Donahue, N. Schneider and M. Voit, Pearson Addison Wesley.
3. An Introduction to Astrophysics, B. Basu, Prentice-Hall of India.
4. Astrophysics: Stars and Galaxies, K. D. Abhyankar, Orient Longman.
5. Spherical Astronomy, F. Brunnow, Van Nostrand.
6. Practical Astronomy, George L. Hosmer, John Wiley and Sons.

Course Code: PH-AEC-IIA
Course Title: Nano Structured Materials
Nature of the Course: AEC
Total Credit assigned: 2
Distribution of Credit: Theory-2

Course Objectives:
The aim of the course is to
1. Provide a systematic coverage and insight into the promising area of nano materials in order to facilitate the understanding of the nature and prospects for the field.
2. Discuss about various types of nanomaterials with specific examples of semiconducting nanomaterials in various dimensions and carbon-based nanomaterials, viz., fullerene and carbon nanotubes
3. Provide information about various synthesis and characterization techniques of nanomaterials
4. Discuss wide applications of nanomaterials

Unit-wise distribution of Course contents with Unit-wise distribution of Weightage and Contact hours:

Unit I: (L 10, Marks 10)
Introduction to nano-science and technology, history and scope, interdisciplinary nature, surface to volume ratio, electronic structure.
Types of nanomaterials, semiconducting nanomaterials: quantum dot, quantum wire, quantum well, idea of band structure, density of states, variation of density of state and band gap with crystal size, electron confinement in one, two and three dimensions, carbon nanomaterials: fullerene, carbon nanotube.

Unit II: (L 10, Marks 10)
Chemical and physical methods for synthesis of nanostructured materials, Applications of nanostructured materials.

Unit III: (L 10, Marks 10)
Nanomaterials characterization, instruments, principle of measurements, measurement techniques: X-ray diffraction, scanning electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, optical and vibrational spectroscopy.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
This course will enable the students to
1. Know the underlying principles governing the fascinating behavior of nanomaterials
2. Gather knowledge about some of the modern promising nanomaterials such as quantum dots, carbon nanotubes etc.

3. Learn the various methods for synthesis and characterization of nanomaterials as well as their wide variety of applications

Suggested Readings:

1. Updated materials/notes on individual topics will be provided during classes.
2. Introduction to Nanotechnology, Charles P. Poole, Jr. and Frank J. Owens, Wiley–Interscience.
3. Nano: The Essentials, T. Pradeep, McGraw Hill Education (India) Private Limited
4. Textbook of Nanoscience and Nanotechnology, B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, Universities Press-IIM

Reference Book:

1. Encyclopedia of Nanoscience and nanotechnology, Edited by Hari Singh Nalwa.

Course Code: PH-AEC-IIB
Course Title: Vacuum Technique
Nature of the Course: AEC
Total Credit assigned: 2
Distribution of Credit: Theory-2

Course Objectives:
1. To introduce the theory of vacuum to the students.
2. Comprehension of thermal and flow behaviour of gases at very low pressures.
3. Methods of achieving and measurement low pressures. Vacuum pumps and vacuum meters.

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: (L 15, Marks 15)
Production of Vacuum: Different types of vacuum pumps, Rotary pump, diffusion pump cryogenic pumps, cryosorption pumps, getter pump.
Vacuum materials: Absorption of gases, out gassing of materials, out gassing rates of vacuum materials, the permeation process, permeability of vacuum materials.

Unit II: (L 15, Marks 15)
Vacuum assembly techniques: Design and performance of high vacuum system.
Vacuum measurements: Leak detection, pressure measurements (McLeod, Pirani, Penning gauge), residual gas analysis, Bayard-Albert partial gas analysis, mass spectrometers.

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
Students will have achieved the ability to:
1. Recognize the importance of vacuum in modern technology and research
2. Basics of kinetic theory of gases, pressure, particle collisions, velocity and free trajectory
3. Vacuum pumps: classification, basic types, range of application; vacuum meters: classification, basic types and range of application.

Suggested Readings:

1. Vacuum Technology, A. Roth, Elsevier
2. Handbook of Vacuum Science and Technology, Dorothy M. Hoffman, John H. Thomas, Bawa Singh, Elsevier Science & Technology Books
3. High Vacuum Technique, J. Yarwood, Chapman and Hall Ltd.

Course Code: PH-AEC-IIC
Course Title: Meteorological Fundamentals
Nature of the Course: AEC
Total Credit assigned: 2
Distribution of Credit: Theory-2

Course Objectives:
1. Make familiar with the Earth's atmosphere as well as the weather and climate systems
2. Provide basic knowledge on meteorological parameters and their measurement techniques
3. Apply the laws of Physics to explain Atmospheric phenomena
4. Get familiar with weather forecasting

Unit wise distribution of course contents with unit wise distribution of weightage and contact hours:

Unit I: Meteorological fundamentals (L 10, Marks 10)
Basics of weather and climate, composition of the Atmosphere, structure of the atmosphere, Meteorological convention, definition and measurements of Meteorological parameters, solar radiation, heat transfer in the atmosphere, temperature controls, atmospheric stability, hydrostatic equilibrium

Unit II: Dynamics of the Atmosphere (L 10, Marks 10)
Scales of atmospheric motion, factors affecting wind (pressure gradient force, Coriolis force, Friction), types of wind, global circulation, monsoons, westerlies, El Nino-La Nina, Thunderstorms: types and formation mechanisms, weather patterns: cyclone, typhoon, tornados

Unit III: Clouds and Precipitation (L 5, Marks 5)
Formation, classification and microphysics of Clouds, Fog, dew, mist, haze, forms and mechanism of Precipitation, role of clouds in climate system

Unit IV: Weather analysis and forecasting (L 5, Marks 5)
Gathering meteorological data and weather maps, modern numerical weather prediction methods, ranges of forecasts, satellites in weather prediction

Mode of Assessment/ Assessment Tools (%)

In Semester: 40	
Assignment /Presentation/ attendance/ Class room interaction/quiz etc.:	20
Written Test:	20
End Semester: 60	
Written Test:	60

(Equal weightage to be assigned to each credit)

Expected Learning Outcome:
After completion of the course, a student will be able to
1. Demonstrate the various atmospheric phenomena and their evolution
2. Solve problems in the atmospheric sciences and related disciplines
3. Impart expertise in sub-disciplines of atmospheric science or related interdisciplinary areas
4. Develop skills for interpreting and applying atmospheric observation
5. Serve as a meteorologist, climate scientist, take part in policy making

Suggested Readings:

1. Meteorology for Scientists and Engineers, R Stull, Brooks/Cole, Thomson Learning
2. The Atmosphere: An Introduction to Meteorology, Frederick K. Lutgens, Edward J. Tarbuck, Illustrated by Dennis Tasa, PHI Learning Private Limited, Delhi, 11^{th} Edition
3. Basics of Atmospheric Science, A Chandrasekar, PHI Learning Private Limited, Delhi
4. Meteorology Today: An Introduction to Weather, Climate, and the Environment, C. Donald Ahrens, Cengage Learning
5. Environmental Meteorology, B Padmanabha Murty, I.K. International Publishing House Pvt. Ltd., Delhi
6. The Physics of Atmospheres, J Houghton, Cambridge University Press

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Course Code: PH-AEC-IID
Course Title: Dissertation/ Project
Nature of the Course: AEC
Total Credit assigned: 2

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

POSTGRADUATE PROGRAMME

Choice Based Credit System (CBCS)

(Academic Year 2021-22)

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So, it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
   - **2.1 Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
   - **2.2 Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
   - **2.3 Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

     P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
   - **3.1** AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
   - **3.2** AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Course and programme outcome of MSC

Profile

- The mission is to impart employability and creativity to the students, to live up to the standards of IT industry.
- Experienced faculty members with good capabilities.
- Faculty members with ample Industry experience and profound caliber.
- Valuable lectures delivered by renowned personalities from the reputed Industries, for the benefit of the students.
- State-of-the-art teaching resources, and well equipped labs, library etc.
- Students' seminar to increase the presentation, skills and their leadership qualities.
- Effective Industry Institute interaction is achieved through seminars, workshops and guest lectures. This encourages the professional discussion between the students and the participating managers from the industry. This also gives the students a chance to envisage their roles in the industry beforehand.
- Enhancing the knowledge of the students by interacting with the Industry skills, and their leadership qualities.

Program Offered: Post Graduate

- M.Sc - Master of Computer Science - 2 Years

VISION

To be the source of bringing out globally competent pioneering computing professionals, researchers, innovators and entrepreneurs and thereby succeed and contribute value to the knowledge-based economy and society.

MISSION

- To offer high-grade, value-based Post-graduate programme in the field of Computer Science.
- To provide conducive environment so as to achieve excellence in teaching-learning, and research and development activities.
- To bridge the gap between industry and academia by framing curricula and syllabi based on industrial and societal needs.
- To offer tasks for experiential technology-intensive knowledge through collaborative and interdisciplinary activities.
- To provide appropriate forums to develop innovative talents, practice ethical values and inculcate as enduring learners.
- To facilitate students to nurture skills to practice their professions competently to meet the ever-changing needs of society

Programme Educational Objective

PEOs of M.Sc programme are:

M.Sc programme of Noida International University will prepare its students for

PEO 1: To progress their career productively in software industry, academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services.

PEO 2: To achieve peer-recognition; as an individual or in a team; by adopting ethics and professionalism and communicate effectively to excel well in cross culture and inter-disciplinary teams.

PEO 3: To continue a lifelong professional development in computing that contributes in self and societal growth.

Programme Outcome: On completion of M.Sc degree, the graduates will be able to

PO1. Apply the knowledge of mathematics and computing fundamentals to various real life applications for any given requirement

PO2. Design and develop applications to analyze and solve all computer science related problems

PO3. Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects

PO4. Analyze and review literatures to invoke the research skills to design, interpret and make inferences from the resulting data

PO5. Integrate and apply efficiently the contemporary IT tools to all computer applications

PO6. Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations

PO7. Involve in perennial learning for a continued career development and progress as a computer professional

PO8. Function effectively both as a team leader and team member on multi-disciplinary projects to demonstrate computing and management skills

PO9. Communicate effectively and present technical information in oral and written reports

PO10. Utilize the computing knowledge efficiently in projects with concern for societal, environmental, and cultural aspects

PO11. Function competently as an individual and as a leader in multidisciplinary projects

PO12. Create and design innovative methodologies to solve complex problems for the betterment of the society

PO13. Apply the inherent skills with absolute focus to function as a successful entrepreneur.

NOIDA INTERNATIONAL UNIVERSITY

COURSE STRUCTURE (COMPUTER SCIENCE)
Details of courses under M.Sc

	Theory+ Practical	Theory + Tutorial
I. Core Course (14 Papers)	12X4= 48	12X5=60
Core Course Practical / Tutorial* (14 Papers)	12X2=24	12X1=12
II. Elective Course (8 Papers)		
A.1. Discipline Specific Elective **(4 Papers)**	4X4=16	4X5=20
A.2. Discipline Specific Elective Practical/ Tutorial* **(4 Papers)**	4 X 2=8	4X1=4
B.1. Generic Elective/ Interdisciplinary **(4 Papers)**	2X4=8	2X5=10
B.2. Generic Elective Practical/ Tutorial* **(4 Papers)**	2 X 2=4	2X1=2

- **Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6th Semester**

III. Ability Enhancement Courses

1. **Ability Enhancement Compulsory**		
(2 Papers of 2 credit each)	2 X 2=4	2 X 2=4
Environmental Science		
English/MIL Communication		
2. **Ability Enhancement Elective** (Skill Based)		
(Minimum 2)	2 X 2=4	2 X 2=4
(2 Papers of 2 credits each)		
Total credit	**108**	**116**

* **Wherever there is a practical there will be no tutorial and vice-versa**

M.Sc. (Hons) Computer Science

Core Papers (C): (Credit: 06 each)
(1 period/week for tutorials/practical or 4 periods/week for theory)

1. MCS01: Problem Solving With C (4 + 2)
2. MCS02: Advanced DBMS (4 + 2)
3. MCS03: Computer Organization and Architecture (4 + 2)
4. MCS04: Data Structure using C (4 + 2)
5. MCS05: Computer Networks (4 + 2)
6. MCS06: OOPS with JAVA (4 + 2)
7. MCS07: Python Programming (4 + 2)
8. MCS08: Operating System (4 + 2)
9. MCS09: Data Mining & Warehousing (4 + 2)
10. MCS010: Theory of Computation (4 + 2)
11. MCS011: Compiler Design / Cryptography & Network Security (4 + 2)
12. MCS012: Software Testing (4 + 2)
13. MCS013: Distributed Systems (4 + 2)
14. MCS014: DOT (.) NET Framework (4 + 2)

Discipline Specific Elective Papers: (Credit: 06 each) - DSE 1-4
(4 papers to be selected: 02 each for Odd semester and Even semester as listed below)

1. DSE01: Cloud computing (4 + 2)
2. DSE02: Cryptography and Network Security (4 + 2)
3. DSE03: Python (4) + Lab (2)
4. DSE04: Big Data (5) + Tutorial (1)
5. DSE05: Numerical Analysis(4) + Lab (2)
6. DSE06: Information Security Cyber Law(4) + Lab (2)
7. DSE07: Information Security (4) + Lab (2)
8. DSE08: Data Mining (4) + Lab (2)
9. DSE09: Operation Reseach (5) + Tutorial (1)
10. DSE10: Dissertation/ Project

Skill Enhancement Courses (02 to 04 papers) (Credit: 02 each) - SEC1 to SEC4

1. SEC01: Management Information System
2. SEC02: Web Technology
3. SEC03: Software Engineering
4. SEC04: Theory of Computation
5. SEC05: Microprocessor
6. SEC06: Digital Image Processing
7. SEC07: Machine Learning
8. SEC08: Data Mining
9. SEC09: Networking Programming

Generic Elective Papers (GE): (Credit: 06 each)

1. GE01: Internet Technologies (4) + Lab (2)
2. GE02: Advanced Industrial Communication (4) + Lab (2)
3. GE03: Hypertext Pre-Processor (4) + Lab (2)
4. GE04: Mobile Computing (4) + Lab (2)
5. GE05: Entrepreneurship (4) + Lab (2)

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for M.Sc. (Information Technology)
Effective from the Session: 2021-2022

M.Sc. (Hons) Computer Science 1st Year
SEMESTER-I

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	MCS-101	Problem Solving With C	4	0	0	20	20	40	60	100	4	C1
2	MCS-102	Data Mining and Warehousing	4	0	0	20	20	40	60	100	4	DSE-1
3	MCS-103	Computer Organization and Architecture	4	1	0	20	20	40	60	100	5	C2
4	MCS-104	Discrete Mathematics Structure	4	1	0	20	20	40	60	100	5	C3
5	MCS-105	Advanced Industrial Communication	4	1	0	20	20	40	60	100	5	GE1
Practical												
1	MCS-151	Problem Solving With C Lab	0	0	2			40	60	100	2	C1
2	MCS-152	Data Mining and Warehousing Lab	0	0	2			40	60	100	2	DSE-1
Total										**700**	**27**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

M.Sc. (Hons) Computer Science 1st Year
SEMESTER-II

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	MCS-201	Data Structure using C	4	0	0	20	20	40	60	100	4	C4
2	MCS-202	Computer Networks	4	1	0	20	20	40	60	100	5	C5
3	MCS-203	OOPS using JAVA	4	1	0	20	20	40	60	100	5	C6
4	MCS-204	Entrepreneurship and Corporate Communications	4	0	0	20	20	40	60	100	4	GE-2
5	MCS-205	Artificial intelligence /Cryptography and network security/information security	4	1	0	20	20	40	60	100	5	DSE2
Practical												
1	MCS-251	Data Structure using C Lab	0	0	2			40	60	100	2	C4
3	MCS-252	OOPS using JAVA lab	0	0	2			40	60	100	2	C6
Total										**700**	**27**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

M.Sc. (Hons) Computer Science 2nd Year
SEMESTER-III

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	MCS-301	Operating System	4	0	0	20	20	40	60	100	4	C7
2	MCS-302	Theory of Computation	2	1	0	20	20	40	60	100	5	SEC1
3	MCS-303	Advanced DBMS	4	1	0	20	20	40	60	100	5	8C
4	MCS-304	Python Programming	4	0	0	20	20	40	60	100	4	C9
5	MCS-305	Compiler Design/ Cryptography and Network Security	4	1	0	20	20	40	60	100	5	DSE-3
Practical												
1	MCS-351	Python Programming LAB	0	0	2			40	60	100	2	C9
2	MCS-352	Operating System LAB	0	0	2			40	60	100	2	C7
Total										**700**	**27**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

M.Sc. (Hons) Computer Science 2nd Year
SEMESTER-IV

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	MCS-401	Software Testing	4	1	0	20	20	40	60	100	5	C10
2	MCS-402	Software Engineering	4	1	0	20	20	40	60	100	5	SEC-2
3	MCS-403	Dot (.) NET Framework	4	0	0	20	20	40	60	100	4	C11
4	MCS-404	Distributed System	4	1	0	20	20	40	60	100	5	C12
5	MCS-405	Industrial Project	0	0	6	20	20	40	60	200	6	DSE-4
Practical												
1	MCS-451	Dot (.) NET Framework LAB	0	0	2			40	60	100	2	C11
Total										**700**	**27**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

OVERALL CREDIT SCHEME

S. No.	SEMESTER	Theory Total	Practical Total	Subject Total	Total Credit
1	I	500	200	700	27
2	II	500	200	700	27
3	III	500	200	700	27
4	IV	400	300	700	27
			Grand Total	**2800**	**108**

SEMESTER 1

Course Code: MCS101
Course Name: Problem Solving with C
Course Credit Hour: 4hr
Total Contact Hour: 60hr

Course Objective:

- The course is intended to create an understanding of the fundamentals of high-level structural programming concepts through the medium of C language.
- C language is a general purpose, procedural computer programming language.

Course Outcome:

- The students will be able to solve problems systematically and to implement the solution in C language.
- Develop programming skills.
- Develop the knowledge of how to learn a programming language, which will help in learning other Computer Languages in the curriculum

Course Description:

- The course is used to demonstrate the understanding of computer programming languages.
- Able to define data types and use them in simple data processing applications also student must be able to understand the concept of array of structures.

Course Contents:

- **Unit – I: C Fundamentals:** Character Set, Identifier & Keywords, Data Types, Variables, Operators and expressions, Symbolic Constants, Preprocessor Directives, and Library Functions.
- **Unit – II: Control Structure and Functions:** If statement, if-else statement, nested if-else, conditional operators, while, do-while and for loop, multiple initializations of for loop, break and continue statement. Function definition, passing values between functions, call by value and call by reference.
- **Unit – III: Arrays and Structure:** Definition and classification of arrays, string definition and standard library string functions, defining a structure, Array vs Structure, Initialization of a structure, Nested structure.
- **Unit – IV: Pointers and File Handling:** Pointers variables, Pointer operator, array of pointer, pointers to functions, dynamic allocation functions, File I/O: Types of I/O, console I/O functions sfrintf() and sscanf() functions, file operations, file opening modes, record I/O in files

Course learning Outcome:

- **CLO1:** this unit is to develop an understanding of basic character sets keywords and identifiers used for the c programming dataset. Learning objective of this unit is defining data types and uses them in simple data processing applications.
- **CLO2:** the learning objective here is to identify and put to use basic loops, conditional loops and iterative loops. Various break statements and call by value and reference are understandable in this unit.
- **CLO3:** This unit is to classify basic arrays and structures, various standard library functions, nested structures etc.
- **CLO4:** this unit is for learning console I/O, various functions and modes for file opening closing and recording I/O.

Textbooks:

1.Let Us C: Yashvant Kanitkar[BPB]
2.C The Complete Reference,rdSchildt, TMH
3.Practical C Programming,3 Ed,Oualline,SPD/O'REILLY

Reference books:

1. Programming in C, Schaum Outline, McGraw-Hill 3
2.Lab Manual for Basic Linux commands, to be provided by the department

Online links for study & reference materials:

https://lecturenotes.in/download/note/18532-note-for-cprogramming-by-anshuman

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCS102 **Course Name :** Data Mining and Warehousing
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- This course gives an introduction to methods and theory for development of data warehouses and data analysis using data mining. Data quality and methods and techniques for preprocessing of data. Modeling and design of data warehouses. Algorithms for classification, clustering and association rule analysis.

Course outcome :

- Understand theoretical and practical aspects of information and data mining
- Understand the quantitative evaluation methods for the IR systems and data mining techniques

Course Description :

- Data preprocessing and data quality.
- Modeling and design of data warehouses.
- Algorithms for data mining.

Course Contents :

- **UNIT-1: Introduction to Data mining**, types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data: Data Set, Summary Statistics, Visualization, OLAP and multi-dimensional data analysis.
- **UNIT-II: Classification:** Basic Concepts, Decision Trees and model evaluation: General approach for solving a classification problem, Decision Tree induction, Model over fitting: due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier. Nearest Neighborhood classifier, Bayesian Classifier, Support vector Machines: Linear SVM, Separable and Non Separable case.
- **UNIT-III: Association Analysis:** Problem Definition, Frequent Item-set generation, rule generation, compact representation of frequent item sets, FP-Growth Algorithms. Handling Categorical, Continuous attributes, Concept hierarchy, Sequential, Sub graph patterns
- **UNIT-IV: Clustering:** Over view, K-means, Agglomerative Hierarchical clustering, DBSCAN, Cluster evaluation: overview, Unsupervised Cluster Evaluation using cohesion and separation, using proximity matrix, Scalable Clustering algorithm
- **UNIT-V: Web Data Mining:** Introduction, Web terminology and characteristics, Web content mining, Web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of WebPages, Enterprise search

Course learning outcome:

- **CLO1 :** to have an Overview and Definition of Data Warehousing Components, 8 Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse
- **CLO2:** : Data Cleaning: Missing Values, Noisy Data,(Binning, Clustering, Regression, Computer and Human inspection),Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Decision Tree.
- **CLO3**: To familiar with principles Warehousing Strategy, Warehouse management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, , Data Extraction, Cleanup & Transformation Tools, Warehouse Metadata
- **CLO4** :To familiar with Classification: Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases
- **CLO5:** To familiar with Data Visualization and Overall Perspective: Aggregation, Historical 8 information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery

Text books :

1.Alex Berson, Stephen J. Smith "Data Warehousing, Data-Mining & OLAP", TMH
2.mark Humphries, Michael W. Hawkins, Michelle C. Dy, " Data Warehousing: Architectureand Implementation", Pearson

Online links for study & reference materials :

https://www.dei.unipd.it/~capri/SI/MATERIALE/DWDM0405.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MCS103 **Course Name:** Computer organization and Architecture
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- To facilitate the students, learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.
- To facilitate the students to be familiarized with the hardware components and concepts related to the input-output organization.
- To facilitate the students to be familiarized with the hardware components and concepts related to the memory organization.
- To facilitate the students to be familiarized with the concepts related to the 8086-micro controller like pin diagram, different types of registers and addressing modes.

Course Outcome:

- The students will be capable of using the methods to study of physical memory and various machine language codes.
- The students will get an overall view of computer architecture

Course Description:

- Computer architecture is a specification detailing how a set of software and hardware technology standards interact to form a computer system or platform. Computer architecture refers to how a computer system is designed and what technologies it is compatible with. There are three categories of computer architecture:
- System Design: This includes all hardware components in the system, including data processors aside from the CPU, such as the graphics processing unit and direct memory access. It also includes memory controllers, data paths and miscellaneous things like multiprocessing and virtualization
- Instruction Set Architecture (ISA): This is the embedded programming language of the central processing unit. It defines the CPU's functions and capabilities based on what programming it can perform or process. This includes the word size, processor register types, memory addressing modes, data formats and the instruction set that programmers use.
- Micro architecture: Otherwise known as computer organization, this type of architecture defines the data paths, data processing and storage elements, as well as how they should be implemented

Course Contents:

- **Unit-I:** Basis Computer Architecture, Functional Organization, Register Organization, Arithmetic and Logic Unit, Central Processing unit, Instruction Formats. CPU architecture, instruction format, addressing mode, stacks and handling of interrupts. Assembly language - Elementary problems

- **Unit-II:** Addressing Modes. Data Transfer and Manipulation, interrupts RISC/CISC architecture. Register transfer and macro-operations, Register Transfer Languages (RTL). Arithmetic, Logic and Shift Macro-operations, Sequencing, Micro-program sequences.

- **Unit-III:** Memory & Storage: Processor Vs. Memory speed: Cache memory. Associative memory, Virtual memory and Memory management. Pipeline & vector processing

- **Unit-IV:** Input/ Output organization: Peripheral devices, I/O Asynchronous Data Transfer: Strobe Control, Data Transfer Schemes (Programmed, Initiated, DW, Transfer)

- Unit-V: Memory Hierarchy, Main Memory, Auxiliary Memory, Cache Memory

Course learning Outcome:

- **CO1.** This unit is for understanding function and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer.

- **CO2.** Machine instructions, Operands, addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.

- **CO3.** Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Micro programmed control unit

- **CO4.** Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Address t l ti H d t f t translation, Hardware support for memory manage.

- **CO5.** Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O Interrupt controlled I/O and DMA controlled I/O I/O interfaces Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infini Band, I/O peripherals - Input devices, Output devices, Secondary storage devices.

Text books :

- Moris Mano, “Computer System Architecture”, PHI Publications, 2002
- R. P. Jain, “Modern Digital Electronics”, TMH, 3rd Edition, 2003

Reference Books:

- Computer System Architecture (Third Edition),. Morris Mono - Pearson PrenticeHall,2007.

Online links for study & reference materials :

- http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

NOIDA INTERNATIONAL UNIVERSITY

Course Code: MCS104 **Course Name:** Discrete Mathematics Structure

Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- The course is aimed at general introduction to the subject of discrete mathematics and its relevance to computer science. We start with elements of logic with emphasis on propositional logic and predicate calculus. Next we discuss sets and functions and develop the concepts of floor and ceiling functions and their use in computer science. The important topic of growth of functions and the methods of estimating the order of growth with the big-O, big-Omega, and big-Theta are discussed. After introducing algorithms, we pass on to principle of mathematical induction which is an important tool for proving general results. Counting techniques, relations, graphs and trees are also discussed at some length.

Course Outcome:

- The students will be capable of using the mathematical methods and algorithms learned for analyzing and solving problems related to Computer Science.
- The students will get an overall view of concepts in probability and statistics.

Course Description:

- The subject is very important in forming the basics for algorithms, complexity and computational theory. The concept of Boolean algebra is useful in not only creating logical solution but is very important as a critical programming skill too.

Course Contents:

- **Unit - I: Mathematical Logic:** Statements and notations, Connectives, Well-formed formulas, Truth tables, tautology, equivalence implication, Normal forms, Theory of inference for the statement calculus, Rules of inference, Consistency of premises and indirect method of proof, Automatic Theorem Proving Predicate calculus: Predicates, statement functions, variables and quantifiers, predicate formulas, free & bound variables, universe of discourse, inference theory of predicate calculus

- **Unit - II: Set theory & Relations:** Introduction, Relations and ordering, Properties of binary Relations, Equivalence, Compatibility Relations, Partial ordering, Hasse diagram. **Functions:** composition of functions, Inverse Function, Recursive Functions, Lattice and its Properties, Pigeon-hole Principles and its application.
  Algebraic structures: Algebraic systems, Examples and general properties, Semi groups and monoids, groups, sub groups, Definitions, Examples, homomorphism, Isomorphism and related problems.

- **Unit - III: Elementary Combinatorics:** Basis of counting, Enumeration of Combinations & Permutations, Enumerating of Combinations & Permutations with repetitions and constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, principles of Inclusion – Exclusion.

- **Unit - IV: Recurrence Relations:** Generating Function of Sequences, Calculating Coefficient of generating functions, Recurrence relations, Solving recurrence relation by substitution and Generating functions, the method of Characteristic roots, Solution of Inhomogeneous Recurrence Relation.

- **Unit - V: Graph Theory:** Representation of Graph, Spanning Trees, BFS, DFS, Krushkal's Algorithm, Binary trees, Planar Graphs, Graph Theory and Applications, Basic Concepts, Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers.

Course learning outcome:

- **CO1.** The students will be able to understand the concept of functions and various relations as well as function mappings performed. The concept of algebraic structures and manipulations using various axioms is performed Introduction to partially ordered sets and conditions necessary for a poset to qualify as a lattice. Lattice homomorphism and practice problems on the same.

- **CO2.** Concept of mathematical logic, arguments and reasoning. Conjunction, disjunction and negation of statements. Wff, the concept of free and bounded variables. Tautology and equivalence relations and proof of contradiction.

- **CO3.** This unit is for introduction to the basics of counting. Permutations and combinations. Principal of inclusion- exclusion and practice for the same.

- **CO4.** Students will be able to have an understanding of various methods of generating coefficient of functions. Recurrence relation by substitution and generating root solution for homogeneous recurrence relation.

- **CO5.** This unit covers the graph representation. Various types of graphs and graph isomorphism, paths circuits and sub graphs. Multi-graphs, Euler circuits Euler paths, Hamiltonian graphs and chromatic representation of graphs.

Text books:

- Discrete mathematical structures with applications to computer science Trembly J.P. & Manohar. P, TMH
- Discrete mathematics and its applications, Kenneth H. Rosen, 5th edition. TMH

Reference Books:

- Discrete mathematical structures, bernand kolman, roberty C.
- Discrete maths and problems thomas koshey, Elsevier.

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Online links for study & reference materials :

- https://mathworld.wolfram.com/DiscreteMathematics.html
- https://mls.cs.fiu.edu/fajkkmnmh/16-lonzo-mayert-i-1/BRe4S4kyV-discrete-mathematics-with-graph-theory-9789382127185.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCS 105 **Course Name: Advance Industrial Communication**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- To create an understanding in the mind of the student regarding formal and professional communication practised in a professional environment .

Course Description:

- In the present industrial scenario the role of instrumentation is becoming more vital day by day specially in case of industrial automation. More advanced, precise and complex instrumentations are being employed in the industry. These advance instruments requires communication of data from equipment/machines to instruments and vice versa for process and quality control.

Course Contents :

- **Unit - I: (Business Communication) :**Difference between general and business communication, this should cover general and technical writing, oral communications and listening skill
- **Unit - II : (Expression)** Practical communication skill development, business presentation with multimedia, speaking skill, prepared speech, extempore speech
- **Unit - III :(Reading Skills)** Reading skill: comprehension test, technical report writing: precise, technical/business letter, organization of writing material, poster presentation

- **UNIT-IV (Literature) :**Of Studies: Francis Bacon
- **UNIT-V (Presentation) :**Writing technical document, preparing software user manual, preparing project documentation.

Course learning outcome :

- **CO1.** this unit is for understanding general business communication.
- **CO2.** this unit is for understanding skill development and confidense development.
- **CO3.** reading skills are extremely important for any type of business communication.
- **CO5.** writing technical documentation

Text books:

- Business Correspondence & Report Writing, Sharma, TMH 2.Business Communication Strategies, Monipally, TMH

- English for Technical Communication ,Laxminarayanan,Scitech
- Business Communication, Kaul,PHI

Online links for study & reference materials:

- https://mgdic.files.wordpress.com/2016/12/3361704-industrial-data-communication.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

MCS-151- C-Programming Lab-

MCS-152- Data Mining and Warehousing Lab

SEMESTER 2

Course Code: MCS 201 **Course Name: Data Structures using C**
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- The objective of the course is to teach programming (with an emphasis on problem solving) and introduce elementary data structures. The student should, at a rudimentary level, be able to prove correctness (loop invariants, conditioning, etc) and analyze efficiency (using the `O' notation).

Course Description :

- Design correct programs to solve problems.
- Choose efficient data structures and apply them to solve problems.
- Analyze the efficiency of programs based on time complexity.
- Prove the correctness of a program using loop invariants, pre-conditions and post-conditions in programs

Course Contents:

- **Unit – I: Arrays:** Representation of single and multidimensional arrays; sparse arrays - lower and upper triangular matrices and Tri-diagonal matrices

- **Unit – II:** .**Stacks and Queues**: Introduction and primitive operations on stack; Stack application, Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion from infix to postfix, Introduction and primitive operation on queues.

- **Unit – III: Lists**: Introduction to linked lists; Sequential and linked lists, operations such as traversal,insertion, deletion, searching, Two way lists and Use of headers. **Trees**: Introduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion, deletion; threaded trees, binary search trees, trees in search algorithm. B- tree. B+ tree and applications.

- **Unit – IV: Sorting Techniques**: Insertion sort, selection sort, merge sort, heap sort.
  Searching Techniques: Linear search, binary search and hashing

- **Unit - V :File structure:** physical storage devices and their characteristics, constituents of a file viz. fields,records, fixed and variable length records, primary and secondary keys; file operations, basic filesystem operations, file organizations:

serial sequential, index sequential, direct , inverted, hashing function and collision handling methods

Course learning outcome :

- **CLO1 :** this unit is to Review of Problem Solving using computers, Abstraction, Elementary Data Types. Algorithm design- Correctness via Loop invariants as a way of arguing correctness of programs, preconditions, post conditions associated with a statement.develop a understanding of basic character sets keywords and identifiers used for the c programming dataset. Learning objective of this unit is define data types and use them in simple data processing applications .
- **CLO2:** Introduction to stacks , arrays and queues. Difference and various use case.
- **CLO3**: This unit is to introduce lists and tree terminology . introduction to graphs and trees .
- **CLO4** : various sorting techniques. Insertion , bubble etc.
- **CLO5:** this unit is for learning different modes of file storage. Records and there usage .

Text books:

- Data Structures and Algorithm Analysis in C++, by Mark Allen Weiss (Pearson 2007)

Reference books :

- Data structures and Algorithms in C++ -- by Adam Drozdek (1994 2001).
- How to solve it by Computer -- by R G Dromey (PHI 1982, Paperback 2008).
- Fundamentals of Data Structures in C -- by Horowitz, Sahni and Anderson-Freed (Silicon Press 2007).
- Data Structure Using C and C++ -- by Y. Langsam, M. J. Augenstein and A. N. Tanenbaum (Pearson Education, 2nd Edition, 2015).

Online links for study & reference materials :

https://slideplayer.com/slide/5987087/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCA202 **Course Name :** Computer Networks
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- The main emphasis of this course is on the organization and management of local area networks (LANs). The course objectives include learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and gaining practical experience in installation, monitoring, and troubleshooting of current LAN systems.
- The course introduces computer communication network design and its operations. The course includes the following topics: Open Systems Interconnection (OSI) communication model; error detection and recovery; local area networks; bridges, routers and gateways; network naming and addressing; and local and remote procedures.

Course outcome :

- The students will gain proficiency in various network protocols and models.

Course Description :

- Describe how computer networks are organized with the concept of layered approach.
- Implement a simple LAN with hubs, bridges and switches.
- Describe how packets in the Internet are delivered.
- Analyze the contents in a given Data Link layer packet, based on the layer concept. Design logical sub-address blocks with a given address block.
- Decide routing entries given a simple example of network topology

Course Contents :

- **Unit – I: Data communications concepts**: Digital and analog , parallel and serial, synchronous and asynchronous, simplex, half duplex, duplex, multiplexing, Transmission media: Wired(physical): Twisted pair, Coaxial cable, Optical Fiber.

Communication switching techniques: Circuit switching, message switching, packetswitching.

- **Unit – II: .Introduction to Computer Network** : Network Topologies, Types of Network, OSI and TCP/IP Models: Layers and their functions, comparison of models. **Data Link Layer Fundamentals**: Framing, Basics of Error Detection, Forward ErrorCorrection, Cyclic Redundancy Check codes for Error Detection.

- **Unit – III: Media Access Protocols :** The advantages of Multiple-Access Sharing of Channel Resource, ALOHA, Carrier Sense Multiple Access (CSMA),

CSMA with Collision Detection (CSMA/CD), Token Ring, Token Bus, Asynchronous Transfer Mode (ATM).

- **Unit – IV: Network Layer:** Host to Host Delivery: IP Addressing and Routing, Gateway, N/W Layer Protocols: ARP, IPV4, ICMP, IPV6. **Transport Layer:** Process-to-Process Delivery: UDP, TCP Congestion Control & Quality of Service**.**

- **Unit - V :Application Layer:** Client Server Model, Domain Name System (DNS), E-mail (SMTP), File Transfer (FTP) and Model TCP/IP.

Course learning outcome :

- **CLO1 :**Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
- **CLO2:** : Have a basic knowledge of the use of cryptography and network security.
- **CLO3**: Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols.
- **CLO4** : Analyze, specify and design the topological and routing strategies for an IP based networking infrastructure
- **CLO5:** Have a working knowledge of datagram and internet socket programming

Text books :

- A.S. Tanebaum : Computer Networks (4th ed.), Prentice-Hall of India.
- W. Tomasi : Introduction to Data Communications and Networking, Pearson, Education.
- P.C. Gupta : Data Communications and Computer Networks, Prentice-Hall of India.

Reference books :

- Behrouz Forouzan and S.C., Fegan : Data Communications and Networking, McGrawHill.
- L.L. Peterson and B.S. Davie : Computer Networks : A system Approach, MorganKaufmann.
- William Stalilngs : Data and Computer Communications, Pearson Education

Online links for study & reference materials :

http://www.svecw.edu.in/Docs%5CCSECNLNotes2013.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCS203 **Course Name :** oops using JAVA
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- This course focuses on the advantages of the OO paradigm and domain modeling in reducing the representational gap between a target domain and the software application itself. Minimizing this gap leads to more effective solutions that are both flexible and robust. The modeling notation taught and used in conjunction with the course is the industry standard UML (Unified Modeling Language) 2.0.
- UML provides a programming language independent framework for the analysis, design, programming and testing of software applications. Using a combination of UML and various techniques for analysis and design.
- the course relates Object Oriented concepts to modeling complex problems. Models built using these techniques have a very high success rate when turned into working code.

Course outcome :

- Design the classes needed, given a problem specification.
- Implement the designed classes using the object oriented programming language.
- Learn how to test, verify, and debug object-oriented programs and create programs using object oriented principals

Course Description :

- Learn the three pillars of building a system; The Model, The Process, The Best Practices
- Have a good, working definition of object-oriented programming
- Understand the object oriented model, including types, objects, encapsulation, abstraction, messaging, protocols, inheritance, polymorphism, relationships, and coupling, strengths and weaknesses
- Understand the concept of representational gap between an application and its targeted domain
- Relate how Domain Modeling minimizes the representational gap between domain and application
- Learn how to read and create the most important UML diagrams

Course Contents :

- **UNIT–I: Basics of Object Oriented Programming (OOP):** Need for OO paradigm , A way of viewing world- Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of OOP concepts, coping with complexity, abstraction mechanisms.

Java Basics: Data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects- concepts of classes, objects, constructors methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

- **UNIT–II: Inheritance:** Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism, abstract classes.

  Packages and Interfaces: Defining, Creating and Accessing a package, Understanding CLASSPATH, Importing packages, differences between classes and interfaces, defining an interface, Implementing interface, applying interfaces variables in interface and extending interfaces.
- **UNIT–III: Exception handling and Multithreading**: Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throws and finally, built in exceptions, creating own exception sub classes. Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups
- **UNIT–IV: Event Handling:** Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy , user-interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, list panes- scroll pane, dialogs, menu bar, graphics, layout manager- layout manager types- boarder, grid, flow, card and grid bag.
- **UNIT-V: Applets:** Concepts of Applets, differences between applets and applications, lifecycle of an applet, types of applets, creating applets, passing parameters to applets,

  Swings: Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons-The JButton class, Check boxes, Radio Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees and Tables.

Course learning outcome :

- **CLO1 :** basics of object learning medhology and concepts of class creation and object interaction
- **CLO2:** : Have a basic knowledge of the use of attributes , objects, methods etc.
- **CLO3**: To understand Class Modeling and Design Approaches: Three approaches for identifying classes - using Noun phrases, Abstraction,

Use Case Diagram. Comparison of approaches. Using combination of approaches

- **CLO4** :Techniques for Interaction diagrams: Sequence diagram - Sequence diagram notations and examples, iterations, conditional messaging, branching, object creation and destruction, time constraints, origin of links, Activations in sequence diagram
- **CLO5:** developing dynamic systems: Top - down approach for dynamic systems. Bottom - up approach for dynamic systems. Flexibility Guidelines for Behavioral Design

Text books :

- Designing Flexible Object Oriented systems with UML - Charles Ritcher
- object Oriented Analysis & Design, Sat/.inger. Jackson, Burd Thomson
- Object oriented Modeling and Design with UML - James Rumbaugh. Micheal Blaha (secondedition)

Reference books :

- The Unified Modeling Language User Guide - Grady Booch, James Rumbaugh, IvarJacobson.
- Oriented Modeling and Design - James Rumbaugh
- Teach Yourself UML in 24 Hours - Joseph Schmuilers

Online links for study & reference materials :

https://www.vssut.ac.in/lecture_notes/lecture1423183198.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCS204 **Course Name:** Entrepreneurship and Corporate Communications

Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- To create an understanding in the mind of the student regarding formal and professional communication practiced in a professional environment .

Course outcome :

- Master the art of a professional business presentation •
- Distinguish different communication process and its practical application

Course Description:

- In the present industrial scenario the role of instrumentation is becoming more vital day by day specially in case of industrial automation. More advanced, precise and complex instrumentations are being employed in the industry. These advance instruments requires communication of data from equipment/machines to instruments and vice versa for process and quality control.

Course Contents :

- Unit - I: (Business Communication) :Difference between general and business communication, this should cover general and technical writing, oral communications and listening skill

- Unit - II : (Expression) Practical communication skill development, business presentation with multimedia, speaking skill, prepared speech, extempore speech

- Unit - III :(Reading Skills) Reading skill: comprehension test, technical report writing: precise, technical/business letter, organization of writing material, poster presentation

- UNIT-IV (Literature) :Of Studies: Francis Bacon

- UNIT-V (Presentation) :Writing technical document, preparing software user manual, preparing project documentation.

Course learning outcome :

- **CO1.** this unit is for understanding general business communication.
- **CO2.** this unit is for understanding skill development and confidense development.
- **CO3.** reading skills are extremely important for any type of business communication.
- **CO5.** writing technical documentation

Text books :

- Business Correspondence & Report Writing, Sharma, TMH 2.Business Communication Strategies, Monipally, TMH
- English for Technical Communication ,Laxminarayanan,Scitech

- Business Communication, Kaul,PHI

Online links for study & reference materials :

- https://mgdic.files.wordpress.com/2016/12/3361704-industrial-data-communication.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCS 205 | **Course Name : Information Security and Cyber Law**

Course Credit Hour : 4hr | **Total Contact Hour : 60hr**

Course Objective :

- The goal of this course is for students to maintain an appropriate level of awareness, knowledge and skill on the disciplines of technology, business and law to allow them to minimize the occurrence and severity of information security incidents. The students will learn techniques used to detect, respond to, and prevent network intrusions.
- The course bear a strong adherence to computer based technological skills and capabilities, and thereby resulting in efficiency to handle a variety of issues related to Information and Cyber Security in any organization.

Course Description :

- Understanding Intelligence
- Understanding Cyber Threat Intelligence

Course Contents :

- **Unit – I:** History of Information Systems and its Importance, basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages.

- **Unit – II:** Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles. Security Threats to E Commerce, Virtual Organization, Business Transactions on Web, E-Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards.

- **Unit – III:** .Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges.
- **Unit – IV:**Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls, Design and Implementation Issues, Policies.Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection.

- **Unit - V** Laws, Investigation and Ethics: Cyber Crime, Information Security and Law, Types & overview of Cyber Crimes, Cyber Law Issues in E-Business Management.Overview of Indian IT Act, Ethical Issues in Intellectual property rights, Copy Right, Patents, Data privacy and protection, Domain Name, Software piracy, Plagiarism, Issues in ethical hacking.

Course learning outcome :

- **CLO1 :**Threats, Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, Spoofing, Sniffing, Firewall.
- **CLO2:** : Have a basic knowledge of the use of confidentiality , data integrity . **CLO3**: To understand Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteriafor selection of biometrics.
- **CLO4** :Techniques, Mathematical foundation, Stream Ciphers, Block Ciphers, Cryptanalysis, Hash Algorithms.
- **CLO5:** Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES. Hash Functions and Message Digests:

Text books :

- Godbole,“ Information Systems Security”, Willey
- Merkov, Breithaupt,“ Information Security”, Pearson Education

Reference books :

- Yadav, “Foundations of Information Technology”, New Age, Delhi
- Schou, Shoemaker, “ Information Assurance for the Enterprise”, Tata McGraw Hill
- Sood,“Cyber Laws Simplified”, Mc Graw Hill
- Furnell, “Computer Insecurity”, Springer.

Online links for study & reference materials :

https://www.vssut.ac.in/lecture_notes/lecture1423183198.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

MCS-251: Data Structure Using C Lab-
MCS-252: OOPS with java- Lab

SEMESTER 3

Course Code : MCS301
Course Credit Hour : 4hr
Course Name : Operating System
Total Contact Hour : 60hr

Course Objective :

- To study concepts related to operating systems, like process management, concurrency and control of processes, deadlocks, memory management, processor and disk scheduling, parallel processing, and file system organization and implementation. Also to study different methods for protection and security that is becoming vital now-a-days.

Course outcome :

- The students will understand Operating System concepts and design Operating Systems

Course Description :

- To master the basic concepts related to operating systems. To learn in detail about process management.
- To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.
- To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.

Course Contents :

- **Unit – I:** Operating system and function, Evolution of operating system, Batch, Interactive, multiprogramming, Time Sharing and Real Time System, multiprocessor system, Distributed system, System protection. Operating System structure, Operating System Services, System Program and calls.

- **Unit – II:** Process concept, State model, and process scheduling, job and process synchronization, structure of process management, Threads interprocess Communication and Synchronization: Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Hardware Synchronization, Critical Regions, Conditional critical region, Monitor, Inter Process Communication. CPU Scheduling: Job scheduling functions, Process scheduling, Scheduling Algorithms, Non Preemptive and preemptive. Strategies, Algorithm Evaluation, Multiprocessor Scheduling.Deadlock: System Deadlock Model, Deadlock Characterization, Methods for handling deadlock, Prevention strategies, voidance and Detection, Recovery from deadlockcombined approach.

- **Unit – III:** Single Contiguous Allocation: H/W support, S/W support, Advantages and disadvantages, Fragmentation, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Swapping, Overlays
- **Unit – IV:**Principles of I/O hardware, Device controller, Device Drivers, Memory mapped I/O, Direct Access Memory, Interrupts, Interrupt Handlers, Application I/O interface, I/O Scheduling, Buffering, Caching, Spooling, Disk organization, Disk space management, Disk allocation Method, Disk Scheduling, Disk storage.
- **Unit - V :**File Concept, File Organization and Access Mechanism, File Directories, Basic file system, File Sharing,Allocation method, Free space management. Policy Mechanism, Authentication, Internalexcess Authorization.

Course learning outcome :

- **CLO1 :** To master the basic concepts related to operating systems. To learn in detail about process management.
- **CLO2:** : To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.
- **CLO3**: To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.
- **CLO4** :To familiar with file system implementation. To understand mass storage management functions of operating systems.
- **CLO5:** To familiar with Protection and security aspects of operating systems. To expose to other operating systems like distributed OS, Multi-processor OS, RTOS and Mobile OS.

Text books :

1. Operating systems concepts , galvin gagne , TATA-Mcgrawhill
2. Operating systems and applications , william stallings

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

NOIDA INTERNATIONAL UNIVERSITY

Course Code : MCS302 **Course Name :** Theory of Computation
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- Theory provides a simple, elegant view of the complex machine that we call a computer. Theory possesses a high degree of permanence and stability, in contrast with the ever-changing paradigms of the technology, development, and management of computer systems. Further, parts of the theory have direct bearing on practice, such as Automata on circuit design, compiler design, and search algorithms; Formal Languages and Grammars on compiler design; and Complexity on cryptography and optimization problems in manufacturing, business, and management.

Course outcome :

- Learn the theory and foundations of machine learning
- Learn the different process of syntax creation of low level language

Course Description :

- introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
- enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

Course Contents :

- **Unit – I:** Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition tabl e, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transi ion, Language of NFA, Equi valence of NFA and DFA, Minimization of Finite Automata, Distinguis hing one string from other, Myhill-Nerode Theorem
- **Unit – II:** Regular expression (RE) , Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression toFA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages . Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

- **Unit – III:** Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation , Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.
- **Unit – IV:**Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA
- **Unit - V :**Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory

Course learning outcome :

- **CLO1 :** automata, computability, and complexity ,Mathematical tools, Definitions, theorems, and proofs
- **CLO2:** .Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression toFA, DFA to Regular expression
- **CLO3**: Understand recursive and recursively enumerable languages.
- **CLO4** :Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack
- **CLO5:** Understand Turing Machines and the simple primitive mechanisms needed for all computation

Text books :

1.Hopcroft, Ullman, "Introduction to Automata Theory,Languages andComputation", Pearson Education .
2K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science : Automata, Languagesand Computation", PHI Learning Private Limited, Delhi India.

Reference books:

1.Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
2.Y.N.Singh "Mathematical Foundation of Computer Science", New Age International.

Online links for study & reference materials :

http://www.cs.virginia.edu/~robins/cs3102/CS3102

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MCS303 **Course Name:** Advance Database Management system
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- This course introduces database design and creation. Emphasis is on data dictionaries, normalization, data integrity, data modelling, and creation of simple tables, queries, reports, and forms. Upon completion, students should be able to design and implement normalized database structures by creating simple database tables, queries, reports, and forms.

Course Outcome:

- The students will understand the fundamentals of relational, object-oriented, and distributed database systems including data models, database architectures, and database manipulations.
- Understand the theories and techniques in developing database applications and be able to demonstrate the ability to build databases.

Course Description:

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
- To understand and use data manipulation language to query, update, and manage a database
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Contents:

- **Unit - I:** Data base system vs. file system, data models, relational model, database languages, DDL, DML, database access for applications programs, data base users and administrator, transaction management, history of data base systems, data base design and ER diagrams, attributes and entity sets, relationships and relationship sets, additional features of ER model, concept design with the ER model, and conceptual design for large enterprises, Codds Rules.
- **Unit - II:** Data Base Design: Functional Dependency and Decomposition - Functional Dependency - Decomposition. Normalization - Introduction - Normalization - Normal Forms INF, 2NF, 3NF - BCNF - 4 NF - 5 NF.
- **Unit - III:** Examples of basic SQL queries, nested queries, correlated nested queries set, comparison operators, aggregative operators, NULL values, comparison using null values, logical connectivity, AND, OR and NOTR,

impact on SQL constructs, outer joins, disallowing NULL values, complex integrity constraints in SQL triggers and active data bases.

- **Unit - IV:** Data Base Recovery Systems: Introduction - Recovery Concepts - Types of Failures - Types of Recovery - Recovery Techniques - Buffer Management. Data Base Security: Goals - Firewalls - Data Encryption
- **Unit - V:** ACID properties, transactions and schedules, concurrent execution of transaction, lock based concurrency control, performance locking, and transaction support in SQL, crash recovery, concurrency control, Serializability and recoverability, lock management, lock conversions, dealing with dead locks, specialized locking techniques, concurrency without locking, crash recovery:

Course learning outcome:

- **CLO1** : this unit is to create understanding of Defining program-data independence, data models for database systems, database schema
- **CLO2:** the learning objective here is to Recall Relational Algebra concepts, and use it to translate queries to Relational Algebra statements and vice versa. Identify Structure Query Language statements used in creation and manipulation of Database Identify the methodology of conceptual modeling through Entity Relationship model.
- **CLO3:** Identify the methodology of logical model. Identify the methodology of physical model
- **CLO4:** Develop an understanding of the differences between OODBMS, ORDBMS and RDBMS and the practical implications of each approach.
- **CLO5 :**Analyze and design a real database application. Develop and evaluate a real database application using a database management system

Text books:

1. Elmasri Navathe, Data Base Management System, Pearson Education, 2008.

2.S.K. Singh, "Database Systems Concepts, Design and Applications", Pearson Education Pte.Ltd., New Delhi: 2006.

3.C. J. Date, Introduction to Database Systems, Pearson Education, 2009.

Reference books:

1. Silberschatz, Korth, Database System Concepts, McGraw hill, 5th edition, 2005.

2. Rob, Coronel & Thomson, Database Systems Design: Implementation and Management,2009.

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Online links for study & reference materials:

https://lecturenotes.in/subject/38/database-management-system-dbms

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MCS304 **Course Name:** Python Programming
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- To acquire programming skills in core Python.
- To acquire Object Oriented Skills in Python.
- To develop the skill of designing Graphical user Interfaces in Python.
- To develop the ability to write database applications in Python.

Course outcome: At the end of the course, student will be able to

- Understand and comprehend the basics of python programming.
- Demonstrate the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
- Explain the use of the built-in data structures list, sets, tuples and dictionary.
- Make use of functions and its applications.
- Identify real-world applications using oops, files and exception handling provided by python.

Course Description:

- This **course** includes an **overview** of the various tools available for writing and running **Python**, and gets students **coding** quickly. It also provides hands-on **coding** exercises using commonly used data structures, writing custom functions, and reading and writing to files.

Course Contents:

- **Unit – I: Introduction:** History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

- **Unit – II: Types, Operators and Expressions**: Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass

- **Unit – III: Data Structures**-Lists- Operations, Slicing, Methods, Tuples, Sets, Dictionaries, Sequences, Comprehensions.

- **Unit – IV: Functions** - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning

Values), Scope of the Variables in a Function - Global and Local Variables, **Modules:** Creating modules, import statement, from. Import statement, name spacing.

Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages

- **Unit - V Object Oriented Programming OOP in Python:** Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.

Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User defined Exceptions.
Brief Tour of the Standard Library - Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics**.**
Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

Course learning outcome:

- **CLO1:** To acquire programming skills in core Python.
- **CLO2:** To acquire Object Oriented Skills in Python
- **CLO3**: To develop the skill of designing Graphical user Interfaces in Python
- **CLO4**: To develop the ability to write database applications in Python
- **CLO5:** To develop the ability to write database applications in Python

Text books:

1Yang, "Applied Numerical Methods using MATLAB", Wiley India
2Pradip Niyogi, "Numerical Analysis and Algorithms", TMH, 1st Edition. Gerald & Whealey, "Applied Numerical Analyses"

Reference books :

1Grewal B S, "Numerical methods in Engineering and Science",
2KhannaPublishers, Delhi.

Online links for study & reference materials :

https://ocw.mit.edu/courses/mathematics/18-330-introduction-to-numerical-analysis-spring-2012/lecture-notes/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCS305

Course Name : Compiler Design

Course Credit Hour : 4hr

Total Contact Hour : 60hr

Course Objective :

- This course introduces the basic concepts and mechanisms traditionally employed in language translators, with emphasis on compilers. Topics include strategies for syntactic and semantic analysis, techniques of code optimization and approaches toward code generation.

Course outcome :

- Understand basic concepts of Usability Engineering
- Understand the fundamental aspects of interaction and designing the interaction
- Understand basic concepts of Dialog Designing aspects in Human Computer Interaction

Course Description :

- Introduction to Compilers
- Lexical Analysis
- Syntax Analysis
- Parsers Implementation
- Semantic Analysis

Course Contents :

- **Unit – I:** Introduction to Compiler, Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX-compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.

- **Unit – II:** Basic Parsing Techniques: Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables.

- **Unit – III:** Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements.

- **Unit – IV:**Symbol Tables: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.

- **Unit - V** Code Generation: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis

Course learning outcome :

- **CLO1 :** Understand the structure of compilers - Understand the basic techniques used in compiler construction such as lexical analysis, top-down, bottom-up parsing, context-sensitive analysis, and intermediate code generation - Understand the basic data structures used in compiler construction such as abstract syntax
- **CLO2:** : Code generation and Code optimization • Error Detection and Recovery Error Repair, Compiler Implementation
- **CLO3**: To understand Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements
- **CLO4** :Data structure for symbols tables, representing scope information. Run-Time Administration
- **CLO5:** Code Generation: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator

Text books :

- Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", PearsonEducation
- V Raghvan, " Principles of Compiler Design", TMH

Reference books :

- Kenneth Louden,” Compiler Construction”, Cengage Learning.
- Charles Fischer and Ricard LeBlanc,” Crafting a Compiler with C”, Pearson EducationOriented Modeling and Design - James Rumbaugh

Online links for study & reference materials :

https://www.uu.se/en/admissions/master/selma/kursplan/?kKod=1DL321&lasar=

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

MCA 351: ADBMS LAB

MCA 352: python programming Lab

SEMESTER 4

Course Code : MCS401
Course Credit Hour : 4hr

Course Name : software Testing
Total Contact Hour : 60hr

Course Objective :

- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.

Course Description :

- Have an ability to apply software testing knowledge and engineering methods.
- Have an ability to design and conduct a software test process for a software testing project.
- Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.

Course Contents :

Unit – I: Introduction: Introduction to software, Basics of Software Testing, fault, errors and failures, Testingobjectives, Causes of software errors, test case, test plan.

Software testing principles, software testing process, software quality and features

Unit – II: Testing and Debugging , Validation and Verification , Types of Testing : Unit testing , integration testing,system testing , acceptance testing , regression testing , installation testing.
White box testing: Dynamic Testing, Structural testing , White Box Testing , pros and cons of white boxtesting, unit/code functional testing.

Unit – III: Black box testing: Black box testing, pros and cons of black box testing, Requirement based testing, Boundary Value Analysis, Model based testing and model checking. Difference between White box and Black box testing. Difference between Functional testing and Structural testing.

Unit – IV:Integration, System and Acceptance testing: Integration Testing , Types of integration testing : Top down and Bottom up integration, Bi- directional integration, system integration. Functional v/s Non functional testing .
Alpha and Beta Testing : Alpha testing , Beta testing , Scalability testing , Reliability testing, Stress testing.

- **Unit - V Acceptance Testing:** Acceptance testing, acceptance criteria, test cases, selection and execution. **Regression Testing** : Regression Testing, test process, selection of regression tests, tools for regressiontesting.

Course learning outcome :

- **CLO1 :** Understand software testing and quality assurance as a fundamental component of software life cycle • Define the scope of SW T&QA projects
- **CLO2:** : Efficiently perform T&QA activities using modern software tools
- **CLO3**: Prepare test plans and schedules for a T&QA project
- **CLO4** :Develop T&QA project staffing requirements
- **CLO5:** Effectively manage a T&QA project

Text books :

- Dileep Kumar Gupta and Umesh Singh: Paradigms Of Software Testing, Dhanpat Rai & Co.Publications.
- Newman: Principles of Software Testing, McGraw Hill

Reference books :

Online links for study & reference materials :

https://www.uu.se/en/admissions/master/selma/kursplan/?kKod=1DL321&lasar=

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MCS402 **Course Name:** Software Engineering
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- Software Engineering (SE) comprises the core principles consistent in software construction and maintenance: fundamental software processes and life-cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools. iterative development, interpretation of requirements and use case documents into code; application of design notation in UML and use of commonly-used design patterns. Current industry-strength programming languages, technologies and systems feature highly in the practical components, electives and projects of the course, but they are also taught with a view to understanding and applying principles underlying their more ephemeral character.

Course outcome :

- Learn the theory and foundations of software engineering.
- Learn the different process models and choose the best model for their project
- Be able to construct requirement models
- Be able to Understand the different development practices and its advantages.
- Be able to create test cases and implement different testing strategies

Course Description :

- Knowledge of basic SW engineering methods and practices, and their appropriate application.
- . Describe software engineering layered technology and Process frame work. 3
- . A general understanding of software process models such as the waterfall and evolutionary models. Understanding of software requirements and the SRS documents. Understanding of the role of project management including planning, scheduling, risk management, etc.
- Describe data models, object models, context models and behavioural models. Understanding of different software architectural styles. Understanding of implementation issues such as modularity and coding standards. Understanding of approaches to verification and validation including static analysis, and reviews.

Course Contents :

- **Unit-I: Introduction** Software life cycle models: Waterfall, Prototype,Evolutionary and Spiral models, Overview of Quality Standards like ISO 9001, SEI-CMM.

- **UNIT-II Software Metrics and Project Planning** Size Metrics like LOC, Token Count, Function Count, Design Metrics, Data Structure Metrics, Information Flow Metrics. Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management.

- **UNIT- III Software Requirement Analysis, design and coding** Problem Analysis,Software Requirement and Specifications, Behavioural and non-behavioural requirements, Software Prototyping Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design Top-down and bottom-up Structured programming, Information hiding.

- **UNIT- IV : Software Reliability, Testing and Maintenance** Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Software process, Functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing: path testing, Data flow and mutation testing, unit testing, integration and system testing, Debugging, Testing Tools, & Standards. Management of maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software RE-engineering.

- **UNIT- V : UML:** Introduction to UML, Use Case Diagrams, Class Diagram: State Diagram in UML Activity Diagram in UML. Sequence Diagram in UML Collaboration Diagram in UML

Course learning outcome :

- **CLO1 :** Understand basic SW engineering methods and practices, and their appropriate application.
- **CLO2:** Understand u of software process models such as the waterfall and evolutionary 10. models.
- **CLO3**: problem analysis and description, This unit is to introduce Discuss data models, object models, context models and behavioural models.
- **CLO4** : Understand of different software architectural styles and Process frame work

- **CLO5:** this unit is for learning different modes of file storage. Records and there usage .

Text books :

- K. K. Aggarwal & Yogesh Singh, .Software Engineering., 2nd Ed, New AgeInternational, 2005.
- R. S. Pressman, ―Software Engineering – A practitioner‗s approach‖, 5th Ed., McGrawHill Int. Ed., 2001.

Online links for study & reference materials :

https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1 - 05%
Assessment-2 - 05%
Assessment-3(Midexam) - 20%
Assessment-3 - 05%
Assessment-4 - 05%

Course Code : MCS-403
Course Credit Hour : 4hr

Course Name : DOT NET Framework
Total Contact Hour : 60hr

Course Objective :

- Dot Net Framework helps the students in developing applications and web sites.
- To get appropriate programming methodologies, functions, procedures.

Course Description :

- The course covers basics of dot net and its components.
- Course will help the students in mastering the programming concepts.

Course Contents :

UNIT - I

C# Fundamentals: Basic classes, declarations, conditionals, loops, arrays, strings, enumerations, structures, andEncapsulation, inheritance, polymorphism, Structured exception handling. Understanding interface types

UNIT - II

Delegates, Events, and Lambdas: basics of each -- very important for event driven (GUI), Understanding the garbage collector, creating and working with .NET assemblies.

UNIT - III

Windows Forms and WPF: Basic windows programming: forms, component class, control class, control events, menus, status bars, tool bars, interacting with the registry. Indexers, Operator Overloading, Custom Type Conversion, Extension Methods, Anonymous Types, Pointer Types

UNIT - IV

Input, Output, and Serialization: System.IO, Directory and File Types, StreamReaders and StreamWriters, working with binary data, configuring objects for serialization, Working with and creating custom generic types.

UNIT - IV

Processes, AppDomains, Contexts, Threading, Type Reflection, Late Binding, Attribute-based programming: Advanced topics from the text will be discussed as time permits. We can decide as a class on what to explore if we get to this point.

Course Learning Outcomes(CLOs) :

CLO-1 :The students will be able to work on different server, web sites and applications.

CLO-2 :Students will be able to develop the backend of any project.

CLO-3 :Students will have the idea of encryption , decryption and maintain the database and all the security parameters.

CLO-4 :Students can work as system administrator and technical support.

Text books :

1. C Sharp and Dot net framework by Andrew Troelsen
2. C Sharp in Depth by Jon Skeet
3. Pro VB 2008 and the .NET 3.5 Platform (Windows.Net) by Andrew Troelsen

Reference books :

Programming Entity Framework by Julia
Learning Visual Basic .NETJesse Liberty
Beginning VB.NET Databases by Thearon Willis
Professional VB 2005 with .NET 3.0 (Programmer to Programmer) by Bill Evjen, Billy Hollis, Bill Sheldon, and Kent Sharkey

Online links for study & reference materials :

https://noidatut.com/view-nts.php?vntpntsfxxvisurz=b6d767d2f8ed5d21a44b0e5886680cb9

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCS404

Course Credit Hour : 4hr

Course Name : Distributed Systems

Total Contact Hour : 60hr

Course Objective :

- List the principles of distributed systems and describe the problems and challenges associated with these principles.
- Understand Distributed Computing techniques, Synchronous and Processes.
- Apply Shared Data access and Files concepts

Course outcome :

- To provide hardware and software issues in modern distributed systems.
- To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.

Course Description :

- Apply Distributed web-based system.
- Understand the importance of security in distributed systems

Course Contents :

- **Unit – I: Fundamentals** Evolution of Distributed Computing Systems, System models, issues in design of Distributed- computing environment, web based distributed model, computer networks related to distributed systems and web based protocols

- **Unit – II: Message Passing** Inter process Communication, Desirable Features of Good Message-Passing Systems, Issues in IPC by Message, Synchronization, Buffering, Multi datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication
- **Unit – III: Distributed Shared Memory** Design and Implementation Issues of DSM, Granularity, Structure of shared memory space, Consistency Models, replacement Strategy, Thrashing, Other Approaches to DSM, Advantages of DSM

- **Unit – IV: Synchronization** Clock Synchronization, Event Ordering, Mutual Exclusion, Election Algorithms.

- **Unit - V Distributed File Systems** Desirable Features of a good Distributed File Systems, File Models, File-Accessing Models, File- sharing Semantics, File-caching schemes, File Replication, Fault Tolerance, Design Principles, Sun's network file system, Andrews file system, comparison of NFS and AFS

Course learning outcome :

- **CLO1 :** Review of Networks, Operating Systems, Concurrent Programming, and Characteristics & Properties of Distributes Systems – Taxonomy - Design goals – Transparency Issues
- **CLO2:** : basic Message Passing Model – The Client Server, Message Passing, RPC basics, RPC implementation, RPC communication
- **CLO3**:Communication in Distributed Systems, Socket Programming - Client Server examples, I/O Multiplexing, Inetd Super Server – Secure Sockets – The SSL & the Java Secure Socket Extension
- **CLO4** :Motivation, Object Replication, Consistency Models, Distribution Protocols –5Consistency Protocols
- **CLO5:** Desirable Features of a good Distributed File Systems, File Models, File-Accessing Models

Text books :

- Distributed OS by Pradeep K. Sinha (PHI)
- Tanenbaum S. : Distributed Operating Systems, Pearson Education

Reference books :

- Tanenbaum S. Maarten V.S.: Distributed Systems Principles and Paradigms. (Pearson Education)
- George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems concepts and design

Online links for study & reference material

https://www.ict.gnu.ac.in/content/2cse50e2-distributed-systems-elective-i

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

MCS 451: Dot (.) NET Framework LAB lab

Industrial Project MCS 405

NOIDA INTERNATIONAL UNIVERSITY

GREATER NOIDA

CHOICE BASED COURSE SYLLABUS

Effective from the Session: 2019-2020

MSc. CHEMISTRY

(ALL SEMESTERS)

Department Of Chemistry

SCHOOL OF SCIENCES

Aims of Master's degree programme in Chemistry

The broad aims of Master's degree programme in Chemistry are:
The aim of b Master's degree programme in chemistry is intended to provide:
(i) Broad and balance knowledge in chemistry in addition to understanding of key chemical concepts, principles and theories.
(ii) To develop students' ability and skill to acquire expertise over solving both theoretical and applied chemistry problems.
(iii) To provide knowledge and skill to the students' thus enabling them to undertake further studies in chemistry in related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship.
(iv) To provide an environment that ensures cognitive development of students in a holistic manner. A complete dialogue about chemistry, chemical equations and its significance is fostered in this framework, rather than mere theoretical aspects.
(v) To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A chemistry post graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
(vi) To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
(vii) To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination.

Program Learning Outcomes

The student graduating with the Degree M.Sc. Chemistry should be able toacquire
 Core competency: Students will acquire core competency in the subject Chemistry, and in allied subject areas.
(i). Systematic and coherent understanding of the fundamental concepts in Physical chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry, Industrial Chemistry and all other related allied chemistry subjects.
(ii).Students will be able to use the evidence based comparative chemistry approach to explain the chemical synthesis and analysis.
(iii).The students will be able to understand the characterization of materials.
(iv). Students will be able to understand the basic principle of equipment's, instruments used in the chemistry laboratory.
(v).Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Chemistry.
(vi). ***Disciplinary knowledge and skill***: A graduate student is expected to be capable of demonstrating comprehensive knowledge and understanding of both theoretical and experimental/applied chemistry knowledge in various fields of interest like Analytical Chemistry, Physical Chemistry, Inorganic Chemistry, Organic Chemistry, Material Chemistry, etc. Further, the student will be capable of using of advanced instruments and related soft-wares for in-depth characterization of materials/chemical analysis and separation technology.
(vii) ***Skilled communicator***: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

(viii) ***Critical thinker and problem solver***: The course curriculum also includes components that can be helpful to graduate students to develop critical thinking ability by way of solving problems/numerical using basic chemistry knowledge and concepts.

(ix) ***Sense of inquiry***: It is expected that the course curriculum will develop an inquisitive characteristics among the students through appropriate questions, planning and reporting experimental investigation.

(x) ***Team player***: The course curriculum has been designed to provide opportunity to act as team player by contributing in laboratory, field based situation and industry.

(xi) ***Skilled project manager***: The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about chemistry project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

(xii) ***Digitally literate***: The course curriculum has been so designed to impart a good working knowledge in understanding and carrying out data analysis, use of library search tools, and use of chemical simulation software and related computational work.

(xiii) ***Ethical awareness/reasoning***: A graduate student requires to understand and develop ethical awareness/reasoning which the course curriculum adequately provide.

(xiv) ***Lifelong learner***: The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

NOIDA INTERNATIONAL UNIVERSITY

SCHOOL OF SCIENCES
Study & Evaluation Scheme for M.Sc. Chemistry
1st Year, SEMESTER-I

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			External Exam		
			L	T	P	CA	TA	Total			
1	STPC-101	Physical Chemistry-I	4	0	0	20	20	40	60	100	4
2	STPC-102	Inorganic Chemistry-I	4	0	0	20	20	40	60	100	4
3	STPC-103	Organic Chemistry-I	4	0	0	20	20	40	60	100	4
4	STPC-104	Green Chemistry	4	0	0	20	20	40	60	100	4
Practical											
5	SPPC-101	Physical Chemistry-I Lab	0	0	2			25	25	50	2
6	SPPC-102	Inorganic Chemistry-I Lab	0	0	2			25	25	50	2
7	SPPC-103	Organic Chemistry-I Lab	0	0	2			25	25	50	2
8	SPPC-104	Green Chemistry Lab	0	0	2			25	25	50	2
Total										600	24

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for M.Sc. Chemistry
1st Year,
SEMESTER-II

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			External Exam		
			L	T	P	CA	TA	Total			
1	STPC-201	Physical Chemistry-II	4	0	0	20	20	40	60	100	4
2	STPC-202	Inorganic Chemistry-II	4	0	0	20	20	40	60	100	4
3	STPC-203	Organic Chemistry-II	4	0	0	20	20	40	60	100	4
4	STPC-204	Applied Nanomaterials	4	0	0	20	20	40	60	100	4
Practical											
5	SPPC-201	Physical Chemistry-II Lab	0	0	2			25	25	50	2
6	SPPC-202	Inorganic Chemistry-II Lab	0	0	2			25	25	50	2
7	SPPC-203	Organic Chemistry-II Lab	0	0	2			25	25	50	2
8	SPPC-204	Synthesis of Nanomaterials Lab	0	0	2			25	25	50	2
Total										**600**	**24**

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for M.Sc. Chemistry
II Year
SEMESTER-III

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			External Exam		
			L	T	P	CA	TA	Total			
1	STPC-301	Physical Chemistry-III	4	0	0	20	20	40	60	100	4
2	STPC-302	Synthetic Organic Chemistry	4	0	0	20	20	40	60	100	4
3	STPC-303	Drug Synthesis	4	0	0	20	20	40	60	100	4
4	STPC-304	Industrial Chemistry	4	0	0	20	20	40	60	100	4
Practical											
5	SPPC-301	Physical Chemistry-III Lab	0	0	2			25	25	50	2
6	SPPC-302	Synthetic Organic Chemistry Lab	0	0	2			25	25	50	2
7	SPPC-303	Drug Synthesis Lab	0	0	2			25	25	50	2
8	SPPC-304	Industrial Chemistry Lab	0	0	2			25	25	50	2
Total										**600**	**24**

Study & Evaluation Scheme for M.Sc. Chemistry
II Year
SEMESTER-IV

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			External Exam		
			L	T	P	CA	TA	Total			
1	STPC-401	Polymers and Plastics	4	0	0	20	20	40	60	100	4
2	STPC-402	Intellectual Property Rights	4	0	0	20	20	40	60	100	4
3	SPPC 403	Dissertation/Project								200	12
Total										**400**	**20**

OVER ALL SCHEME

S. No.	SEMESTER	Theory Total	Practical Total	Subject Total	Total Credit
1	I	400	150	600	24
2	II	400	150	600	24
3	III	400	150	600	24
4	IV Dissertation/ Project	200 (Theory) +200 (Project)	200 (Dissertation + presentation + viva)	400	20
			Grand Total	**2200**	**92**

SEMESTER-I

Course Code : STPC-101 **Course Name : Physical Chemistry**

Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- This course is aimed to provide the students with a solid understanding of all the fundamental concepts physical chemistry necessary for the study of the more advanced or specialized courses. General idea about the heat flow, work done, enthalpy. Concept of system and types. Brief knowledge of laws of thermodynamics, kinetics and molecular dynamics. Reactions and their kinetics awareness. Application based learning of the subject.

Course Description :

- The use of simple models for predictive understanding of physical phenomena associated to chemical thermodynamics and kinetics. To relate the thermodynamic changes and its relevance in our daily lives and processes. Discussion on the improvement of technology by increasing the heat efficiency.

Course Contents : L-4 T-0 P-2

TEHRMODYNAMICS

Unit-I First law of Thermodynamics: Heat, Work, & Conservation of energy – The basic concepts, the first law, infinitesimal changes, mechanical work, work of compression & expansion, free expansion, Expansion against constant pressure, reversible expansion, Heat:-heat capacity, enthalpy. State functions & differentials – state functions, Exact & Inexact differential, changes in internal energy, temperature dependence of the internal energy, Temperature dependence of the enthalpy.

Unit-II Second law of Thermodynamics: Measuring the dispersal the entropy, The second law, the definition of entropy, the entropy changes in the system, natural events. Entropy changes in the universe – The enthalpy change when a system is heated, Entropy changes in surroundings, the entropy of phase transition, the entropy of irreversible changes.

Unit-III Combining First & Second Law: One way of developing the fundamental equations Properties of Gibbs function, The temperature dependence of the Gibbs functions, The pressure dependence of the Gibbs functions, The Chemical potential of a perfect gas, The open system & changes of composition.

CHEMICAL KINETICS

Unit-IV Chemical equilibria: Simple reactions, The temperature dependence of reaction rates, Reaction approaching equilibrium consecutive reactions, The steady state approximations, Pre-equilibira, Unimolecular reactions, Enzyme catalysis – Michaelis

Menton mechanism, Lineweaver and Eadie plots, The kinetics of complex reaction, Chain reactions, the structure of chain reactions Explosions, - Fast reactions, flash photolysis, Flow technique, relaxation methods,

Unit-V Molecular reaction dynamics: Collision theory basic calculation, the steric requirement, Diffusion controlled reactions- Classes of reactions, diffusion & reaction, the details of diffusion, Activated complex. The reaction co – ordinate & transition state, the formulation & decay of the activated complex, How to use the Eyring equation. Thermodynamic aspect, reaction between ions, Dynamics of molecular collisions,

SPPC-101: Lab Experiments:

1. Estimate the amount of magnesium present in the whole of the given solution. You are provided with the crystals of magnesium sulphate.
2. Estimate the amount of calcium present in the whole of the given solution. You provided with the crystals of calcium sulphate.
3. Estimate the amount of zinc present in the whole of the given solution. You provided with the crystals of zinc sulphate.
4. To determine the amount of Ni^{++} in the given sample of nickel ammonkum sulphate using 0.1 M EDTA solution and murexide as an indicator.
5. To estimate the amount of sodium nitrite present in the give sample of solution using 0.1 N $KMnO_4$
6. To estimate the amount of cerium and ferrous using cerium sulphate and ferrous ammonium sulphate

Course Learning Outcomes (CLOs) :

CLO-1: To gain better understanding of the heat changes, internal energy, enthalpy and heat capacity.

CLO-2: To understand the mathematical relations of different physical quantity.

CLO-3: To develop the better understanding of entropy changes and heat efficiency concept.

CLO-4: To learn reactions, their dependence and kinetics.

CLO-5: To understand the molecular reaction dynamics study with the introduction of collision theory, activated complex and dynamics of molecular collisions.

Text books :

1. Physical Chemistry - P.W. Atkin, ELBS fourth edition.
2. Physical Chemistry – R.A. Alberty, R.I. Bilby, Johy Wiley – 1995
3. Physical Chemistry – G.M. Barrow, Tata Mc – Graw Hill – 1988
4. Quantum Chemistry, - I . Levine, Fifth edition, Prentice Hall- 1999

Reference books :

1. Essentials of Physical chemistry - Bahl and Tuli, S. Chand- 2012
2. Mark Zemansky (Author), Richard Dittman, Heat and Thermodynamics – SIE 8th Edition Paperback – 1 July 2017, ISBN-13: 978-0070700352
3. Yunus A. Cengel, Michael A. Boles, Mehmet Kanoglu, Thermodynamics - An Engineering Approach, 9th Edition Paperback – 26 June 2019, ISBN-13 : 978-9353165741

Online links for study & reference materials :

1. https://courses.lumenlearning.com

2. https://courses.lumenlearning.com3.

3. https://www2.estrellamountain.edu

4. https://www.siyavula.com

5. https://www.britannica.com/science/chemical-equilibrium

6. .https://www.jstor.org/stable/43420629

Course Code : STPC-102 **Course Name: INORGANIC CHEMISTRY-I**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- After completion of the course, the learner shall be able to understand the various types of isomerism which can occur in coordination complexes, the systematic names of simple coordination compounds.

Course Description :

- The students should be able to explain what is meant by the Spectrochemical Series and list the approximate order of common ligands, molecular orbital theory, Crystal Symmetry. The students should be able to give appropriate definitions of the terms inert and labile and state which d-electron configurations are associated with inertness. Solutions in non-aqueous Media, application of crown ethers, Allotropes of Carbon, synthesis, properties, uses, structure & bonding with respect to VSEPR.

Course Contents : L-4 T-0 P-2

-

Unit-I Molecular symmetry and symmetry groups: Symmetry elements and operations. Symmetry planes, reflections, inversion centre, proper/ improper axes of rotation, products of symmetry operations, equivalent symmetry elements and atoms, symmetry elements and optical isomerism, symmetry point groups, classes of symmetry operations, classification of molecular point groups.

Unit-II Molecular Orbital Theory: Transformation properties of atomic orbital, MO's for Sigma bonding ABn molecules, tetrahedral AB4 case.

Unit-III Crystallographic Symmetry: Unit cell, screw axis, glide plane on unit cell, crystal lattice, space lattice, stereographic projectors. Examples on crystallographic planes, cubic planes, Miller indices, Bravais lattices.

Unit-IV Alkali & alkaline earth metals
Solutions in non-aqueous Media. Application of crown ethers in extraction of alkali & alkaline earth metals.

Unit-V: Carbon, Nitrogen, Oxygen, Halogen groups and Noble gases
Allotropes of Carbon, C60 and compounds (fullerenes), Nitrogen activation, Boron nitride, Interhalogens, Pseudohalogen, synthesis, properties &applications, structure, oxyacids&oxoanions of Hallogens, Nobel gases synthesis, properties, uses, structure & bonding with respect to VSEPR.

SPPC-102: Lab Experiments:

1. Estimate the amount of magnesium present in the whole of the given solution. You are provided with the crystals of magnesium sulphate.
2. Estimate the amount of calcium present in the whole of the given solution. You provided with the crystals of calcium sulphate.
3. Estimate the amount of zinc present in the whole of the given solution. You provided with the crystals of zinc sulphate.
4. To determine the amount of Ni^{++} in the given sample of nickel ammonkum sulphate using 0.1 M EDTA solution and murexide as an indicator.
5. To estimate the amount of sodium nitrite present in the give sample of solution using 0.1 N $KMnO_4$
6. To estimate the amount of cerium and ferrous using cerium sulphate and ferrous ammonium sulphate

Course Learning Outcomes (CLOs) :

CLO-1 : To learn the various characteristics of Symmetry elements and operations. Symmetry planes, reflections, inversion centre, proper/ improper axes of rotation.

CLO-2 : To learn the various characteristics of solutions in non-aqueous Media

CLO-3 : To learn the concept of molecular orbital theory.

CLO-4 : To learn the various application of crown ethers,

CLO-5 : To learn the allotropes of Carbon, synthesis, properties, uses, structure & bonding with respect to VSEPR.

Text books :

1. Chemical application and group Theory: F.A. Cotton, 3rd edition (1999)
2. Advanced Inorganic Chemistry: F.A. Cotton, G. Wilkinson, C.A. Murillo, M.Bochmann 6th Edn. (2003)
3. Symmetry in Chemistry: H. Jaffe' and M. Orchin (2002)
4. Group theory and its chemical application: P.K. Bhattacharya, 2nd edn. (1989)
5. Inorganic Chemistry: Shriver and Atkins, 4th edn. (2003) Oxford

Reference books :

1. Lee., J. D.(2010),A new Concise Inorganic Chemistry, Pearson Education.
2. Huheey, J.E.; Keiter, E.; Keiter, R. (2009),Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication.
3. Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A.(2010),Shriver and Atkin's Inorganic Chemistry, Oxford
4. Sykes, P.(2005), A Guide Book to Mechanism in Organic Chemistry, Orient Longman.

Online links for study & reference materials :

Course Code: STPC-103 **Course Name: ORGANIC CHEMISTRY-I**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- After completion of the course, the learner shall be able to understand the mechanisms involved in aliphatic nucleophillic substitution reactions, topicity of ligands, the concept of aromaticity and Mechanistic and Stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and Free radicals.

Course Description :

- This course summary shall indicate the specific key topics of the aromaticity, aromaticity in Benzenoid and non – Benzenoid compounds, SN2, SN1, mixed (SN1 and SN2) and SNi, neighboring group mechanism, Mechanistic and Stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and Free radicals, Regio and Chemo selectivity, Orientation and reactivity, E2, E1, E1cb Mechanisms, Orientation, stereochemistry in elimination, reactivity effect of structure attacking and leaving groups, competition between substitution & elimination.

Course Contents : L-4 T-0 P-2

Unit-I: Nature of Bonding in Organic Molecules: Delocalized chemical bonding – Conjugation, cross conjugation, resonance, hyper conjugation, tautomerism, inductive Resonance effects. Acidity and Basicity. Introduction to aromaticity in Benzenoid and non – Benzenoid compounds, alternant and non-alternant hydrocarbon, Huckel Rule.

Unit-II Aliphatic Nucleophilic Substitution: The SN2, SN1, mixed (SN1 and SN2) and SNi mechanism. The neighboring group mechanism, The Neighbouring group participation by π & σ bonds, anchimeric assistance, classical and non classical carbocations, phenonium ions, norbornylsyste, carbocation rearrangements in neighboring group participation.

Unit-III Addition to Carbon – Carbon Multiple bonds: Mechanistic and Stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and Free radicals, Regio and Chemo selectivity, Orientation and reactivity, Michael reaction.

Unit-IV Aromatic Electrophilic Substitution: The arenium ion mechanism, orientation and reactivity, energy profile diagram, The ortho/ para ratio ipso attack, orientation in other ring systems, Naphthalene, Anthracene, Six and five membered heterocycles, Diazonium coupling Vilsmeier reaction, Gattermann – Koch reaction, etc.

Unit-V Elimination reactions: E2, E1, E1cb Mechanisms, Orientation, stereochemistry in elimination, reactivity effect of structure attacking and leaving groups, competition between substitution & elimination , syn eliminations.

SPPC-103: Lab Experiments:

1. To prepare p-nitro benzoic acid from p-nitro toluene.
2. To prepare anthracene to anthraquinone
3. To prepare benzhydrol from benzophenone
4. To prepare 1,2,3,4-Tetrahydrocarbazole from cyclohexanone
5. To prepare methyl orange from sulphanilic acid.
6. To prepare benzilic acid from benzoin.

Course Learning Outcomes (CLOs) :

CLO-1 : To learn the aromaticity, aromaticity in Benzenoid and non – Benzenoid compounds

CLO-2 : To understand the SN2, SN1, mixed (SN1 and SN2) and SNi, neighboring group mechanism

CLO-3 : To learn the mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and Free radicals, Regio and Chemo selectivity

CLO-4 : To understand the orientation and reactivity, E2, E1, E1cb Mechanisms, Orientation, stereochemistry in elimination, reactivity effect of structure attacking and leaving groups, competition between substitution & elimination.

Text books :

1. Eliel, E. L. (2000), Stereochemistry of Carbon Compounds, Tata McGraw Hill.
2. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Bahl, A; Bahl, B. S. (2012), Advanced Organic Chemistry, S. Chand.
4. Finar, I. L. Organic Chemistry (Volume 1 & 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Reference books :

5. Pine S. H. Organic Chemistry, Fifth Edition, McGraw Hill, (2007)
6. F. A. Carey, Organic Chemistry, Seventh Edition, Tata McGraw Hill (2008).
7. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd Ed., (2012), Oxford
8. Universitiy Press.
9. F. A. Carey, R. J. Sundberg, Advanced Organic Chemistry, Part A: Structure and mechanism, Kluwer Academic Publisher, (2000).

Online links for study & reference materials :

1. http://www.freebookcentre.net/Chemistry/Organic-Chemistry-Books.html
2. https://chem.ucr.edu/curricular-materials/textbook
3. https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm
4.https://chemistry.com.pk/free-download-chemistry-books/
5.https://bookboon.com › chemistry-ebooks
6. **https://bookauthority.org/books/best-industrial-chemistry-books**

Course Code : STPC-104 Course Name: GREEN CHEMISTRY
Course Credit Hour : 4hr Total Contact Hour : 60hr

Course Objective :

- Today's society is moving towards becoming more and more environmentally conscious. There is rising concern of environmental pollution, depleting resources, climate change, ozone depletion, heaps and heaps of landfills piling up, legislation which is getting stringent with strict environmental laws, rising cost of waste deposits and so on. We are faced with a challenge to work towards sustainable practices. Green chemistry has arisen from these concerns. It is not a new branch of chemistry but the way chemistry should be practiced. Innovations and applications of green chemistry in education has helped companies not only gain environmental benefits but at the same time achieve economic and societal goals also. This is possible because these undergraduate students are ultimate scientific community of tomorrow.

Course Description :

- Understand the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances. Understand stoichiometric calculations and relate them to green chemistry metrics. They will learn about atom economy and how it is different from percentage yield. Learn to design safer chemical, products and processes that are less toxic, than current alternatives. Importance led reactions in various green solvents. Green chemistry is a way to boost profits, increase productivity and ensure sustainability with absolute zero waste. Success stories and real world cases also motivate them to practice green chemistry.

Course Contents : L-4 T-0 P-2

Unit l Introduction to Green Chemistry

What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/Obstacles in the pursuit of the goals of Green Chemistry.

Unit II Principles of Green Chemistry and Designing a Chemical synthesis

Twelve principles of Green Chemistry with their explanations and examples; Designing a Green Synthesis using these principles; Prevention of Waste/byproducts; maximum incorporation of the materials used in the process into the final products (Atom Economy); prevention/minimization of hazardous/toxic products; designing safer chemicals – different basic approaches to do so; selection of appropriate auxiliary substances (solvents, separation agents), green solvents, solventless processes, immobilized solvents and ionic liquids; energy requirements for reactions - use of microwaves, ultrasonic energy; selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protectinggroups; use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; designing of biodegradable products; prevention of chemical accidents; strengthening/development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

Unit III Examples of Green Synthesis/Reactions

1 Green Synthesis of the following compounds: adipic acid, catechol, BHT, methyl methacrylate, urethane, aromatic amines (4-aminodiphenylamine), benzyl bromide, acetaldehyde, disodium iminodiacetate (alternative to strecker synthesis), citral, ibuprofen, paracetamol, turtural. (furfural)

2 Microwave assisted reactions in water: Hofmann Elimination, Hydrolysis (of benzyl chloride, benzamide, n-phenyl benzamide, methylbenzoate to benzole acid), Oxidation (of toluene, alcohols). Microwave assisted reactions in organic solvents: Esterification, Fries rearrangement, Orthoester Claisen Rearrangement, Diels Alder Reaction, Decarboxylation. Microwave assisted solid state reactions: Deacetylation, Deprotection. Saponification of esters, Alkylation of reactive methylene compounds, reductions, synthesis of nitriles from aldehydes; anhydrides from dicarboxylic acid; pyrimidine and pyridine derivatives; 1,2-dihydrotriazine derivatives; benzimidazoles.

Unit IV

1 Ultrasound assisted reactions: Esterification, saponification, substitution reactions, Alkylations, oxidation, reduction, coupling reaction, Cannizaro reaction, Strecker synthesis, Reformatsky reaction.

2 Selective methylation of active methylene group using dimethylcarbonate: Solid-state polymerization of amorphous polymers using diphenylcarbonate; Use of "Clayan", a non-metallic oxidative reagent for various reactions; Free Radical Bromination; Role of Tellurium in Organic Syntheses; Biocatalysis in Organic Syntheses.

Unit V Future Trends in Green Chemistry

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; oncovalent derivatization; Green chemistry in sustainable development.

Course Learning Outcomes (CLOs) :

After finishing the course student will be able to:

CLO-1: To understand the principles of green chemistry and end-of-pipe method

CLO-2: To understand and can plan green solutions for industrial production of Petroleum and petrochemicals, Surfactants, Organic and inorganic chemicals

CLO-3: To provide green solutions for chemical energy storage, Energy carriers and alternative fuels including electrofuels and hydrogen

CLO-4: To present examples of successful green technologies

Text books :

1. V.K. Ahluwalia & M.R. Kidwai: New Trends in Green Chemistry, Anamalaya Publishers, 1st Edition, ISBN 978-94-015-7102-9
2. P.T. Anastes & J.K. Warmer: Oxford Green Chemistry- Theory and Practical, University Press (1998). ISBN: 9780198506980

3. A.S. Matlack: Introduction to Green Chemistry, Marcel Deckkar, (2001).

4. M.C. Cann & M.E. Connely: Real-World cases in Green Chemistry, American Chemical Society, Washington (2000).

5. M.A. Ryan & M. Tinnesand, Introduction to Green Chemistry, American Chemical Society, Washington (2002).

Reference books :

1. Lancaster, M.(2016),Green Chemistry An Introductory Text.2nd Edition, RSC Publishing.
2. Dr. Indu Tucker Sidhwani, Rakesh K. Sharma **An Introductory Text on Green Chemistry,** 1st edition, ISBN-10 : 812655407X
3. Paul T. Anastas, John Charles Warner, Green Chemistry Theory and Practice, 1st Edition, ISBN:9780198506980, 0198506988
4. R. A. Sheldon, Isabella Arends, Ulf Hanefeld , Green Chemistry and Catalysis, Wiley, 1st Edition, ISBN:9783527611010, 3527611010

Online links for study & reference materials :

1. https://www.acs.org/content/dam/acsorg/greenchemistry/education/summerschool/Kirchhoff%20Green%20Chemistry%20Principles%20and%20Practice2.pdf
2. https://oregonstate.edu/instruct/ch390/lessons/media/lesson1.pdf
3. faculty.swosu.edu/tim.hubin/share/Microwave%20Synthesis.pdf
4. https://oatao.univ-toulouse.fr/10066/1/Lesage_10066.pdf

SPPC-104- List of Laboratory Experiments

1. Pechmann Condensation For Coumarin Synthesis
2. Electrophilic Aromatic Substitution Reaction-I
3. Electrophilic Aromatic Substitution Reaction-II (Bromination Of Acetanilide)
4. Green Photochemical Reaction ((Photoreduction Of Benzophenone To Benzopinacol)
5. Pinacol Pinacolone Rearrangement Reaction-I ((Preparation Of Benzopinacolone)
6. Rearrangement Reaction - II ((Rearrangement Of Diazoaminobenzene To p-Aminoazobenzene)
7. Radical Coupling Reaction ((Preparation Of 1, 1-Bis-2-Naphthol)
8. Three Component Coupling (Synthesis Of Dihydropyrimidinone)

SEMESTER – II

Course Code : STPC-201 Course Name: PHYSICAL CHEMISTRY-II
Course Credit Hour : 4hr Total Contact Hour : 60hr

Course Objective :

- After completion of the course, the learner shall be able to understand the course exposes students to the laws of spectroscopy and selection rules governing the possible transitions in the different regions of the electromagnetic spectra. Thermal and electroanalytical methods of analysis are also dealt with. Students are exposed to important separation methods like solvent extraction and chromatography. The practicals expose students to latest instrumentation and they learn to detect analytes in a mixture.

Course Description :

- This course summary shall indicate the specific key topics of the perform experiment with accuracy and precision. Develop methods of analysis for different samples independently. Test contaminated water samples. Understand basic principle of instrument like Flame Photometer, UV-vis spectrophotometer. Learn separation of analytes by chromatography. Apply knowledge of geometrical isomers and keto-enol tautomers to analysis. Estimate macronutrients using Flame photometry. Basic concepts of nuclear chemistry.

Course Contents : L-4 T-0 P-2

MOLECULAR SPECROSCOPY

Unit-I Introduction: Width and intensity of spectral transitions, Fourier transform, microwave spectroscopy, rotation spectra of di – and poly- atomic molecules,

Unit-II Infrared spectroscopy: Harmonic and anharmonic oscillator, vibrational spectra of di – and poly atomic molecules, coarse and fine structure, Nuclear spin effect.

Unit-III Raman Spectroscopy: Introduction, Rotational Raman spectra, Vibrational Raman Spectra, polarization of light and Raman effect, structure elucidation from combined Raman and IR spectroscopy and applications.

NUCLEAR & RADIATION CHEMISTRY

Unit-1V Radio Chemistry: Type of radioactive decay, Decay Kinetics, Detection &

measurement of radiation (G.M. & Scintillation counter)

Unit-V Nuclear Reactor: The fission energy, The Natural uranium reactor, the four factor formula- The reproduction factor K, the classification of reactor. Reactor power, Critical size of thermal reactor, excess reactivity & control, the Breeder reactor, The Indians nuclear energy programme, Reprocessing of spent fuel: Recovery of Uranium & Plutonium, Nuclear waste management.

SPPC-201 - Lab Experiments:

1. To estimate the amount of Nickel present in the whole of given solution.
2. To estimate the amount of copper present in the whole of given solution.
3. Qualitative analysis of inorganic mixture
4. Qualitative analysis of inorganic mixture
5. Qualitative analysis of inorganic mixture
6. Qualitative analysis of inorganic mixture

Course Learning Outcomes (CLOs) :

CLO-1 : To understand the spectral transitions and rotation spectra of di – and poly-atomic molecules

CLO-2 : To understand the basic principles of Infrared spectroscopy of vibrational spectra, di – and poly- atomic molecules, nuclear spin effect and applications in structure elucidation.
CLO-3 : To understand the basic principles of Raman spectroscopy of polarization of light and Raman effect applications in structure elucidation
CLO-4 : To learn chemistry of radio activity, Type of radioactive decay, Decay Kinetics, Detection & measurement of radiation.
CLO-5 : To learn chemistry of nuclear reactors, classification, type of reactors, Nuclear waste management.

Text books :

1. Willard, H.H.(1988),Instrumental Methods of Analysis, 7th Edition, Wardsworth Publishing Company.
2. Christian, G.D.(2004),Analytical Chemistry, 6th Edition, John Wiley & Sons, New York.
3. Harris, D. C.(2007),Quantitative Chemical Analysis,6th Edition, Freeman.
4. Elements of Nuclear chemistry – H.J. Arnikar, fourth edition wileyEstern Ltd.
5. Source book of atomic energy – S. Glasstanc, D. Van Norton company.
6. Chemical applications of radioisotopes – H.J. M. Brown Buffer & Jammer Ltd.
7. Fundamentals of molecular spectroscopy: C.N. Banewell and E.Mc. Cash (Fourth

edition).

Reference books :

8. Khopkar, S.M. (2008), Basic Concepts of Analytical Chemistry, New Age International Publisher.
9. Skoog, D.A.; Holler F.J.; Nieman, T.A. (2005), Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd.

Online links for study & reference materials :

1. https://www2.chemistry.msu.edu.
2. https://chem.libretexts.org.
3. https://chemistry.tutorvista.com/inorganic-chemistry/oxidation-states.html.
4. http://www.uou.ac.in/sites/default/files/slm/BSCCH-201.pdf
5. https://www.bing.com/videos/search?q=liquid+states+of+matter&&view=detail&mid=888BE9D5C1C2757422F9888BE9D5C1C2757422F9&&FORM=VRDGAR&ru=%2Fvideos%2Fsearch%3Fq%3Dliquid%2Bstates%2Bof%2Bmatter%26qpvt%3Dliquid%2Bstates%2Bof%2Bmatter%26FORM%3DVDRE

Course Code : STPC-202 **Course Name: INORGANIC CHEMISTRY-II**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- To get significant knowledge on molecular symmetry to understand its role in chemistry. To describe bonding and anti-bonding molecular orbitals. To describe three-dimensional periodicity of crystal structure; define relationship between diffraction pattern and crystal structure. Explain the properties and extraction of alkali metals and alkaline earth metals. List the allotropes of carbon, physical and chemical properties of halogens, noble gases.

Course Description :

- Symmetry operations, equivalent symmetry elements and atoms, optical isomerism, symmetry point groups, sigma bonding for tetrahedral molecules, symmetry elements of molecules and simple crystal structures, relationship between diffraction pattern and crystal structure; describe and explain basic structural types, alkali and alkaline earth metals, allotropes of carbon, halogens and noble gases, their properties structure and bonding.

Course Contents : L-4 T-0 P-2

Unit-I Chemistry of non – Transition elements:

Polymorphism in carbon, Synthesis, properties and structure of boranes, carboranes, silicates, carbides, phosphazenes, sulphur – nitrogen compounds, peroxo compounds of boron, carbon, sulphur.

Unit-II Studies and applications of Lanthanides and Actinides:

Transition metals – general characteristics – metallic character – oxidation states – size – density – melting and boiling points – ionization energy – colour – magnetic properties – reducing properties – catalytic properties – Non stoichiometric compounds – complex formation – alloy formation – difference between first row and other two rows.

Lanthanides – Electronic configuration and general characteristics – occurrence of lanthanides – separation by ion exchange method – lanthanide contraction.

Actinides – Electronic configuration and general characteristics – comparison with lanthanides. Organometallic chemistry applications of lanthanide and actinide compounds in Industries.

Unit-III Metallurgy

Occurrence of metals based on standard electrode potential – concentration of ores– calcination, roasting and smelting – reduction using carbon and other reducing agents – electrolytic reduction – hydrometallurgy – Ellingham diagram. Refining of metals – electrolytic refining – oxidative refining – zone refining – Van Ankel method.

Extractive metallurgy of Li, Ni, Ti and U – Ferrous metallurgy – manufacture of steel by open hearth process – Alloys – composition and uses of German silver, Brass, Broze, Gunmetal, Alnico.

Unit-IV Chemistry in Non- aqueous solvents:

Classification of solvents, properties, levelling effect, type reactions in solvents, chemistry of liquid ammonia, liquid dinitrogen tetraoxide and anhydrous sulphuric acid with respect to properties, solubilities and reactions.

Unit-V Organometallic compounds

Definition – classification based on the nature of metal-carbon bond. Metal carbonyls – 18 electron rule – Mononuclear and polynuclera carbonyls (give examples of Fe, Co, Ni) – Bonding in metal carbonyls – Preparation of carbonyls of Fe and Ni.

Ferrocene – Preparation, properties and structure – Bonding in ferrocene (only qualitative treatment).

Applications of Organometallic compounds – Ziegler-Natta catalyst, Wilkinson catalyst

SPPC-202: Laboratory Experiments

1. To prepare methyl salicylate from salicylic acid.
2. To prepare picric acid from phenol.
3. Separation and analysis of two component systems and preparation of their derivatives
4. Separation and analysis of two component systems and preparation of their derivatives
5. Separation and analysis of two component systems and preparation of their derivatives
6. Separation and analysis of two component systems and preparation of their derivatives

Course Learning Outcomes (CLOs) :

After completing the course the student has gained a significant knowledge on
CLO-1: Formal group theory, including representations, and familiar with its applications to molecular symmetry.
CLO-2: Bonding in transition compounds by MOT.
CLO-3: Difference between crystalline and amorphous solids, recognize symmetry elements of molecules and simple crystal structures.
CLO-4: Properties and extraction of alkali metals and alkaline earth metals
CLO-5: Carbon allotropes, halogens, Nobel gases synthesis, properties, uses, structure & bonding

Text books :

1. F.A. Cotton , Chemical application and group Theory, Wiley, 3rd edition, ISBN: 978-0-471-51094-9
2. 2. F.A. Cotton, G. Wilkinson, C.A. Murillo, M.Bochmann, Advanced Inorganic Chemistry, Wiley, 6th Edn. (2003), ISBN: 978-0-471-19957-1
3. H. Jaffe' and M. Orchin , Symmetry in Chemistry, Dover Publication. Inc, 1st Edition, ISBN-13 : 978-0486421810

Reference books :

4. P.K. Bhattacharya, Group theory and its chemical application, Himalaya Publishing House, 2nd edn. (1989), ISBN-13 : 978-8184884760
5. Shriver and Atkins, Inorganic Chemistry, Oxford, 4th edn. (2003), ISBN 978–1–42–921820–7

Online links for study & reference materials :

1. https://onlinecourses.nptel.ac.in/noc21_cy16
2. https://www.academia.edu/35126326/Inorganic_Chemistry_Atkins_Shriver_PDF
3. https://chem.libretexts.org/Courses/University_of_California_Davis/UCD_Chem_110B%3A_Physical_Chemistry_II
4. http://xrayweb.chem.ou.edu/notes/symmetry.html
5. https://chem.libretexts.org https://www.britannica.com/science/alkaline-earth-metal

Course Code : STPC-203 **Course Name: ORGANIC CHEMISTRY-II**

Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- After completion of the course, the learner shall be able to understand Structure and aromaticity, Electrophilic substitution reactions, molecular-rearrangements and heterocyclic chemical reactions with mechanisms.

Course Description :

- This course summary shall indicate the specific key topics of the aromaticity, electrophilic substitution reactions, heterocyclic compounds, basicity, preparations and reactions with mechanisms, molecular-rearrangements and Occurrence and physiological importance natural carbohydrates, pigments, alkaloids.

Course Contents : L-4 T-0 P-2

Unit-I Reactions of benzene & phenol: Structure and aromaticity; Electrophilic substitution reactions: halogenation, nitration, sulphonation, Friedel-Crafts alkylation and acylation. Phenols: Acidity, electrophilic substitution reactions (halogenation, nitration and sulphonation); mechanism of Reimer-Tieman reaction, Kolbe reaction.

Unit-II Heterocyclic Chemistry:

Five membered heterocycles – Furan, Pyrrole and Thiophene, Condensed five membered heterocycles – Benzofuran, Indole and Benzothiophene, Pyridine, Quinoline and Isoquinoline, Rings with more than one heteroatom 1, 2 –Azoles and 1, 3-Azoles, Purines and Pyrimidines.

Unit-III Natural products:

Carbohydrates: Introduction to naturally occurring sugars: Deoxysugars, aminosugars, branched sugars. Structure elucidation of lactose, D-glucosamine and mesoinositol. Structure and applications of inositol, starch, cellulose, chitin and heparin. **Natural pigments:** General structural features, occurrence, biological importance and applications of carotenoids, anthocyanins, quinones, flavones, pterins and porphyrins (chlorophyll). **Alkaloids:** Occurrence and physiological importance of morphine, coniine and papaverine. Structure elucidation of papaverine.

Unit-IV Rearrangements: Reactive intermediate, Carbocations, carbanions,carbenes, nitrenes Beckmann, Hofmann, Curtius, Schmidt, Wolf, Lossen, Baeyer – Villiger, Sommelet, Favorskii, Pinacole – Pinacolone, Benzil – Benzillic acid, Claisen and Cope Rearrangements, Fries Migration.

Unit V: Addition to Carbon – Hetero Multiple bonds, Addition of Grignard Reagent, Organo Zinc, Organo Copper, and Organo lithium reagents to Carbonyl and unsaturated Carbonyl compounds.

SPPC-203- Laboratory Experiments

1. To estimate the amount of Nickel present in the whole of given solution.
2. To estimate the amount of copper present in the whole of given solution.
3. Qualitative analysis of inorganic mixture
4. Qualitative analysis of inorganic mixture
5. Qualitative analysis of inorganic mixture
6. Qualitative analysis of inorganic mixture

Course Learning Outcomes (CLOs) :

CLO-1 : To learn the aromaticity, electrophilic substitution reactions. Phenols-acidity comparison, electrophilic substitution reactions and mechanism with examples.

CLO-2 : To learn the heterocyclic compounds, comparison of basicity, preparations and reactions with mechanisms

CLO-3 : To learn the various molecular-rearrangements mechanism with examples.

CLO-4 : To learn the occurrence and isolation techniques, physiological importance natural carbohydrates, pigments, alkaloids.

Text books :

1. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1 & 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Kapoor, K.L. (2014), A Textbook of Physical Chemistry,Vol 2, 6th Edition, McGraw Hill Education.
4. Bahl, A; Bahl, B. S. (2012), Advanced Organic Chemistry, S. Chand.

Reference books :

5. F. A. Carey, Organic Chemistry, Seventh Edition, Tata McGraw Hill (2008).
6. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd Ed., (2012), Oxford Universitiy Press.
7. F. A. Carey, R. J. Sundberg, Advanced Organic Chemistry, Part A: Structure and mechanism, Kluwer Academic Publisher, (2000).
8. Wiley-Interscience, 5th edition, 2001, ISBN 0-471-58589-0
9. Wiley-Interscience, 6th edition, 2007, ISBN 978-0-471-72091-1

Online links for study & reference materials :

1. http://www.freebookcentre.net/Chemistry/Organic-Chemistry-Books.html
2. https://chem.ucr.edu/curricular-materials/textbook
3. https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm
4.https://chemistry.com.pk/free-download-chemistry-books/
   1. 5.https://bookboon.com › chemistry-ebooks
6.**https://bookauthority.org/books/best-industrial-chemistry-books**

Course Code :STPC-204 **Course Name: APPLIED NANOMATERIALS**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- A graduate level introductory course to "nanotechnology". The course will cover several key aspects of applied nanomaterials, namely their synthesis, characterization, processing, and applications. Knowledge on an advanced level on the connections between structure and properties of solids, including theory and methods that can be applied in the development of new materials with particular desired properties within this field can be gained.

Course Description :

- To understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life. To learn how interdisciplinary approach helps in providing better solutions and new ideas for the sustainable developments. To develop newer materials and composites and to study their applications.

Course Contents : L-4 T-0 P-2

Unit 1. Introduction to nanotechnology and nanomaterials
Historical development, Definition. Overview of Nanostructures and Nanomaterials: classification (materials, functional materials)

Unit 2. **Synthesis**

Selection of support metals. Preparative methods: Chemical methods (sol-gel, thermal, microwave, co-precipitation, impregnation method.

Unit 3. **Characterization**
Principle, instrumentation, and applications of X-ray diffraction, Electron microscopies SEM, TEM, EDX, Scanning Probe Microscopy (SPM).
Trends and highlights in instruments and metrology

Unit 4. **Processing**

Top-down approaches, bottom-up approaches, details of porous materials and industrial applications.

5. **Applications**
Nanotechnology for sustainability (water, energy, etc), Reinforcement in Ceramics, Drug delivery, Giant magnetoresistance, etc. Nanomedicine, Environmental, health, and safety issues

SPPC-204- Laboratory Experiments

1. Synthesis of Ni-loaded Al2O3 supported porous material.
2. Synthesis of Bi-Metallic Nano-Particals by wet chemical method.
3. Synthesis of Potassium-Nitrite loaded Zr-Supported porous material by Co-Precipitation method.
4. Synthesis of Cu-loaded, Alumina supported porous material by Thermal Method.
5. Synthesis of K-loaded, Lanthnium nitrate supported peroskite oxide material by sol-gel method.
6. Synthesis of Fe-Cr loaded Zeolite by weight – impregnation method.

Course Learning Outcomes (CLOs) :

CLO-1: To understand and apply basic concepts of nanotechnology and nanoscience. Introduction to different classes of nanomaterials, including both inorganic and organic constituents; synthesis of nanomaterials , including chemical and physical vapor transport, solution chemistry, and nanofabrication methods; characterization of nanomaterials, including x-ray techniques, scanning probe.

CLO-2: To understand the different synthesis techniques used for the synthesis of nanomaterials.

CLO-3: To study the different nano-materials along with their characterization.

CLO-4: To understand the different synthesis techniques used for the synthesis of nanomaterials. To gain the understanding of approaches to the development of chemical and biological sensors based on plasmonic, spintronics, nano porosity and issues related to their translation from the research laboratory to the clinic and to point-of-care applications

CLO-5: To gain understanding of futuristic concepts like nanorobots, nanorockets, and fantastic voyage-like submarines. These objectives are packaged with discussion sessions designed to enforce out-of-the-box thinking skills, teaming work, and communications.

Textbooks:

1. "Nanomaterials, Nanotechnologies and Design: An Introduction for Engineers and Architects" by Daniel L. Schodek, Paulo Ferreira, Michael F. Ashby (Butterworth-Heinemann)
2. "Nanostructures and Nanomaterials: Synthesis, Properties, and Applications" (2^{nd} Edition) (World Scientific Series in Nanoscience and Nanotechnology) by Guozhong Cao and Ying Wang (Imperial College Press)

Reference books :

1. NANO: The Essentials: Understanding Nanoscience and Nanotechnology Paperback – by T. Pradeep (2017)
2. Introduction to Graphene-Based Nanomaterials: From Electronic Structure to Quantum Transport Luis E. F. Foa Torres, Stephan Roche, Jean-Christophe Charlier. Cambridge.
3. Nanoparticles – Nanocomposites, Nanomaterials: An Introduction for Beginners 1st Edition by Dieter Vollath, paperback

Online links for study & reference materials :

1. https://iopscience.iop.org › book › chapter

2.https://www.academia.edu/33515592/Synthesis_Structural_Optical_and_Dielectric_Properties_of_Cadmium_Sulfide_Nanoparticles_as_Photocathode_for_a_Solar_Cell

3. https://www.sciencedirect.com/science/article/pii/B9780081005576000031
4. https://www.news-medical.net/life-sciences/Characterization-of-Nanoparticles.aspx
5.https://pdfs.semanticscholar.org/5bb8/e4ab9300292793522911117e15943349e56c.pdf
6. https://www.azonano.com/article.aspx?ArticleID=1710
7.https://www.ttu.ee/public/m/Mehaanikateaduskond/Instituudid/Materjalitehnika_instituut/MTX9100/Lecture11_Synthesis.pdf
8. https://www.understandingnano.com/nanotech-applications.html
9. https://www.longdom.org/open-access/applications-of-nanotechnology-2155-983X-1000131.pdf
10. https://www.nano.gov/you/nanotechnology-benefits

SEMESTER – III

Course Code : STPC-301 **Course Name: PHYSICAL CHEMISTRY-III**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- To gain general idea about the gases and liquid states, collision theory, chemical equilibrium, electrochemistry and surface chemistry. To identify methods and instruments that can be used to study physical chemistry. Evaluate data generated by experimental methods for chemical characterization.

Course Description :

- To apply gas laws in various real life situations. To explain the behavior of real and ideal gas. To differentiate between gaseous state and vapour. To explain the kinetic theory of gases. To explain the properties of liquids. To describe condition required for liquefaction of gases. To understand chemical equilibrium, electrochemistry and surface chemistry phenomenon.

Course Contents : L-4 T-0 P-2

Unit-I Gaseous and liquid states: Absolute scale of temperature, ideal gas equation; Deviation from ideality, van der Waals equation; Kinetic theory of gases, average, root mean square and most probable velocities and their relation with temperature; Law of partial pressures; Vapour pressure; Diffusion of gases.

Unit-II Kinetic theory of gases: Postulates of kinetic theory of gases, P-V-T relations for an ideal gas, non-ideal behavior of gases, equation of state, van der Waal's equation, relations of vanderWaal's constants with virial coefficients and Boyle temperature.

Molecular statistics, distribution of molecular states, deviations of Boltzmann law for molecular distribution, translational partition function, Maxwell-Boltzmann law for distribution of molecular velocities, physical significance of the distribution law, deviation of expressions for average, root mean square and most probable velocities, experimental verification of the distribution law. Molecular collision in gases, mean free path, collision diameter and collision number in a gas and in a mixture of gases, kinetic theory of viscosity and diffusion.

Unit-III Chemical equilibrium: Law of mass action; Equilibrium constant, Le Chatelier's principle (effect of concentration, temperature and pressure); Significance of ΔG and $\Delta G°$ in chemical equilibrium; Solubility product, common ion effect, pH and buffer solutions; Acids and bases (Bronsted and Lewis concepts); Hydrolysis of salts.

Unit-IV Electrochemistry: Electrochemical cells and cell reactions; Standard electrode potentials; Nernst equation and its relation to ΔG; Electrochemical series, emf of galvanic cells; Faraday's laws of electrolysis; Electrolytic conductance, specific, equivalent and molar conductivity, Kohlrausch's law; Concentration cells.

Unit-V: Surface chemistry: Elementary concepts of adsorption (excluding adsorption isotherms); Colloids: types, methods of preparation and general properties; Elementary ideas of emulsions, surfactants and micelles (only definitions and examples)

SPPC-301- Lab Experiments:

1. To prepare acetyl salicylic acid (aspirin) from methyl salicylate
2. To prepare benzanilide from benzoquinone
3. To prepare Meta nitro benzoic acid from methyl benzoate
4. To prepare p-Iodobenzoic acid from p-Toluidine
5. To prepare benzilic acid from benzoin.
6. To prepare β-napthol from naphthalene.

Course Learning Outcomes (CLOs) :

CLO-1: To understand the different gas laws, the kinetic theory of gases, deviations from ideal behaviour.

CLO-2: To understand the corrections made in vanderwaals equations and to learn the terminologies used such as molecular collision in gases, mean free path, collision diameter and collision number in a gas and in a mixture of gases, kinetic theory of viscosity and diffusion.

CLO-3: To study chemical equilibrium and spontaneity of reactions by using thermodynamic principles. To understand the concept of acids and bases (Bronsted and Lewis concepts) and hydrolysis of salts.

CLO-4: Students can learn depth concepts about electrochemistry. To understand the faraday's laws of electrolysis; electrolytic conductance, specific, equivalent and molar conductivity, kohlrausch's law and concentration cells. To understand cell constant and use of it to obtain specific and equivalent conductance.

CLO-5: To understand various types of colloids and its applications. To gain understanding of elementary concepts of adsorption, emulsions, surfactants and micelles.

Text books :

1. Physical Chemistry – G.M. Barrow, Tata Mc – Graw Hill – 1988
2. Quantum Chemistry - I. Levine, Fifth edition, Prentice Hall- 1999
3. Essentials of Physical chemistry - Bahl and Tuli, S. Chand- 2012

Reference books :

1. Atkins P.W., Paula, J. De, Physical Chemistry, W.H. Freeman, 2012 ELBS fourth edition.
2. Physical Chemistry – R.A. Alberty, R.I. Bilby, Johy Wiley – 1995
3. McQuarrie, D. A., Statistical Mechanics, Viva Books Pvt. Ltd.: New Delhi, 2013.

Online links for study & reference materials :

1. https://courses.lumenlearning.com/introchem/chapter/kinetic-molecular-theory-and-gas-laws/
2. http://www.chem.hope.edu/~polik/Chem3451997/gasviscosity/GasViscosity.html
3. https://chem.libretexts.org/Textbook_Maps/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Equilibria/Le_Chatelier's_Principle

4. https://www.nature.com/subjects/surface-chemistry

Course Code : STPC-302 **Course Name: Synthetic Organic Chemistry**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- To provide extensive knowledge about molecular organometallic chemistry. To know the most important classes of ligands found in organometallic compounds. To provide broad knowledge of nomenclature, coordination modes, geometries, and fundamental reaction types. To get knowledge of the chemical bonds and the theories that explain the electronic properties within organometallic compounds. To know how to establish the relationship between the structures, chemical bonds in organometallic chemistry to determine and elucidate mechanisms in catalysis

Course Description :

- Transition metals are becoming more and more important in modern organic synthesis. This is particularly true for organic transformations which are impossible or difficult to achieve by classic organic chemistry. The important role of organometallic complexes within catalysis will be discussed. The transition metal complexes bonds, structures and reactions will also be discussed. Special emphasis will be put on the application of organometallic complexes in organic synthesis. Basic knowledge is provided with regards to polymer and polymerization.

Course Contents : L-4 T-0 P-2

Unit-I Transitional metals complexes in organic synthesis
Transition metal complexes in organic synthesis-Introduction-oxidation states of transition metals, 16-18 rule, dissociation, association, insertion, oxidative addition, reductive elimination of transition metal

Unit-II Organo nickels- coupling carboxylation, amination, carbonylation

Unit-III Chromium carbonyls regioselective alkylation and acylation of aromatics, nucleophilc substitution, lithiation reaction, Reactions Iron carbonyls, ferrocenes, Fe-cyclopentadiene complex, protection of dienes, isomerization.

Unit-IV Wilkinson, Noyori, Knowls catalyst of Ruthenium and Rhodium – synthesis and uses its use in hydrogenation reactions-dealkylation, C-C, C-O, C-N bond cleavages

Unit-V Polymers

Polymers, monomers, Molecular weight and molar mass, End groups, Degree of polymerization, Nomenclature Classification of polymer-thermoplastic, thermosetting Copolymers- random, alternate, block and graft copolymers, Molecular architecture Polymerization and functionality Polymerization processes-Addition and step polymerization, Mechanism of polymerization – free radical and ionic.

Molecular Weight of polymers – Arithmetic, weight average and number average molecular weights of polymers Determination of molecular weight of polymers End-Group Analysis Cryoscopy, Light scattering, Viscosity, and gel permeation chromatographic methods. Thermal Transition in Polymers, DSC, TGA Spectral methods of Analysis

SPPC-302: Lab Experiments:

1. To determine the cell constant and equivalent conductance of a strong electrolyte at infinite dilution. (verification of Debye- Huckel Onsagar equation)
2. To verify the Ostwald's dilution law and to determine the dissociation constant of the weak electrolyte.
3. Determination of relative strengths of the given 2 acids catalysed by methyl acetate
4. To estimate the amount of iron present in the whole of given solution.
5. To determine the amount of manganese in the given solution by colorimetric method
6. To determine the Specific Gravity of soil a particle passing through 4.75 mm IS sieve using Density bottle.

Course Learning Outcomes (CLOs) :

After completing the course, the candidate will have the following knowledge and able to

CLO-1: To solve problem formulations and methodologies for use of organometallic compounds in organic synthesis.

CLO-2: To evaluate when it is appropriate to use organometallic compounds in organic synthesis..

CLO-3 : To explain bonding in metal complexes and the magnetic behaviour of complexes and its application

CLO-4 : To define the nomenclature, electronic structure, properties of transition-metal compounds.

CLO-5: Is able to identify the basic fundamental reactions in organometallic chemistry.

CLO-6: Is able to describe the bond-to-metal complexes, establish the structure-reactivity/activity relationship and the operating mechanisms in the catalytic processes.

Text books :

1. Modern synthetic reactions – H. O. House (Benjamin)
2. Some modern methods of organic synthesis – W. Carruthers (Cambridge);
3. [illegible]
4. Comprehensive organometallic chemistry-Vol. Chiron approach in organic synthesis – S. Hanessian (Relavent chapters For Chirons)
5. Carbocyclic non-benzenoid aromatic compounds, D. Lloyd Text Book of Polymer Science by F. W. Bilmayer
6. Polymer Science by Gowarikar
7. Introduction to polymer science and chemistry by ManasChanda, Taylor and Francis Pub.

Reference books :

1. J.D.Lee, Concise Inorganic chemistry, ELBS (1986) , 5th Edition, ISBN-10: 0632052937
2. A.G.Sharpe, Inorganic Chemistry, ELBS, 4th Edition (1984). I*SBN* 978-0-273-74276-0
3. Inorganic Chemistry: D.F.Shriver, P.W.Atkins, 3rd Edition, Oxford University press (1999), 9780199236176 0199236178 9781429218207 1429218207
4. P. Powell, Principles of Organometallic Chemistry, 2ed, ELBS, 1991. ISBN 13:978-94-010-9681-2
5. J. E. Huheey, Inorganic Chemistry, 4ed, Harper International, 2002
6. A.F. Wells , Structural Inorganic Chemistry, 5th Edition (1984), *ISBN*-10 : 0198553706; *ISBN*-13 : 978-0198553700
7. F. N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971, 2nd edition, ***ISBN***-10 : 0471072990; ***ISBN***-13 : 978-0471072997
8. Robert H. Crabtree, The Organometallic Chemistry of the Transition Metals, wiley, 6th Edition,ISBN 13:9781118138076
9. B D Gupta, A J Elias, Basic Organometallic Chemistry: Concepts, Syntheses and Applications, Universities Press, 1st edition,ISBN-13 : 978-8173717093

Online links for study & reference materials :

1. https://onlinecourses.nptel.ac.in/noc21_cy12
2. https://www.youtube.com/watch?v=3FRV31YYtL8

3. https://www.youtube.com/watch?v=8pqCeN7GoMc
4. https://chem.libretexts.org
5. https://pubs.rsc.org/en/content/articlelanding/2009/gc/b915563p

Course Code : STPC-303 Course Name: DRUG SYNTHESIS
Course Credit Hour : 4hr Total Contact Hour : 60hr

Course Objective :

- General structural features of agents belonging to the therapeutic class. Relevant physicochemical properties. Relevant chemical reactions/synthetic pathways for selected drugs. Structural influences on mechanism of pharmacologic action (structure-activity relationship). Structural influences on pharmacologic/toxicological/therapeutic profiles.

Course Description :

- The course gives an introduction to the most common synthetic methods that are applied in industrial and laboratory drug synthesis. The course deals with Structure, stereochemistry, Mode of action, Structure activity relationships, synthesis of drugs and with the molecular mechanism of drug action.

Course Contents : L-4 T-0 P-2

Structure, stereochemistry, Mode of action, Structure activity relationships, specific clinical applications of following classes of pharmaceuticals with synthetic/commercial route to the indicated examples.

1. Antibacterials: Penicillines, Cephalosporins, Tetracyclines, Aminoglycosides, Chloramphenicol, Macrolides, Lincomycins, Polypeptides antibiotics, Polyene antibiotics. Sulfonamides and Sulfones fluoroquinolines, Trimethoprim and other unclassified antibiotics. Antimycobacterials: Sulfanilamides, p-Aminosalicyclic acid derivatives, Thioamides, Thiourea, derivatives, Thiosemicarbonazones, Isoniazid, Kanamycin sulfate, Capreomycin, Rifaampin, Pyrazinamide, Anthionamide, Clofazimine, Cyclosporin, Dapsone, Sulfazem. Commercial synthetic/semi-synthetic routes to : 6-amino penicillanic acid, ampicillin, amoxycillin, production of penicillin, 7- amino cephalsporanic acid, cephalexin, ceftizoxime, cefaclor, cephslothin, Tetracyclins: doxycycline, nalidixic acid, sulfadiazine, Norflaxacin, Ciproflexacin, O-flaxacin, Amiflaxacin, Difloxacin, Chloramphenicol, Nitroflurantion, Sulfamethyoxazole, Acetysulfoxiazole, Trimethoprim.

2. Antimalarials: Cinchona alkaloids, 4-Aminoquinolines, 8-Aminoquinolines, 9-Aminoacridines, Biguanides, Pyramidines and Sulfones, Mefloquine, Sulfonamides. Commercial synthetic routes to: Chloroquine, pamaquine, primaquine, proguanil, Amodiaquine, Mefloquine, Pyremethamine, Sontoquine.

3. Antiamoebic and antiprotozoal drugs: Emetine hydrochloride, 8-Hydroxyquinoline, Iodochlorohydroxyquinol, Metronidazole, Diloxanide furoate, Bilamical hydrochloride, Hydroxystilbamidine isothinate, Pentamidine isothionate, Nifurtimox, Suramin sodium, Carbarsone, Glycobiarsol, Melarsoprol, Sodium stibogluconate, Dimercaprool, Diethylcabamazine citrate, Centarsone, Acetarsone, Antimony potassium tartarate, Bismuth sodium thioglycollate, Sulphonamide, Stibiophen. Bismuth sodium thioglycollamate, Furazolidone.

4. Anthelmintics: Introduction, Tetrachloroethylene, Piperazines, Gentian violet, Pyrvinium pamoate, Thiabendazole, Mabendazole, baphenium hydroxynaphthoate, Dichlophene, Niclosamide, Levamisole hydrochloride, Tetramisole, Niridazole, Biothional, Antimonypotassium tartarate, Stibiophen, Sodium Stibiocaptate.

5. Antifungal drugs: Fatty acids and their derivatives (Propionic acid, zinc propionate, sodium caprylate, zinc caprylate, undecylenic acid, Zinc undecylenate, Triacetin), Salicylanilids, Salicyclic acid, Tolnaftate, pchloromethoxylenol, Acrisocrin, Fluconazole, Itraconazole, Haloprogin, Clotrimazole, Econazole, Miconazole, Ketoconazole, Flucytosine, Griseofulvin, Polyene antibiotics (Nystatin, Amphoetericin-B), Chlorophenesin, Dithranol. Commercial synthetic routes to: Miconazole, Clotrimazole, Econoazole, Fluconazole, Griseofulvin, Ketoconazole, Nafttidine, Tolnaftate, Flucytosin.

Course Learning Outcomes(CLOs) :

After completion of the course student will be able to understand/explain

CLO-1 : Recognize the drug structure and predict its pharmacologic action.

CLO-2 : Relevant chemical reactions/synthetic pathways for selected drugs

CLO-3 : Knowledge of the connection between the structural features of the drugs and their physico-chemical characteristics, mechanism of action and use.

CLO-4: Application the gained knowledge about the drugs. Counseling and giving information to patients about the drug action.

SPPC-303: Lab Experiments:

1. Synthesis of Paracetamol
2. Synthesis of NO-SPA (drotaverine hydrochloride)
3. Synthesis of Pyralginum, Analgin (metamizole sodium)
4. Synthesis of Ascodan (acetylsalicylic acid + codeine phosphate)
5. Synthesis of Etopiryna (acetylsalicylic acid + ethenzamide + caffeine)
6. Synthesis of Cardiamidum (cardiamide, nikethamide, drug in drops)

7. Synthesis of Unguentum undecylenicum (undecylenic acid and its zinc salt, drug in ointment form)
8. Synthesis of Ibuprofen (drug in suspension form)
9. Synthesis of Guaiafenezin (Williamson ether synthesis and isolation from tablets)

Books Recommended:

1. 1. Thomas L. Lemke, David A. Williams, Victoria F. Roche, S. William Zito, Foye's Principles of Medicinal Chemistry, 7th Ed.,Lippincott Williams & Wilkins, 2012,ISBN 13: 9780781768795
2. Graham L. Patrick, "An Introduction to Medicinal Chemistry", 5th Ed. Oxford University Press 2013, ASIN : 0199697396
3. Wilson and Gisvolds Textbook of Organic Medicinal and Pharmaceuticals Chemistry, 8th edition, edited by R.F. Deorge, J.B. Lippincott Company, Philadelphia, 1982, ISBN 978-0-7817-7929-6
4. Jie Jack Li, Douglas S. Johnson, Modern Drug Synthesis, Wiley, 1st Edition, **ISBN:** 9780470768594
5. Pharmaceutical Chemicals in Perspective. B.G. Reuben and H.A. Wittcoff, John Wiley & Sons, New York, 1989., 1st Edition, ISBN 13: 9780471540366
6. Rama Rao nadendla, Principles of Medicinal Chemistry, New Ace publisher, 1st Edition, ISBN (13) : 978-81-224-2485-0

References Books:

1. Strategies of Organic Drug Synthesis and Design, D. Lendnicer, John Wiley and Sons, New York, 1998.

2. Pharmaceutical Chemicals in Perspective. B.G. Reuben and H.A. Wittcoff, John Wiley & Sons, New York, 1989.

3. W.C. Foye, Principles of Medicinal Chemistry, Lea & Febiger, Philadelphia, U.S.A. Suggested Readings 1. Strategies of Organic Drug Synthesis and Design, D. Lendnicer, John Wiley and Sons, New York, 1998.

Online links for study & reference materials :

1. https://pubs.acs.org/doi/abs/10.1021/jm00388a027
2. https://www.sciencedirect.com/book/9780444521668/synthesis-of-essential-drugs
3. https://cmr.asm.org/content/12/4/501
4. https://www.sciencedirect.com/book/9780444521668/synthesis-of-essential-drugs, An introduction to medicinal chemistry, Graham L. Patrick

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Course Code : STPC-304 Course Name: INDUSTRIAL CHEMISTRY
Course Credit Hour : 4hr Total Contact Hour : 60hr

Course Objective :

- After completion of the course, the learner shall be able to understand about the industrial processes of various types of the chemical and derivatives preparation in industrial scale and challenges. Have sound knowledge of pharmaceuticals, cosmetics, perfumes and pesticides. Become well equipped to design, carry out, record and analyze the industrial preparations. Understand the ethical, historic, philosophical, and environmental dimensions of problems and issues facing industrial chemists. Become skilled in problem solving, critical thinking and analytical reasoning. Identify and solve chemical problems and explore new innovative areas of research. Know the proper procedures and regulations for safe handling and use of chemicals and can follow the proper procedures.

Course Description :

- This course summary shall indicate the specific key topics of the Food-flavours, colours, preservatives, Production, and purification of ethyl alcohol, citric acid, lactic acid, Vitamin B12, Penicillin, fertilizers-classification, types, industrial preparation process, types and industrial process of glass and ceramics, Paints-classification, constituents, binders, solvents, Fats and oils.

Course Contents : L-4 T-0 P-2

Unit-I:
Food Additives: Food flavour, food colour, food preservatives, artificial sweeteners, acidulants, alkalies, edible emulsifiers and edible foaming agents, sequesterants – uses and abuses of these substances in food beverages.
Fermentation Chemicals: Production, and purification of ethyl alcohol, citric acid, lactic acid, Vitamin B12, Penicillin.

Unit-2:
Fertilizers: Manufacture of ammonia and ammonium salts, urea, Superphosphate, biofertilizers.

Unit-3:
Glass and Ceramics: Definition and manufacture of glasses, optical glass and coloured glass. Clay and feldspar, glazing and vitrification, glazed porcelein, enamel. Portland cement: composition and setting of cement, white cement.

Unit-4:
Paints, Varnishes and Synthetic Dyes: Primary constituents of a paint, binders and solvents for paints. Oil based paints, latex paints, baked-on paints (alkyd resins). Constituents of varnishes. Formulation of paints and varnishes. Synthesis of Methylorange, Congo red, Malachite green, Crystal violet.

Unit-5:

Fats-Oils-Detergents: Fats and oils, natural fat, edible and inedible oil of vegetable origin. Common fatty acids, glycerides. Hydrogenation of unsaturated oil, Production of toilet and washing soaps, detergent powder, liquid soaps.

SPPC-304-List of Laboratory Experiments

1. Preparation and Properties of a Soap
2. The Preparation and Verification of Malachite
3. Sulphur trioxide - the sulphuric acid contact process
4. Preparation of iron from oxidic ores (blast furnace process)
5. Evaluation of Detergents and Cleaning Aids
6. Checking the purity of Toothpaste
7. Preparation of a skin cream
8. Titration: Standardization of a base and analysis of stomach antacid tablets.

Course Learning Outcomes (CLOs) :

CLO-1 : To learn about various types of Food-flavours, colours, preservatives, Production, and purification of ethyl alcohol, citric acid, lactic acid, Vitamin B12, Penicillin.

CLO-2 : To learn about various types of fertilizers-classification, types, industrial preparation process.

CLO-3 : To learn about various types of industrial process of glass and ceramics,
CLO-4 : To learn about various types of Paints-classification, constituents, binders, solvents with case studies.

CLO-5 : To learn about various types of Fats and oils-classification, preparation, constitutes with case studies.

Text books :

1. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, John Wiley & Sons, Inc. Publishers, New Delhi.(2005 edition).
2. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
3. Richard Turton, Wallace B Whiting, Richard C Bailie Analysis, Synthesis and Design of Chemical Processes, 2020, Addison Wesley, ISBN-13: 9780134177403

Reference books :

1. George T. A. (1977). Shreve's Chemical Process Industries. 5th edn. McGraw-Hill International Edition. Chemical Engineering Series. Singapore.
2. Chang R. and Tikkanen W. (1988). The Top Fifty Industrial Chemicals. Random House, New York.
3. Price R.F. and Regester M.M. (2000), WEFA Industrial Monitor, 2000-2001, John Wiley & Sons Inc., New York. Chang R. (1991). Chemistry, 4th Edition, McGraw-Hill Inc. New York.
4. Shukla S. D and Pandey G. N, (1978). A Textbook of Chemical Technology. Vol.1 (Inorganic/Organic). Vikas publishing House PVT Ltd. New Delhi.
5. Stephenson R.M. (1966). Introduction to the Chemical Process Industries, Reinhold Publishing Corporation, New York.
6. Groggins P.H. (1958). Unit Processes in Organic Synthesis, 5th Edition, McGraw-Hill Book Company, New Delhi.
7. Das R.K. (1988) Industrial Chemistry: Metallurgy, Kalyani Publishers, New Delhi. Gerhartz, W. (Editor), (1987). Ullmann's Encyclopaedia of Industrial Chemistry Vol A8, 5th Edition, VCH Verlagsgesellschaft mbH, Weinheim.

Online links for study & reference materials

1. https://bookboon.com › chemistry-ebooks
2. https://www.researchgate.net/publication/257417805_Industrial_Chemistry
3. https://chemistry.com.pk/free-download-chemistry-books/
4. https://www.kopykitab.com/Industrial-Chemistry-1-by-Dr-G-S-Gugale-Dr-A-V-Nagawade-Dr-R-A-Pawar-Dr-K-M-Gadave
5. https://www.internetchemistry.com/chemistry/industrial-chemistry.php
6. **https://bookauthority.org/books/best-industrial-chemistry-books**

SEMESTER – IV

Course Code : STPC-401 Course Name: POLYMERS AND PLASTICS
Course Credit Hour : 4hr Total Contact Hour : 60hr

Course Objective :

- The aim of the course is to familiarize students with electrochemical processes occurring in the solid state. Quantitative determination of degree of polymerization and molecular weight distribution.

Course Description

- Polymer Chemistry is a course that introduces students to Polymer science, engineering and technology, types of polymer, reactions to form polymer, polymerization mechanisms, structures, properties and applications.

Course Contents : L-4 T-0 P-2

Unit-I

Basic concepts. Nomenclature- Degree of polymerization – polymerization process – Classification of polymerization reactions – Difference between thermoplastics and thermosets. Types of polymerization – Addition and step growth.

Unit II

Copolymerization- Block copolymerization – Graft copolymerisation. Stereo isomers – isotactic, atactic and syndyotactic polymers. Mechanism of polymerization – free radical and ionic. Heterogeneous polymerization – Zeigler-Natta catalysis. Compounding of plastics – Fabrication techniques of plastic.

Unit III

Polymer degradation – Types of degradation – thermal, mechanical, ultrasonic waves, photo-degradation, oxidative degradation (rubber and phenol-formaldehyde) and hydrolytic degradation.

Kinetics of polymer reaction – addition – Free-radical, cationic and Anionic polymerization. Condensation polymerization – acid catalysed condensation reactions.

Unit –IV

Analysis and testing of polymers – weight average nad number average molecular weights of polymers ratio of M_w and M_n. Determination of molecular weight of polymers by Cryoscopy – Light scattering – X-ray scattering – Viscosity – Ultra centrifuge and gel permeation chromatographic methods.

Unit –V

RUBBERS, ELASTOMERS AND ADHESIVES

Origin and chemical nature of natural rubber – D irect processing of lLatex – Compounding of rubber – Fabrication of rubber – Vulcanization of rubber. Elastomers – Manufacture, properties and uses of Butadiene, Isoprene and chloroprene. Natural and synthetic adhesives- Classification animal glue. Protein and starch adhesives – Resin adhesives. Difference between plastics, elastomers and adhesives.

Course Learning Outcomes (CLOs) :

CLO-1: The subject provides an introduction to polymer science with respect to synthesis, polymerization kinetics and network formation/gelation of macromolecules formed by step-growth and chain-growth polymerization. Polymer structure/conformation and transitions from liquid (melt, solutions) to solid (polymer crystals and –glass) states are discussed using equilibrium thermodynamics, kinetics and free volume considerations. Polymer solubility/miscibility and phase diagrams are determined using thermodynamic parameters.

CLO-2: An overview of mechanical and rheological properties of polymers is also given. Specialized synthesis for flow assurance industry.

CLO-3: Study of kinetic polymer reactions and degradation.

CLO-4: Molecular weight determination of polymers is shown using osmotic pressure, viscometry and size exclusion chromatography (SEC).

CLO-5: To differentiate between natural and man-made polymers, plastics, elastomers and adhesives.

Text books :

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publishing Company, 15th Edition.
2. Chemicals from petroleum, A. L. Waddns and J. Murray, ELBS Edn. 1970.
3. Chemical process Industries 5th Ed, George T. Austin, Mc Graw- Hill company Inc. 1984.
4. Textbook of polymer science, P. W. Billmeyer, John Wiley, 1962.
5. Petroleum products Hand Book, Virgil.B Guthhrie, Editor, 1st ed Mc Graw Hill book company Inc 1960.
6. Polymer science, V.R. Gowariker et al ., New Age Intl (P)Ltd, New Delhi.
7. Organic chemistry of synthetic High Polymers, Robert W. Lenz, Interscience Publishers.

Reference books :

1. Industrial chemistry by B. k Sharma, 5th Ed. 1993.
2. Introduction to Polymer Chemistry, Raymond B, Seymour.

Online links for study & reference materials:

1. https://www.accessengineeringlibrary.com/browse/polymer-science-and-technology-plastics-rubbers-blends-and-composites-third-edition
2. https://books.google.co.in/books?id=BS-hAgAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
3. https://books.google.co.in/books?id=BS-hAgAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

4. http://cryssmat.fq.edu.uy/ricardo/libro.pdf
5. http://courses.washington.edu/mengr553/Polymers.pdf

6. https://www.pharosproject.net/uploads/files/sources/1828/1371736918.pdf
7. https://www.mdpi.com/2073-4360/5/1/225.

Course Code : STPC-402 Course Name: INTELLECTUAL PROPERTY RIGHTS
Course Credit Hour : 4hr Total Contact Hour : 60hr

Course Objective :

- In this era of liberalization and globalization, the perception about science and its practices have undergone dramatic change. The importance of protecting the scientific discoveries, with commercial potential or the intellectual property rights is being discussed at all levels – statutory, administrative, and judicial. With India ratifying the WTO agreement, it has become obligatory on its part to follow a minimum acceptable standard for protection and enforcement of intellectual property rights. The purpose of this course is to apprise the students about the multifaceted dimensions of this issue. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries. To disseminate the knowledge on patents, patent regime in India and abroad on registration aspects. To disseminate the knowledge on copyrights and its related rights. To disseminate knowledge on trademarks and registration aspects. To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects. To aware about current trends in IPR and Govt. steps in fostering IPR.

Course Description :

- This course is an intensive study of the core subjects of intellectual property law: patents, copyrights, trade secrets, and trademarks. It examines the fundamental principles of these bodies of law, their underlying policies, and how the laws inter-relate. Course will provide the comprehensive knowledge to the students regarding Indian position of the Patent Law (1970), Historical development, Procedure for granting a patent, Infringement. Comprehensive knowledge to the students regarding Indian position of the Copyright Law, 1957, Historical background and Development of Copyright Law, Infringement. Comprehensive knowledge to the students regarding Indian position of the Trademark Act, 1999, Historical development of the concept of trademark and trademark law, Registration of trademark, Infringement of trademark, geographical indications and for industrial designs too.

Course Contents : L-4 T-0 P-2

Unit I: Introduction to Intellectual Property
Historical Perspective, Different Types of IP, Importance of protecting IP.

Unit II: Copyrights
Introduction, How to obtain, Differences from Patents.

Unit III: Trade Marks
Introduction, How to obtain, Different types of marks – Collective marks, certification marks, service marks, Trade names, etc. Differences from Designs.

Unit IV: Patents
Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India.

Unit V: Geographical Indications
Definition, rules for registration, prevention of illegal exploitation, importance to India.

Unit VI: Industrial Designs
Definition, How to obtain, features, International design registration.

Course Learning Outcomes (CLOs) :

CLO 1: The students once they complete their academic projects, shall get an adequate knowledge on patent and copyright for their innovative research works

CLO 2: During their research career, information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provides further way for developing their idea or innovations

CLO 3: Pave the way for the students to catch up Intellectual Property (IP) as a career option

a. R&D IP Counsel

b. Government Jobs – Patent Examiner

c. Private Jobs

d. Patent agent and Trademark agent

e. Entrepreneur

Text books :

1. N.S. Gopala krishnan and T.G. Agitha, (2009) Principles of Intellectual Property Eastern Book Company, Lucknow.
2. David Kitchin QC , David Llewelyn , James Mellor , Richard Meade , Thomas Moody-Stuart,and D. Keeling, Robin Jacob (2005). Kerly's Law of Trade Marks and Trade Names (14th Edition) Thomson, Sweet & Maxweel.
3. Ajit Parulekar and Sarita D' Souza, (2006) Indian Patents Law – Legal & Business Implications; Macmillan India Ltd.
4. B.L.Wadehra (2000) Law Relating to Patents, Trade Marks, Copyright, Designs &Geographical Indications; Universal law Publishing Pvt. Ltd., India.
5. P. Narayanan (2010) Law of Copyright and Industrial Designs; Eastern law House, Delhi.

Reference books :

1. N.K. Acharya: *Textbook on intellectual property rights*, Asia Law House (2001).
2. Manjula Guru & *M.B.* Rao, *Understanding Trips: Managing Knowledge in Developing Countries*, Sage Publications (2003).
3. P. Ganguli, Intellectual Property Rights: *Unleashing the Knowledge Economy*, Tata McGraw-Hill (2001).
4. Arthur Raphael Miller, Micheal H.Davis; *Intellectual Property: Patents,Trademarks and Copyright in a Nutshell*, West Group Publishers (2000).
5. Jayashree Watal, *Intellectual property rights in the WTO and developing countries,* Oxford University Press, Oxford.

Online links for study & reference materials :

http://cipam.gov.in/

(https://www.wipo.int/about-ip/en/

(http://www.ipindia.nic.in/

http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

POSTGRADUATE PROGRAMME

Choice Based Credit System (CBCS)

(Academic Year 2021-22)

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So, it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
   - **2.1 Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
   - **2.2 Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
   - **2.3 Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

     P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
   - **3.1** AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
   - **3.2** AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Course and programme outcome of MSC

Profile

- The mission is to impart employability and creativity to the students, to live up to the standards of IT industry.
- Experienced faculty members with good capabilities.
- Faculty members with ample Industry experience and profound caliber.
- Valuable lectures delivered by renowned personalities from the reputed Industries, for the benefit of the students.
- State-of-the-art teaching resources, and well equipped labs, library etc.
- Students' seminar to increase the presentation, skills and their leadership qualities.
- Effective Industry Institute interaction is achieved through seminars, workshops and guest lectures. This encourages the professional discussion between the students and the participating managers from the industry. This also gives the students a chance to envisage their roles in the industry beforehand.
- Enhancing the knowledge of the students by interacting with the Industry skills, and their leadership qualities.

Program Offered: Post Graduate

- M.Sc - Master of Information Technology - 2 Years

VISION

To be the source of bringing out globally competent pioneering computing professionals, researchers, innovators and entrepreneurs and thereby succeed and contribute value to the knowledge-based economy and society.

MISSION

- To offer high-grade, value-based Post-graduate programme in the field of Computer Science.
- To provide conducive environment so as to achieve excellence in teaching-learning, and research and development activities.
- To bridge the gap between industry and academia by framing curricula and syllabi based on industrial and societal needs.
- To offer tasks for experiential technology-intensive knowledge through collaborative and interdisciplinary activities.
- To provide appropriate forums to develop innovative talents, practice ethical values and inculcate as enduring learners.
- To facilitate students to nurture skills to practice their professions competently to meet the ever-changing needs of society

Programme Educational Objective

PEOs of M.Sc programme are:

M.Sc programme of Noida International University will prepare its students for

PEO 1: To progress their career productively in software industry, academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services.

PEO 2: To achieve peer-recognition; as an individual or in a team; by adopting ethics and professionalism and communicate effectively to excel well in cross culture and inter-disciplinary teams.

PEO 3: To continue a lifelong professional development in computing that contributes in self and societal growth.

Programme Outcome: On completion of M.Sc degree, the graduates will be able to

PO1. Apply the knowledge of mathematics and computing fundamentals to various real life applications for any given requirement

PO2. Design and develop applications to analyze and solve all computer science related problems

PO3. Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects

PO4. Analyze and review literatures to invoke the research skills to design, interpret and make inferences from the resulting data

PO5. Integrate and apply efficiently the contemporary IT tools to all computer applications

PO6. Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations

PO7. Involve in perennial learning for a continued career development and progress as a computer professional

PO8. Function effectively both as a team leader and team member on multi-disciplinary projects to demonstrate computing and management skills

PO9. Communicate effectively and present technical information in oral and written reports

PO10. Utilize the computing knowledge efficiently in projects with concern for societal, environmental, and cultural aspects

PO11. Function competently as an individual and as a leader in multidisciplinary projects

PO12. Create and design innovative methodologies to solve complex problems for the betterment of the society

PO13. Apply the inherent skills with absolute focus to function as a successful entrepreneur.

COURSE STRUCTURE (INFORMATION TECHNOLOGY)
Details of courses under M.Sc

	Theory+ Practical	Theory + Tutorial
I. Core Course (14 Papers)	12X4= 48	12X5=60
Core Course Practical / Tutorial* (14 Papers)	12X2=24	12X1=12
II. Elective Course (8 Papers)		
A.1. Discipline Specific Elective **(4 Papers)**	4X4=16	4X5=20
A.2. Discipline Specific Elective Practical/ Tutorial* **(4 Papers)**	4 X 2=8	4X1=4
B.1. Generic Elective/ Interdisciplinary **(4 Papers)**	2X4=8	2X5=10
B.2. Generic Elective Practical/ Tutorial* **(4 Papers)**	2 X 2=4	2X1=2

- **Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6th Semester**

III. Ability Enhancement Courses

1. **Ability Enhancement Compulsory**

(2 Papers of 2 credit each)	2 X 2=4	2 X 2=4

Environmental Science

English/MIL Communication

2. **Ability Enhancement Elective** (Skill Based)

(Minimum 2) **(2 Papers of 2 credits each)**	2 X 2=4	2 X 2=4
Total credit	**108**	**116**

*** Wherever there is a practical there will be no tutorial and vice-versa**

M.Sc. (Hons) Information Technology

Core Papers (C): (Credit: 06 each)

(1 period/week for tutorials/practical or 4 periods/week for theory)

1. MIT01: Problem Solving With C (4 + 2)
2. MIT02: Advanced DBMS (4 + 2)
3. MIT03: Computer Organization and Architecture (4 + 2)
4. MIT04: Data Structure using C (4 + 2)
5. MIT05: Computer Networks (4 + 2)
6. MIT06: OOPS with JAVA (4 + 2)
7. MIT07: Python Programming (4 + 2)
8. MIT08: Operating System (4 + 2)
9. MIT09: Data Mining & Warehousing (4 + 2)
10. MIT010: Theory of Computation (4 + 2)
11. MIT011: Compiler Design / Cryptography & Network Security (4 + 2)
12. MIT012: Software Testing (4 + 2)
13. MIT013: Distributed Systems (4 + 2)
14. MIT014: DOT (.) NET Framework (4 + 2)

Discipline Specific Elective Papers: (Credit: 06 each) - DSE 1-4

(4 papers to be selected: 02 each for Odd semester and Even semester as listed below)

1. DSE01: Cloud computing (4 + 2)
2. DSE02: Cryptography and Network Security (4 + 2)
3. DSE03: Python (4) + Lab (2)
4. DSE04: Big Data (5) + Tutorial (1)
5. DSE05: Numerical Analysis(4) + Lab (2)
6. DSE06: Information Security Cyber Law(4) + Lab (2)
7. DSE07: Information Security (4) + Lab (2)
8. DSE08: Data Mining (4) + Lab (2)
9. DSE09: Operation Reseach (5) + Tutorial (1)
10. DSE10: Dissertation/ Project

Skill Enhancement Courses (02 to 04 papers) (Credit: 02 each) - SEC1 to SEC4

1. SEC01: Management Information System
2. SEC02: Web Technology
3. SEC03: Software Engineering
4. SEC04: Theory of Computation
5. SEC05: Microprocessor
6. SEC06: Digital Image Processing
7. SEC07: Machine Learning
8. SEC08: Data Mining
9. SEC09: Networking Programming

Generic Elective Papers (GE): (Credit: 06 each)

1. GE01: Internet Technologies (4) + Lab (2)
2. GE02: Advanced Industrial Communication (4) + Lab (2)
3. GE03: Hypertext Pre-Processor (4) + Lab (2)
4. GE04: Mobile Computing (4) + Lab (2)
5. GE05: Entrepreneurship (4) + Lab (2)

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for M.Sc. (Information Technology)
Effective from the Session: 2021-2022

M.Sc. (Hons) Information Technology 1st Year
SEMESTER-I

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	MIT-101	Problem Solving With C	4	0	0	20	20	40	60	100	4	C1
2	MIT-102	Data Mining and Warehousing	4	0	0	20	20	40	60	100	4	DSE-1
3	MIT-103	Computer Organization and Architecture	4	1	0	20	20	40	60	100	5	C2
4	MIT-104	Discrete Mathematics Structure	4	1	0	20	20	40	60	100	5	C3
5	MIT-105	Advanced Industrial Communication	4	1	0	20	20	40	60	100	5	GE1
Practical												
1	MIT-151	Problem Solving With C Lab	0	0	2			40	60	100	2	C1
2	MIT-152	Data Mining and Warehousing Lab	0	0	2			40	60	100	2	DSE-1
Total										**700**	**27**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

M.Sc. (Hons) Information Technology 1st Year
SEMESTER-II

S. No	Course Code	Subject	Period			Evaluation Scheme			External Exam	Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total				
1	MIT-201	Data Structure using C	4	0	0	20	20	40	60	100	4	C4
2	MIT-202	Computer Networks	4	1	0	20	20	40	60	100	5	C5
3	MIT-203	OOPS using JAVA	4	1	0	20	20	40	60	100	5	C6
4	MIT-204	Entrepreneurship and Corporate Communications	4	0	0	20	20	40	60	100	4	GE-2
5	MIT-205	Artificial intelligence /Cryptography and network security/information security	4	1	0	20	20	40	60	100	5	DSE2
Practical												
1	MIT-251	Data Structure using C Lab	0	0	2			40	60	100	2	C4
3	MIT-252	OOPS using JAVA lab	0	0	2			40	60	100	2	C6
Total										**700**	**27**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

M.Sc. (Hons) Information Technology 2nd Year
SEMESTER-III

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	MIT-301	Operating System	4	0	0	20	20	40	60	100	4	C7
2	MIT-302	Theory of Computation	2	1	0	20	20	40	60	100	5	SEC1
3	MIT-303	Advanced DBMS	4	1	0	20	20	40	60	100	5	8C
4	MIT-304	Python Programming	4	0	0	20	20	40	60	100	4	C9
5	MIT-305	Compiler Design/ Cryptography and Network Security	4	1	0	20	20	40	60	100	5	DSE-3
Practical												
1	MIT-351	Python Programming LAB	0	0	2			40	60	100	2	C9
2	MIT-352	Operating System LAB	0	0	2			40	60	100	2	C7
Total										**700**	**27**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

M.Sc. (Hons) Information Technology 2nd Year
SEMESTER-IV

S. No	Course Code	Subject	Period			Evaluation Scheme			External Exam	Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total				
1	MIT-401	Software Testing	4	1	0	20	20	40	60	100	5	C10
2	MIT-402	Software Engineering	4	1	0	20	20	40	60	100	5	SEC-2
3	MIT-403	Dot (.) NET Framework	4	0	0	20	20	40	60	100	4	C11
4	MIT-404	Distributed System	4	1	0	20	20	40	60	100	5	C12
5	MIT-405	Industrial Project	0	0	6	20	20	40	60	200	6	DSE-4
Practical												
1	MIT-451	Dot (.) NET Framework LAB	0	0	2			40	60	100	2	C11
Total										**700**	**27**	
Note: List of Practical will be supplied at the Start of every Semester												

C: Core Courses;
GE: Generic Elective;
AECC: Ability Enhancement Compulsory Course;
SEEC: Skill Enhancement Elective Courses;
DSE: Discipline Specific Elective

OVERALL CREDIT SCHEME

S. No.	SEMESTER	Theory Total	Practical Total	Subject Total	Total Credit
1	I	500	200	700	27
2	II	500	200	700	27
3	III	500	200	700	27
4	IV	400	300	700	27
			Grand Total	**2800**	**108**

NOIDA INTERNATIONAL UNIVERSITY

SEMESTER 1

Course Code: MIT101 **Course Name:** Problem Solving with C
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- The course is intended to create an understanding of the fundamentals of high-level structural programming concepts through the medium of C language.
- C language is a general purpose, procedural computer programming language.

Course Outcome:

- The students will be able to solve problems systematically and to implement the solution in C language.
- Develop programming skills.
- Develop the knowledge of how to learn a programming language, which will help in learning other Computer Languages in the curriculum

Course Description:

- The course is used to demonstrate the understanding of computer programming languages.
- Able to define data types and use them in simple data processing applications also student must be able to understand the concept of array of structures.

Course Contents:

- **Unit – I: C Fundamentals:** Character Set, Identifier & Keywords, Data Types, Variables, Operators and expressions, Symbolic Constants, Preprocessor Directives, and Library Functions.
- **Unit – II: Control Structure and Functions:** If statement, if-else statement, nested if-else, conditional operators, while, do-while and for loop, multiple initializations of for loop, break and continue statement. Function definition, passing values between functions, call by value and call by reference.
- **Unit – III: Arrays and Structure:** Definition and classification of arrays, string definition and standard library string functions, defining a structure, Array vs Structure, Initialization of a structure, Nested structure.
- **Unit – IV: Pointers and File Handling:** Pointers variables, Pointer operator, array of pointer, pointers to functions, dynamic allocation functions, File I/O: Types of I/O, console I/O functions sfrintf() and sscanf() functions, file operations, file opening modes, record I/O in files

Course learning Outcome:

- **CLO1:** this unit is to develop an understanding of basic character sets keywords and identifiers used for the c programming dataset. Learning objective of this unit is defining data types and uses them in simple data processing applications.
- **CLO2:** the learning objective here is to identify and put to use basic loops, conditional loops and iterative loops. Various break statements and call by value and reference are understandable in this unit.
- **CLO3:** This unit is to classify basic arrays and structures, various standard library functions, nested structures etc.
- **CLO4:** this unit is for learning console I/O, various functions and modes for file opening closing and recording I/O.

Textbooks:

1.Let Us C: Yashvant Kanitkar[BPB]
2.C The Complete Reference,rdSchildt, TMH
3.Practical C Programming,3 Ed,Oualline,SPD/O'REILLY

Reference books:

1. Programming in C, Schaum Outline, McGraw-Hill 3
2.Lab Manual for Basic Linux commands, to be provided by the department

Online links for study & reference materials:

https://lecturenotes.in/download/note/18532-note-for-cprogramming-by-anshuman

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MIT102 **Course Name :** Data Mining and Warehousing
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- This course gives an introduction to methods and theory for development of data warehouses and data analysis using data mining. Data quality and methods and techniques for preprocessing of data. Modeling and design of data warehouses. Algorithms for classification, clustering and association rule analysis.

Course outcome :

- Understand theoretical and practical aspects of information and data mining
- Understand the quantitative evaluation methods for the IR systems and data mining techniques

Course Description :

- Data preprocessing and data quality.
- Modeling and design of data warehouses.
- Algorithms for data mining.

Course Contents :

- **UNIT-1: Introduction to Data mining**, types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data: Data Set, Summary Statistics, Visualization, OLAP and multi-dimensional data analysis.
- **UNIT-II: Classification:** Basic Concepts, Decision Trees and model evaluation: General approach for solving a classification problem, Decision Tree induction, Model over fitting: due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier. Nearest Neighborhood classifier, Bayesian Classifier, Support vector Machines: Linear SVM, Separable and Non Separable case.
- **UNIT-III: Association Analysis:** Problem Definition, Frequent Item-set generation, rule generation, compact representation of frequent item sets, FP-Growth Algorithms. Handling Categorical, Continuous attributes, Concept hierarchy, Sequential, Sub graph patterns
- **UNIT-IV: Clustering:** Over view, K-means, Agglomerative Hierarchical clustering, DBSCAN, Cluster evaluation: overview, Unsupervised Cluster Evaluation using cohesion and separation, using proximity matrix, Scalable Clustering algorithm
- **UNIT-V: Web Data Mining:** Introduction, Web terminology and characteristics, Web content mining, Web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of WebPages, Enterprise search

Course learning outcome:

- **CLO1 :** to have an Overview and Definition of Data Warehousing Components, 8 Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse
- **CLO2:** : Data Cleaning: Missing Values, Noisy Data,(Binning, Clustering, Regression, Computer and Human inspection),Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Decision Tree.
- **CLO3**: To familiar with principles Warehousing Strategy, Warehouse management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, , Data Extraction, Cleanup & Transformation Tools, Warehouse Metadata
- **CLO4** :To familiar with Classification: Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases
- **CLO5:** To familiar with Data Visualization and Overall Perspective: Aggregation, Historical 8 information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery

Text books :

1.Alex Berson, Stephen J. Smith “Data Warehousing, Data-Mining & OLAP”, TMH
2.mark Humphries, Michael W. Hawkins, Michelle C. Dy, “ Data Warehousing: Architectureand Implementation”, Pearson

Online links for study & reference materials :

https://www.dei.unipd.it/~capri/SI/MATERIALE/DWDM0405.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MIT103 **Course Name:** Computer organization and Architecture
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- To facilitate the students, learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.
- To facilitate the students to be familiarized with the hardware components and concepts related to the input-output organization.
- To facilitate the students to be familiarized with the hardware components and concepts related to the memory organization.
- To facilitate the students to be familiarized with the concepts related to the 8086-micro controller like pin diagram, different types of registers and addressing modes.

Course Outcome:

- The students will be capable of using the methods to study of physical memory and various machine language codes.
- The students will get an overall view of computer architecture

Course Description:

- Computer architecture is a specification detailing how a set of software and hardware technology standards interact to form a computer system or platform. Computer architecture refers to how a computer system is designed and what technologies it is compatible with. There are three categories of computer architecture:
- System Design: This includes all hardware components in the system, including data processors aside from the CPU, such as the graphics processing unit and direct memory access. It also includes memory controllers, data paths and miscellaneous things like multiprocessing and virtualization
- Instruction Set Architecture (ISA): This is the embedded programming language of the central processing unit. It defines the CPU's functions and capabilities based on what programming it can perform or process. This includes the word size, processor register types, memory addressing modes, data formats and the instruction set that programmers use.
- Micro architecture: Otherwise known as computer organization, this type of architecture defines the data paths, data processing and storage elements, as well as how they should be implemented

Course Contents:

- **Unit-I:** Basis Computer Architecture, Functional Organization, Register Organization, Arithmetic and Logic Unit, Central Processing unit, Instruction Formats. CPU architecture, instruction format, addressing mode, stacks and handling of interrupts. Assembly language - Elementary problems

- **Unit-II:** Addressing Modes. Data Transfer and Manipulation, interrupts RISC/CISC architecture. Register transfer and macro-operations, Register Transfer Languages (RTL). Arithmetic, Logic and Shift Macro-operations, Sequencing, Micro-program sequences.

- **Unit-III:** Memory & Storage: Processor Vs. Memory speed: Cache memory. Associative memory, Virtual memory and Memory management. Pipeline & vector processing

- **Unit-IV:** Input/ Output organization: Peripheral devices, I/O Asynchronous Data Transfer: Strobe Control, Data Transfer Schemes (Programmed, Initiated, DW, Transfer)

- Unit-V: Memory Hierarchy, Main Memory, Auxiliary Memory, Cache Memory

Course learning Outcome:

- **CO1.** This unit is for understanding function and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer.

- **CO2.** Machine instructions, Operands, addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.

- **CO3.** Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Micro programmed control unit

- **CO4.** Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Address t l ti H d t f t translation, Hardware support for memory manage.

- **CO5.** Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O Interrupt controlled I/O and DMA controlled I/O I/O interfaces Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infini Band, I/O peripherals - Input devices, Output devices, Secondary storage devices.

Text books :

- Moris Mano, “Computer System Architecture”, PHI Publications, 2002
- R. P. Jain, “Modern Digital Electronics”, TMH, 3rd Edition, 2003

Reference Books:

- Computer System Architecture (Third Edition),. Morris Mono - Pearson PrenticeHall,2007.

Online links for study & reference materials :

- http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MIT104 **Course Name:** Discrete Mathematics Structure
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- The course is aimed at general introduction to the subject of discrete mathematics and its relevance to computer science. We start with elements of logic with emphasis on propositional logic and predicate calculus. Next we discuss sets and functions and develop the concepts of floor and ceiling functions and their use in computer science. The important topic of growth of functions and the methods of estimating the order of growth with the big-O, big-Omega, and big-Theta are discussed. After introducing algorithms, we pass on to principle of mathematical induction which is an important tool for proving general results. Counting techniques, relations, graphs and trees are also discussed at some length.

Course Outcome:

- The students will be capable of using the mathematical methods and algorithms learned for analyzing and solving problems related to Computer Science.
- The students will get an overall view of concepts in probability and statistics.

Course Description:

- The subject is very important in forming the basics for algorithms, complexity and computational theory. The concept of Boolean algebra is useful in not only creating logical solution but is very important as a critical programming skill too.

Course Contents:

- **Unit - I: Mathematical Logic:** Statements and notations, Connectives, Well-formed formulas, Truth tables, tautology, equivalence implication, Normal forms, Theory of inference for the statement calculus, Rules of inference, Consistency of premises and indirect method of proof, Automatic Theorem Proving Predicate calculus: Predicates, statement functions, variables and quantifiers, predicate formulas, free & bound variables, universe of discourse, inference theory of predicate calculus

- **Unit - II: Set theory & Relations:** Introduction, Relations and ordering, Properties of binary Relations, Equivalence, Compatibility Relations, Partial ordering, Hasse diagram. **Functions:** composition of functions, Inverse Function, Recursive Functions, Lattice and its Properties, Pigeon-hole Principles and its application.
  Algebraic structures: Algebraic systems, Examples and general properties, Semi groups and monoids, groups, sub groups, Definitions, Examples, homomorphism, Isomorphism and related problems.

- **Unit - III: Elementary Combinatorics:** Basis of counting, Enumeration of Combinations & Permutations, Enumerating of Combinations & Permutations with repetitions and constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, principles of Inclusion – Exclusion.

- **Unit - IV: Recurrence Relations:** Generating Function of Sequences, Calculating Coefficient of generating functions, Recurrence relations, Solving recurrence relation by substitution and Generating functions, the method of Characteristic roots, Solution of Inhomogeneous Recurrence Relation.

- **Unit - V: Graph Theory:** Representation of Graph, Spanning Trees, BFS, DFS, Krushkal's Algorithm, Binary trees, Planar Graphs, Graph Theory and Applications, Basic Concepts, Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers.

Course learning outcome:

- **CO1.** The students will be able to understand the concept of functions and various relations as well as function mappings performed. The concept of algebraic structures and manipulations using various axioms is performed Introduction to partially ordered sets and conditions necessary for a poset to qualify as a lattice. Lattice homomorphism and practice problems on the same.

- **CO2.** Concept of mathematical logic, arguments and reasoning. Conjunction, disjunction and negation of statements. Wff, the concept of free and bounded variables. Tautology and equivalence relations and proof of contradiction.

- **CO3.** This unit is for introduction to the basics of counting. Permutations and combinations. Principal of inclusion- exclusion and practice for the same.

- **CO4.** Students will be able to have an understanding of various methods of generating coefficient of functions. Recurrence relation by substitution and generating root solution for homogeneous recurrence relation.

- **CO5.** This unit covers the graph representation. Various types of graphs and graph isomorphism, paths circuits and sub graphs. Multi-graphs, Euler circuits Euler paths, Hamiltonian graphs and chromatic representation of graphs.

Text books:

- Discrete mathematical structures with applications to computer science Trembly J.P. & Manohar. P, TMH
- Discrete mathematics and its applications, Kenneth H. Rosen, 5th edition. TMH

Reference Books:

- Discrete mathematical structures, bernand kolman, roberty C.
- Discrete maths and problems thomas koshey, Elsevier.

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Online links for study & reference materials :

- https://mathworld.wolfram.com/DiscreteMathematics.html
- https://mls.cs.fiu.edu/fajkkmnmh/16-lonzo-mayert-i-1/BRe4S4kyV-discrete-mathematics-with-graph-theory-9789382127185.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MIT 105 **Course Name: Advance Industrial Communication**
Course Credit Hour : 4hr **Total Contact Hour : 60hr**

Course Objective :

- To create an understanding in the mind of the student regarding formal and professional communication practised in a professional environment .

Course Description:

- In the present industrial scenario the role of instrumentation is becoming more vital day by day specially in case of industrial automation. More advanced, precise and complex instrumentations are being employed in the industry. These advance instruments requires communication of data from equipment/machines to instruments and vice versa for process and quality control.

Course Contents :

- **Unit - I: (Business Communication) :**Difference between general and business communication, this should cover general and technical writing, oral communications and listening skill
- **Unit - II : (Expression)** Practical communication skill development, business presentation with multimedia, speaking skill, prepared speech, extempore speech
- **Unit - III :(Reading Skills)** Reading skill: comprehension test, technical report writing: precise, technical/business letter, organization of writing material, poster presentation

- **UNIT-IV (Literature) :**Of Studies: Francis Bacon
- **UNIT-V (Presentation) :**Writing technical document, preparing software user manual, preparing project documentation.

Course learning outcome :

- **CO1.** this unit is for understanding general business communication.
- **CO2.** this unit is for understanding skill development and confidense development.
- **CO3.** reading skills are extremely important for any type of business communication.
- **CO5.** writing technical documentation

Text books:

- Business Correspondence & Report Writing, Sharma, TMH 2.Business Communication Strategies, Monipally, TMH

- English for Technical Communication ,Laxminarayanan,Scitech
- Business Communication, Kaul,PHI

Online links for study & reference materials:

- https://mgdic.files.wordpress.com/2016/12/3361704-industrial-data-communication.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

MIT-151- C-Programming Lab-

MIT-152- Data Mining and Warehousing Lab

SEMESTER 2

Course Code: **MIT 201**
Course Credit Hour: **4hr**

Course Name: Data Structures using C
Total Contact Hour: **60hr**

Course Objective:

- The objective of the course is to teach programming (with an emphasis on problem solving) and introduce elementary data structures. The student should, at a rudimentary level, be able to prove correctness (loop invariants, conditioning, etc) and analyze efficiency (using the `O' notation).

Course Description :

- Design correct programs to solve problems.
- Choose efficient data structures and apply them to solve problems.
- Analyze the efficiency of programs based on time complexity.
- Prove the correctness of a program using loop invariants, pre-conditions and post-conditions in programs

Course Contents:

- **Unit – I: Arrays:** Representation of single and multidimensional arrays; sparse arrays - lower and upper triangular matrices and Tri-diagonal matrices

- **Unit – II:** .**Stacks and Queues**: Introduction and primitive operations on stack; Stack application, Infix, postfix, prefix expressions; Evaluation of postfix expression; Conversion from infix to postfix, Introduction and primitive operation on queues.

- **Unit – III: Lists**: Introduction to linked lists; Sequential and linked lists, operations such as traversal,insertion, deletion, searching, Two way lists and Use of headers. **Trees**: Introduction and terminology; Traversal of binary trees; Recursive algorithms for tree operations such as traversal, insertion, deletion; threaded trees, binary search trees, trees in search algorithm. B- tree. B+ tree and applications.

- **Unit – IV: Sorting Techniques**: Insertion sort, selection sort, merge sort, heap sort.
  Searching Techniques: Linear search, binary search and hashing

- **Unit - V :File structure:** physical storage devices and their characteristics, constituents of a file viz. fields,records, fixed and variable length records, primary and secondary keys; file operations, basic filesystem operations, file organizations:

serial sequential, index sequential, direct , inverted, hashing function and collision handling methods

Course learning outcome :

- **CLO1 :** this unit is to Review of Problem Solving using computers, Abstraction, Elementary Data Types. Algorithm design- Correctness via Loop invariants as a way of arguing correctness of programs, preconditions, post conditions associated with a statement.develop a understanding of basic character sets keywords and identifiers used for the c programming dataset. Learning objective of this unit is define data types and use them in simple data processing applications .
- **CLO2:** Introduction to stacks , arrays and queues. Difference and various use case.
- **CLO3**: This unit is to introduce lists and tree terminology . introduction to graphs and trees .
- **CLO4** : various sorting techniques. Insertion , bubble etc.
- **CLO5:** this unit is for learning different modes of file storage. Records and there usage .

Text books:

- Data Structures and Algorithm Analysis in C++, by Mark Allen Weiss (Pearson 2007)

Reference books :

- Data structures and Algorithms in C++ -- by Adam Drozdek (1994 2001).
- How to solve it by Computer -- by R G Dromey (PHI 1982, Paperback 2008).
- Fundamentals of Data Structures in C -- by Horowitz, Sahni and Anderson-Freed (Silicon Press 2007).
- Data Structure Using C and C++ -- by Y. Langsam, M. J. Augenstein and A. N. Tanenbaum (Pearson Education, 2nd Edition, 2015).

Online links for study & reference materials :

https://slideplayer.com/slide/5987087/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCA202 | **Course Name :** Computer Networks

Course Credit Hour : 4hr | **Total Contact Hour :** 60hr

Course Objective :

- The main emphasis of this course is on the organization and management of local area networks (LANs). The course objectives include learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and gaining practical experience in installation, monitoring, and troubleshooting of current LAN systems.
- The course introduces computer communication network design and its operations. The course includes the following topics: Open Systems Interconnection (OSI) communication model; error detection and recovery; local area networks; bridges, routers and gateways; network naming and addressing; and local and remote procedures.

Course outcome :

- The students will gain proficiency in various network protocols and models.

Course Description :

- Describe how computer networks are organized with the concept of layered approach.
- Implement a simple LAN with hubs, bridges and switches.
- Describe how packets in the Internet are delivered.
- Analyze the contents in a given Data Link layer packet, based on the layer concept. Design logical sub-address blocks with a given address block.
- Decide routing entries given a simple example of network topology

Course Contents :

- **Unit – I: Data communications concepts**: Digital and analog , parallel and serial, synchronous and asynchronous, simplex, half duplex, duplex, multiplexing, Transmission media: Wired(physical): Twisted pair, Coaxial cable, Optical Fiber.

Communication switching techniques: Circuit switching, message switching, packetswitching.

- **Unit – II: .Introduction to Computer Network** : Network Topologies, Types of Network, OSI and TCP/IP Models: Layers and their functions, comparison of models. **Data Link Layer Fundamentals**: Framing, Basics of Error Detection, Forward ErrorCorrection, Cyclic Redundancy Check codes for Error Detection.

- **Unit – III: Media Access Protocols :** The advantages of Multiple-Access Sharing of Channel Resource, ALOHA, Carrier Sense Multiple Access (CSMA),

CSMA with Collision Detection (CSMA/CD), Token Ring, Token Bus, Asynchronous Transfer Mode (ATM).

- **Unit – IV: Network Layer:** Host to Host Delivery: IP Addressing and Routing, Gateway, N/W Layer Protocols: ARP, IPV4, ICMP, IPV6. **Transport Layer:** Process-to-Process Delivery: UDP, TCP Congestion Control & Quality of Service.

- **Unit - V :Application Layer:** Client Server Model, Domain Name System (DNS), E-mail (SMTP), File Transfer (FTP) and Model TCP/IP.

Course learning outcome :

- **CLO1 :**Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
- **CLO2:** : Have a basic knowledge of the use of cryptography and network security.
- **CLO3**: Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols.
- **CLO4** : Analyze, specify and design the topological and routing strategies for an IP based networking infrastructure
- **CLO5:** Have a working knowledge of datagram and internet socket programming

Text books :

- A.S. Tanebaum : Computer Networks (4th ed.), Prentice-Hall of India.
- W. Tomasi : Introduction to Data Communications and Networking, Pearson, Education.
- P.C. Gupta : Data Communications and Computer Networks, Prentice-Hall of India.

Reference books :

- Behrouz Forouzan and S.C., Fegan : Data Communications and Networking, McGrawHill.
- L.L. Peterson and B.S. Davie : Computer Networks : A system Approach, MorganKaufmann.
- William Stalilngs : Data and Computer Communications, Pearson Education

Online links for study & reference materials :

http://www.svecw.edu.in/Docs%5CCSECNLNotes2013.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MIT203 **Course Name :** oops using JAVA
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- This course focuses on the advantages of the OO paradigm and domain modeling in reducing the representational gap between a target domain and the software application itself. Minimizing this gap leads to more effective solutions that are both flexible and robust. The modeling notation taught and used in conjunction with the course is the industry standard UML (Unified Modeling Language) 2.0.
- UML provides a programming language independent framework for the analysis, design, programming and testing of software applications. Using a combination of UML and various techniques for analysis and design.
- the course relates Object Oriented concepts to modeling complex problems. Models built using these techniques have a very high success rate when turned into working code.

Course outcome :

- Design the classes needed, given a problem specification.
- Implement the designed classes using the object oriented programming language.
- Learn how to test, verify, and debug object-oriented programs and create programs using object oriented principals

Course Description :

- Learn the three pillars of building a system; The Model, The Process, The Best Practices
- Have a good, working definition of object-oriented programming
- Understand the object oriented model, including types, objects, encapsulation, abstraction, messaging, protocols, inheritance, polymorphism, relationships, and coupling, strengths and weaknesses
- Understand the concept of representational gap between an application and its targeted domain
- Relate how Domain Modeling minimizes the representational gap between domain and application
- Learn how to read and create the most important UML diagrams

Course Contents :

- **UNIT–I: Basics of Object Oriented Programming (OOP):** Need for OO paradigm , A way of viewing world- Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of OOP concepts, coping with complexity, abstraction mechanisms.

Java Basics: Data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects- concepts of classes, objects, constructors methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

- **UNIT–II: Inheritance:** Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism, abstract classes.

  Packages and Interfaces: Defining, Creating and Accessing a package, Understanding CLASSPATH, Importing packages, differences between classes and interfaces, defining an interface, Implementing interface, applying interfaces variables in interface and extending interfaces.
- **UNIT–III: Exception handling and Multithreading**: Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throws and finally, built in exceptions, creating own exception sub classes. Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups
- **UNIT–IV: Event Handling:** Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy , user-interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, list panes- scroll pane, dialogs, menu bar, graphics, layout manager- layout manager types- boarder, grid, flow, card and grid bag.
- **UNIT-V: Applets:** Concepts of Applets, differences between applets and applications, lifecycle of an applet, types of applets, creating applets, passing parameters to applets,

  Swings: Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons-The JButton class, Check boxes, Radio Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees and Tables.

Course learning outcome :

- **CLO1 :** basics of object learning medhology and concepts of class creation and object interaction
- **CLO2:** : Have a basic knowledge of the use of attributes , objects, methods etc.
- **CLO3**: To understand Class Modeling and Design Approaches: Three approaches for identifying classes - using Noun phrases, Abstraction,

Use Case Diagram. Comparison of approaches. Using combination of approaches

- **CLO4** :Techniques for Interaction diagrams: Sequence diagram - Sequence diagram notations and examples, iterations, conditional messaging, branching, object creation and destruction, time constraints, origin of links, Activations in sequence diagram
- **CLO5:** developing dynamic systems: Top - down approach for dynamic systems. Bottom - up approach for dynamic systems. Flexibility Guidelines for Behavioral Design

Text books :

- Designing Flexible Object Oriented systems with UML - Charles Ritcher
- object Oriented Analysis & Design, Sat/.inger. Jackson, Burd Thomson
- Object oriented Modeling and Design with UML - James Rumbaugh. Micheal Blaha (secondedition)

Reference books :

- The Unified Modeling Language User Guide - Grady Booch, James Rumbaugh, IvarJacobson.
- Oriented Modeling and Design - James Rumbaugh
- Teach Yourself UML in 24 Hours - Joseph Schmuilers

Online links for study & reference materials :

https://www.vssut.ac.in/lecture_notes/lecture1423183198.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MIT204 **Course Name:** Entrepreneurship and Corporate Communications
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- To create an understanding in the mind of the student regarding formal and professional communication practiced in a professional environment .

Course outcome :

- Master the art of a professional business presentation •
- Distinguish different communication process and its practical application

Course Description:

- In the present industrial scenario the role of instrumentation is becoming more vital day by day specially in case of industrial automation. More advanced, precise and complex instrumentations are being employed in the industry. These advance instruments requires communication of data from equipment/machines to instruments and vice versa for process and quality control.

Course Contents :

- Unit - I: (Business Communication) :Difference between general and business communication, this should cover general and technical writing, oral communications and listening skill

- Unit - II : (Expression) Practical communication skill development, business presentation with multimedia, speaking skill, prepared speech, extempore speech

- Unit - III :(Reading Skills) Reading skill: comprehension test, technical report writing: precise, technical/business letter, organization of writing material, poster presentation

- UNIT-IV (Literature) :Of Studies: Francis Bacon

- UNIT-V (Presentation) :Writing technical document, preparing software user manual, preparing project documentation.

Course learning outcome :

- **CO1.** this unit is for understanding general business communication.
- **CO2.** this unit is for understanding skill development and confidense development.
- **CO3.** reading skills are extremely important for any type of business communication.
- **CO5.** writing technical documentation

Text books :

- Business Correspondence & Report Writing, Sharma, TMH 2.Business Communication Strategies, Monipally, TMH
- English for Technical Communication ,Laxminarayanan,Scitech

- Business Communication, Kaul,PHI

Online links for study & reference materials :

- https://mgdic.files.wordpress.com/2016/12/3361704-industrial-data-communication.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MIT 205 | **Course Name : Information Security and Cyber Law**
Course Credit Hour : 4hr | **Total Contact Hour : 60hr**

Course Objective :

- The goal of this course is for students to maintain an appropriate level of awareness, knowledge and skill on the disciplines of technology, business and law to allow them to minimize the occurrence and severity of information security incidents. The students will learn techniques used to detect, respond to, and prevent network intrusions.
- The course bear a strong adherence to computer based technological skills and capabilities, and thereby resulting in efficiency to handle a variety of issues related to Information and Cyber Security in any organization.

Course Description :

- Understanding Intelligence
- Understanding Cyber Threat Intelligence

Course Contents :

- **Unit – I:** History of Information Systems and its Importance, basics, Changing Nature of Information Systems, Need of Distributed Information Systems, Role of Internet and Web Services, Information System Threats and attacks, Classification of Threats and Assessing Damages.

- **Unit – II:** Basic Principles of Information Security, Confidentiality, Integrity Availability and other terms in Information Security, Information Classification and their Roles. Security Threats to E Commerce, Virtual Organization, Business Transactions on Web, E-Governance and EDI, Concepts in Electronics payment systems, E Cash, Credit/Debit Cards.

- **Unit – III:** .Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteria for selection of biometrics, Design Issues in Biometric Systems, Interoperability Issues, Economic and Social Aspects, Legal Challenges.
- **Unit – IV:**Model of Cryptographic Systems, Issues in Documents Security, System of Keys, Public Key Cryptography, Digital Signature, Requirement of Digital Signature System, Finger Prints, Firewalls, Design and Implementation Issues, Policies.Network Security- Basic Concepts, Dimensions, Perimeter for Network Protection, Network Attacks, Need of Intrusion Monitoring and Detection, Intrusion Detection.

- **Unit - V** Laws, Investigation and Ethics: Cyber Crime, Information Security and Law, Types & overview of Cyber Crimes, Cyber Law Issues in E-Business Management.Overview of Indian IT Act, Ethical Issues in Intellectual property rights, Copy Right, Patents, Data privacy and protection, Domain Name, Software piracy, Plagiarism, Issues in ethical hacking.

Course learning outcome :

- **CLO1 :**Threats, Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, Spoofing, Sniffing, Firewall.
- **CLO2:** : Have a basic knowledge of the use of confidentiality , data integrity . **CLO3**: To understand Physical Security- Needs, Disaster and Controls, Basic Tenets of Physical Security and Physical Entry Controls, Access Control- Biometrics, Factors in Biometrics Systems, Benefits, Criteriafor selection of biometrics.
- **CLO4** :Techniques, Mathematical foundation, Stream Ciphers, Block Ciphers, Cryptanalysis, Hash Algorithms.
- **CLO5:** Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB, Multiple encryptions DES. Hash Functions and Message Digests:

Text books :

- Godbole,“ Information Systems Security”, Willey
- Merkov, Breithaupt,“ Information Security”, Pearson Education

Reference books :

- Yadav, “Foundations of Information Technology”, New Age, Delhi
- Schou, Shoemaker, “ Information Assurance for the Enterprise”, Tata McGraw Hill
- Sood,“Cyber Laws Simplified”, Mc Graw Hill
- Furnell, “Computer Insecurity”, Springer.

Online links for study & reference materials :

https://www.vssut.ac.in/lecture_notes/lecture1423183198.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

MIT-251: Data Structure Using C Lab-
MIT-252: OOPS with java- Lab

SEMESTER 3

Course Code : MIT301 **Course Name :** Operating System
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- To study concepts related to operating systems, like process management, concurrency and control of processes, deadlocks, memory management, processor and disk scheduling, parallel processing, and file system organization and implementation. Also to study different methods for protection and security that is becoming vital now-a-days.

Course outcome :

- The students will understand Operating System concepts and design Operating Systems

Course Description :

- To master the basic concepts related to operating systems. To learn in detail about process management.
- To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.
- To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.

Course Contents :

- **Unit – I:** Operating system and function, Evolution of operating system, Batch, Interactive, multiprogramming, Time Sharing and Real Time System, multiprocessor system, Distributed system, System protection. Operating System structure, Operating System Services, System Program and calls.

- **Unit – II:** Process concept, State model, and process scheduling, job and process synchronization, structure of process management, Threads interprocess Communication and Synchronization: Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Hardware Synchronization, Critical Regions, Conditional critical region, Monitor, Inter Process Communication. CPU Scheduling: Job scheduling functions, Process scheduling, Scheduling Algorithms, Non Preemptive and preemptive. Strategies, Algorithm Evaluation, Multiprocessor Scheduling.Deadlock: System Deadlock Model, Deadlock Characterization, Methods for handling deadlock, Prevention strategies, voidance and Detection, Recovery from deadlockcombined approach.

- **Unit – III:** Single Contiguous Allocation: H/W support, S/W support, Advantages and disadvantages, Fragmentation, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Swapping, Overlays
- **Unit – IV:**Principles of I/O hardware, Device controller, Device Drivers, Memory mapped I/O, Direct Access Memory, Interrupts, Interrupt Handlers, Application I/O interface, I/O Scheduling, Buffering, Caching, Spooling, Disk organization, Disk space management, Disk allocation Method, Disk Scheduling, Disk storage.
- **Unit - V :**File Concept, File Organization and Access Mechanism, File Directories, Basic file system, File Sharing,Allocation method, Free space management. Policy Mechanism, Authentication, Internalexcess Authorization.

Course learning outcome :

- **CLO1 :** To master the basic concepts related to operating systems. To learn in detail about process management.
- **CLO2:** : To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.
- **CLO3**: To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.
- **CLO4** :To familiar with file system implementation. To understand mass storage management functions of operating systems.
- **CLO5:** To familiar with Protection and security aspects of operating systems. To expose to other operating systems like distributed OS, Multi-processor OS, RTOS and Mobile OS.

Text books :

1. Operating systems concepts , galvin gagne , TATA-Mcgrawhill
2. Operating systems and applications , william stallings

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MIT302 **Course Name :** Theory of Computation
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- Theory provides a simple, elegant view of the complex machine that we call a computer. Theory possesses a high degree of permanence and stability, in contrast with the ever-changing paradigms of the technology, development, and management of computer systems. Further, parts of the theory have direct bearing on practice, such as Automata on circuit design, compiler design, and search algorithms; Formal Languages and Grammars on compiler design; and Complexity on cryptography and optimization problems in manufacturing, business, and management.

Course outcome :

- Learn the theory and foundations of machine learning
- Learn the different process of syntax creation of low level language

Course Description :

- introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
- enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

Course Contents :

- **Unit – I:** Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition tabl e, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transi ion, Language of NFA, Equi valence of NFA and DFA, Minimization of Finite Automata, Distinguis hing one string from other, Myhill-Nerode Theorem

- **Unit – II:** Regular expression (RE) , Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression toFA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages . Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.

- **Unit – III:** Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation , Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

- **Unit – IV:**Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA

- **Unit - V :**Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory

Course learning outcome :

- **CLO1 :** automata, computability, and complexity ,Mathematical tools, Definitions, theorems, and proofs
- **CLO2:** .Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression toFA, DFA to Regular expression

- **CLO3**: Understand recursive and recursively enumerable languages.
- **CLO4** :Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack
- **CLO5:** Understand Turing Machines and the simple primitive mechanisms needed for all computation

Text books :

1.Hopcroft, Ullman, "Introduction to Automata Theory,Languages andComputation", Pearson Education .
2K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science : Automata, Languagesand Computation", PHI Learning Private Limited, Delhi India.

Reference books:

1.Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
2.Y.N.Singh "Mathematical Foundation of Computer Science", New Age International.

Online links for study & reference materials :

http://www.cs.virginia.edu/~robins/cs3102/CS3102

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

NOIDA INTERNATIONAL UNIVERSITY

Course Code: MIT303 **Course Name:** Advance Database Management system

Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- This course introduces database design and creation. Emphasis is on data dictionaries, normalization, data integrity, data modelling, and creation of simple tables, queries, reports, and forms. Upon completion, students should be able to design and implement normalized database structures by creating simple database tables, queries, reports, and forms.

Course Outcome:

- The students will understand the fundamentals of relational, object-oriented, and distributed database systems including data models, database architectures, and database manipulations.
- Understand the theories and techniques in developing database applications and be able to demonstrate the ability to build databases.

Course Description:

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
- To understand and use data manipulation language to query, update, and manage a database
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Contents:

- **Unit - I:** Data base system vs. file system, data models, relational model, database languages, DDL, DML, database access for applications programs, data base users and administrator, transaction management, history of data base systems, data base design and ER diagrams, attributes and entity sets, relationships and relationship sets, additional features of ER model, concept design with the ER model, and conceptual design for large enterprises, Codds Rules.
- **Unit - II:** Data Base Design: Functional Dependency and Decomposition - Functional Dependency - Decomposition. Normalization - Introduction - Normalization - Normal Forms INF, 2NF, 3NF - BCNF - 4 NF - 5 NF.
- **Unit - III:** Examples of basic SQL queries, nested queries, correlated nested queries set, comparison operators, aggregative operators, NULL values, comparison using null values, logical connectivity, AND, OR and NOTR,

impact on SQL constructs, outer joins, disallowing NULL values, complex integrity constraints in SQL triggers and active data bases.

- **Unit - IV:** Data Base Recovery Systems: Introduction - Recovery Concepts - Types of Failures - Types of Recovery - Recovery Techniques - Buffer Management. Data Base Security: Goals - Firewalls - Data Encryption
- **Unit - V:** ACID properties, transactions and schedules, concurrent execution of transaction, lock based concurrency control, performance locking, and transaction support in SQL, crash recovery, concurrency control, Serializability and recoverability, lock management, lock conversions, dealing with dead locks, specialized locking techniques, concurrency without locking, crash recovery:

Course learning outcome:

- **CLO1** : this unit is to create understanding of Defining program-data independence, data models for database systems, database schema
- **CLO2:** the learning objective here is to Recall Relational Algebra concepts, and use it to translate queries to Relational Algebra statements and vice versa. Identify Structure Query Language statements used in creation and manipulation of Database Identify the methodology of conceptual modeling through Entity Relationship model.
- **CLO3:** Identify the methodology of logical model. Identify the methodology of physical model
- **CLO4:** Develop an understanding of the differences between OODBMS, ORDBMS and RDBMS and the practical implications of each approach.
- **CLO5 :**Analyze and design a real database application. Develop and evaluate a real database application using a database management system

Text books:

1. Elmasri Navathe, Data Base Management System, Pearson Education, 2008.
2.S.K. Singh, "Database Systems Concepts, Design and Applications", Pearson Education Pte.Ltd., New Delhi: 2006.
3.C. J. Date, Introduction to Database Systems, Pearson Education, 2009.

Reference books:

1. Silberschatz, Korth, Database System Concepts, McGraw hill, 5th edition, 2005.
2. Rob, Coronel & Thomson, Database Systems Design: Implementation and Management,2009.

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Online links for study & reference materials:

https://lecturenotes.in/subject/38/database-management-system-dbms

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

NOIDA INTERNATIONAL UNIVERSITY

Course Code: MIT304
Course Credit Hour: 4hr
Course Name: Python Programming
Total Contact Hour: 60hr

Course Objective:

- To acquire programming skills in core Python.
- To acquire Object Oriented Skills in Python.
- To develop the skill of designing Graphical user Interfaces in Python.
- To develop the ability to write database applications in Python.

Course outcome: At the end of the course, student will be able to

- Understand and comprehend the basics of python programming.
- Demonstrate the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
- Explain the use of the built-in data structures list, sets, tuples and dictionary.
- Make use of functions and its applications.
- Identify real-world applications using oops, files and exception handling provided by python.

Course Description:

- This **course** includes an **overview** of the various tools available for writing and running **Python**, and gets students **coding** quickly. It also provides hands-on **coding** exercises using commonly used data structures, writing custom functions, and reading and writing to files.

Course Contents:

- **Unit – I: Introduction:** History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

- **Unit – II: Types, Operators and Expressions**: Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass

- **Unit – III: Data Structures**-Lists- Operations, Slicing, Methods, Tuples, Sets, Dictionaries, Sequences, Comprehensions.

- **Unit – IV: Functions** - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning

Values), Scope of the Variables in a Function - Global and Local Variables, **Modules:** Creating modules, import statement, from. Import statement, name spacing.

Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages

- **Unit - V Object Oriented Programming OOP in Python:** Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.

  Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User defined Exceptions.
  Brief Tour of the Standard Library - Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics**.**
  Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

Course learning outcome:

- **CLO1:** To acquire programming skills in core Python.
- **CLO2:** To acquire Object Oriented Skills in Python
- **CLO3**: To develop the skill of designing Graphical user Interfaces in Python
- **CLO4**: To develop the ability to write database applications in Python
- **CLO5:** To develop the ability to write database applications in Python

Text books:

1Yang, "Applied Numerical Methods using MATLAB", Wiley India
2Pradip Niyogi, "Numerical Analysis and Algorithms", TMH, 1st Edition. Gerald & Whealey, "Applied Numerical Analyses"

Reference books :

1Grewal B S, "Numerical methods in Engineering and Science",
2KhannaPublishers, Delhi.

Online links for study & reference materials :

https://ocw.mit.edu/courses/mathematics/18-330-introduction-to-numerical-analysis-spring-2012/lecture-notes/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MIT305 **Course Name :** Compiler Design

Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- This course introduces the basic concepts and mechanisms traditionally employed in language translators, with emphasis on compilers. Topics include strategies for syntactic and semantic analysis, techniques of code optimization and approaches toward code generation.

Course outcome :

- Understand basic concepts of Usability Engineering
- Understand the fundamental aspects of interaction and designing the interaction
- Understand basic concepts of Dialog Designing aspects in Human Computer Interaction

Course Description :

- Introduction to Compilers
- Lexical Analysis
- Syntax Analysis
- Parsers Implementation
- Semantic Analysis

Course Contents :

- **Unit – I:** Introduction to Compiler, Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX-compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.

- **Unit – II:** Basic Parsing Techniques: Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables.

- **Unit – III:** Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements.

- **Unit – IV:**Symbol Tables: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.

- **Unit - V** Code Generation: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis

Course learning outcome :

- **CLO1 :** Understand the structure of compilers - Understand the basic techniques used in compiler construction such as lexical analysis, top-down, bottom-up parsing, context-sensitive analysis, and intermediate code generation - Understand the basic data structures used in compiler construction such as abstract syntax
- **CLO2:** : Code generation and Code optimization • Error Detection and Recovery Error Repair, Compiler Implementation
- **CLO3**: To understand Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements
- **CLO4** :Data structure for symbols tables, representing scope information. Run-Time Administration
- **CLO5:** Code Generation: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator

Text books :

- Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools”, PearsonEducation
- V Raghvan, “ Principles of Compiler Design”, TMH

Reference books :

- Kenneth Louden," Compiler Construction", Cengage Learning.
- Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson EducationOriented Modeling and Design - James Rumbaugh

Online links for study & reference materials :

https://www.uu.se/en/admissions/master/selma/kursplan/?kKod=1DL321&lasar=

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

MCA 351: ADBMS LAB
MCA 352: python programming Lab

SEMESTER 4

Course Code : MIT401
Course Credit Hour : 4hr

Course Name : software Testing
Total Contact Hour : 60hr

Course Objective :

- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To discuss various software testing issues and solutions in software unit test; integration, regression, and system testing.

Course Description :

- Have an ability to apply software testing knowledge and engineering methods.
- Have an ability to design and conduct a software test process for a software testing project.
- Have an ability to identify the needs of software test automation, and define and develop a test tool to support test automation.

Course Contents :

Unit – I: Introduction: Introduction to software, Basics of Software Testing, fault, errors and failures, Testingobjectives, Causes of software errors, test case, test plan.

Software testing principles, software testing process, software quality and features

Unit – II: Testing and Debugging , Validation and Verification , Types of Testing : Unit testing , integration testing,system testing , acceptance testing , regression testing , installation testing.
White box testing: Dynamic Testing, Structural testing , White Box Testing , pros and cons of white boxtesting, unit/code functional testing.

Unit – III: Black box testing: Black box testing, pros and cons of black box testing, Requirement based testing, Boundary Value Analysis, Model based testing and model checking. Difference between White box and Black box testing. Difference between Functional testing and Structural testing.

Unit – IV:Integration, System and Acceptance testing: Integration Testing , Types of integration testing : Top down and Bottom up integration, Bi- directional integration, system integration. Functional v/s Non functional testing .
Alpha and Beta Testing : Alpha testing , Beta testing , Scalability testing , Reliability testing, Stress testing.

- **Unit - V Acceptance Testing:** Acceptance testing, acceptance criteria, test cases, selection and execution. **Regression Testing** : Regression Testing, test process, selection of regression tests, tools for regressiontesting.

Course learning outcome :

- **CLO1 :** Understand software testing and quality assurance as a fundamental component of software life cycle • Define the scope of SW T&QA projects
- **CLO2:** : Efficiently perform T&QA activities using modern software tools
- **CLO3**: Prepare test plans and schedules for a T&QA project
- **CLO4** :Develop T&QA project staffing requirements
- **CLO5:** Effectively manage a T&QA project

Text books :

- Dileep Kumar Gupta and Umesh Singh: Paradigms Of Software Testing, Dhanpat Rai & Co.Publications.
- Newman: Principles of Software Testing, McGraw Hill

Reference books :

Online links for study & reference materials :

https://www.uu.se/en/admissions/master/selma/kursplan/?kKod=1DL321&lasar=

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1 - 05%
Assessment-2 - 05%
Assessment-3(Midexam) - 20%
Assessment-3 - 05%
Assessment-4 - 05%

Course Code: MIT402 **Course Name:** Software Engineering
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- Software Engineering (SE) comprises the core principles consistent in software construction and maintenance: fundamental software processes and life-cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools. iterative development, interpretation of requirements and use case documents into code; application of design notation in UML and use of commonly-used design patterns. Current industry-strength programming languages, technologies and systems feature highly in the practical components, electives and projects of the course, but they are also taught with a view to understanding and applying principles underlying their more ephemeral character.

Course outcome :

- Learn the theory and foundations of software engineering.
- Learn the different process models and choose the best model for their project
- Be able to construct requirement models
- Be able to Understand the different development practices and its advantages.
- Be able to create test cases and implement different testing strategies

Course Description :

- Knowledge of basic SW engineering methods and practices, and their appropriate application.
- . Describe software engineering layered technology and Process frame work. 3
- . A general understanding of software process models such as the waterfall and evolutionary models. Understanding of software requirements and the SRS documents. Understanding of the role of project management including planning, scheduling, risk management, etc.
- Describe data models, object models, context models and behavioural models. Understanding of different software architectural styles. Understanding of implementation issues such as modularity and coding standards. Understanding of approaches to verification and validation including static analysis, and reviews.

Course Contents :

- **Unit-I: Introduction** Software life cycle models: Waterfall, Prototype,Evolutionary and Spiral models, Overview of Quality Standards like ISO 9001, SEI-CMM.

- **UNIT-II Software Metrics and Project Planning** Size Metrics like LOC, Token Count, Function Count, Design Metrics, Data Structure Metrics, Information Flow Metrics. Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management.

- **UNIT- III Software Requirement Analysis, design and coding** Problem Analysis,Software Requirement and Specifications, Behavioural and non-behavioural requirements, Software Prototyping Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design Top-down and bottom-up Structured programming, Information hiding.

- **UNIT- IV : Software Reliability, Testing and Maintenance** Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Software process, Functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing: path testing, Data flow and mutation testing, unit testing, integration and system testing, Debugging, Testing Tools, & Standards. Management of maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software RE-engineering.

- **UNIT- V : UML:** Introduction to UML, Use Case Diagrams, Class Diagram: State Diagram in UML Activity Diagram in UML. Sequence Diagram in UML Collaboration Diagram in UML

Course learning outcome :

- **CLO1 :** Understand basic SW engineering methods and practices, and their appropriate application.
- **CLO2:** Understand u of software process models such as the waterfall and evolutionary 10. models.
- **CLO3**: problem analysis and description, This unit is to introduce Discuss data models, object models, context models and behavioural models.
- **CLO4** : Understand of different software architectural styles and Process frame work

- **CLO5:** this unit is for learning different modes of file storage. Records and there usage .

Text books :

- K. K. Aggarwal & Yogesh Singh, .Software Engineering., 2nd Ed, New AgeInternational, 2005.
- R. S. Pressman, ―Software Engineering – A practitioner‘s approach‖, 5th Ed., McGrawHill Int. Ed., 2001.

Online links for study & reference materials :

https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1 - 05%
Assessment-2 - 05%
Assessment-3(Midexam) - 20%
Assessment-3 - 05%
Assessment-4 - 05%

Course Code : MIT-403
Course Credit Hour : 4hr

Course Name : DOT NET Framework
Total Contact Hour : 60hr

Course Objective :

- Dot Net Framework helps the students in developing applications and web sites.
- To get appropriate programming methodologies, functions, procedures.

Course Description :

- The course covers basics of dot net and its components.
- Course will help the students in mastering the programming concepts.

Course Contents :

UNIT - I

C# Fundamentals: Basic classes, declarations, conditionals, loops, arrays, strings, enumerations, structures, andEncapsulation, inheritance, polymorphism, Structured exception handling. Understanding interface types

UNIT - II

Delegates, Events, and Lambdas: basics of each -- very important for event driven (GUI), Understanding the garbage collector, creating and working with .NET assemblies.

UNIT - III

Windows Forms and WPF: Basic windows programming: forms, component class, control class, control events, menus, status bars, tool bars, interacting with the registry. Indexers, Operator Overloading, Custom Type Conversion, Extension Methods, Anonymous Types, Pointer Types

UNIT - IV

Input, Output, and Serialization: System.IO, Directory and File Types, StreamReaders and StreamWriters, working with binary data, configuring objects for serialization, Working with and creating custom generic types.

UNIT - IV

Processes, AppDomains, Contexts, Threading, Type Reflection, Late Binding, Attribute-based programming: Advanced topics from the text will be discussed as time permits. We can decide as a class on what to explore if we get to this point.

Course Learning Outcomes(CLOs) :

CLO-1 :The students will be able to work on different server, web sites and applications.

CLO-2 :Students will be able to develop the backend of any project.

CLO-3 :Students will have the idea of encryption , decryption and maintain the database and all the security parameters.

CLO-4 :Students can work as system administrator and technical support.

Text books :

1. C Sharp and Dot net framework by Andrew Troelsen
2. C Sharp in Depth by Jon Skeet
3. Pro VB 2008 and the .NET 3.5 Platform (Windows.Net) by Andrew Troelsen

Reference books :

Programming Entity Framework by Julia
Learning Visual Basic .NETJesse Liberty
Beginning VB.NET Databases by Thearon Willis
Professional VB 2005 with .NET 3.0 (Programmer to Programmer) by Bill Evjen, Billy Hollis, Bill Sheldon, and Kent Sharkey

Online links for study & reference materials :

https://noidatut.com/view-nts.php?vntpntsfxxvisurz=b6d767d2f8ed5d21a44b0e5886680cb9

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MIT404

Course Name : Distributed Systems

Course Credit Hour : 4hr

Total Contact Hour : 60hr

Course Objective :

- List the principles of distributed systems and describe the problems and challenges associated with these principles.
- Understand Distributed Computing techniques, Synchronous and Processes.
- Apply Shared Data access and Files concepts

Course outcome :

- To provide hardware and software issues in modern distributed systems.
- To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.

Course Description :

- Apply Distributed web-based system.
- Understand the importance of security in distributed systems

Course Contents :

- **Unit – I: Fundamentals** Evolution of Distributed Computing Systems, System models, issues in design of Distributed- computing environment, web based distributed model, computer networks related to distributed systems and web based protocols

- **Unit – II: Message Passing** Inter process Communication, Desirable Features of Good Message-Passing Systems, Issues in IPC by Message, Synchronization, Buffering, Multi datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication
- **Unit – III: Distributed Shared Memory** Design and Implementation Issues of DSM, Granularity, Structure of shared memory space, Consistency Models, replacement Strategy, Thrashing, Other Approaches to DSM, Advantages of DSM

- **Unit – IV: Synchronization** Clock Synchronization, Event Ordering, Mutual Exclusion, Election Algorithms.

- **Unit - V Distributed File Systems** Desirable Features of a good Distributed File Systems, File Models, File-Accessing Models, File- sharing Semantics, File-caching schemes, File Replication, Fault Tolerance, Design Principles, Sun's network file system, Andrews file system, comparison of NFS and AFS

Course learning outcome :

- **CLO1 :**Review of Networks, Operating Systems, Concurrent Programming, and Characteristics & Properties of Distributes Systems – Taxonomy - Design goals – Transparency Issues
- **CLO2:** : basic Message Passing Model – The Client Server, Message Passing, RPC basics, RPC implementation, RPC communication
- **CLO3**:Communication in Distributed Systems, Socket Programming - Client Server examples, I/O Multiplexing, Inetd Super Server – Secure Sockets – The SSL & the Java Secure Socket Extension
- **CLO4** :Motivation, Object Replication, Consistency Models, Distribution Protocols –5Consistency Protocols
- **CLO5:** Desirable Features of a good Distributed File Systems, File Models, File-Accessing Models

Text books :

- Distributed OS by Pradeep K. Sinha (PHI)
- Tanenbaum S. : Distributed Operating Systems, Pearson Education

Reference books :

- Tanenbaum S. Maarten V.S.: Distributed Systems Principles and Paradigms. (Pearson Education)
- George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems concepts and design

Online links for study & reference material

https://www.ict.gnu.ac.in/content/2cse50e2-distributed-systems-elective-i

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

MIT 451: Dot (.) NET Framework LAB lab

Industrial Project MIT 405

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF BIOTECHNOLOGY & MICROBIOLOGY

SYLLABUS OF COURSES TO BE OFFERED

POSTGRADUATE PROGRAMME (MICROBIOLOGY)

Choice Based Credit System (CBCS)

(w.e.f. academic session 2019-20)

POSTGRADUATE PROGRAMME (MICROBIOLOGY)

Curriculum Drafting Committee

1.	Dr. Lomas Tomar, Director, School of Sciences, NIU	Chairperson
2.	Dr. Varun Kumar Sharma, Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member Secretary
3.	Dr. Namrata Dudha Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
4.	Dr. Kashish Gupta Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
5.	Dr. Garima Sharma Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member
6.	Dr. Navroop Kaur Assistant Professor, Dept. of Biotechnology and Microbiology, School of Sciences, NIU	Member

PEOs, POs & PSOs of M.Sc. Microbiology Programme

Programme Educational Objectives (PEOs): The Program Educational Objectives (PEOs) for the M.Sc. Microbiology program enlists the accomplishments that a graduate aims to attain within two years after graduation.

PEO1: To train graduates in basic and advanced areas of microbiology, Industrial Microbiology, Agriculture & Environmental Microbiology and other related subjects along with sensitizing them to the scope for research.

PEO2: To train microbiologists with apt skills to pursue careers both in academia as well as industry such as pharmaceutical, food and bioprocess industries.

PEO3: To empower the students with analytical and research skills, to nurture entrepreneurial endeavors and to prepare a competent generation of microbiologists, capable of excelling in careers of their choosing.

Programme Outcomes (POs):

PO1: Master of Science knowledge: Apply the knowledge of biotechnology, microbiology, biochemistry fundamentals, and bioinformatics to the solution of complex biological problems.

PO2: Design/development of solutions: Design solutions for complex biological problems and design protocols or processes that meet the specified needs with appropriate consideration for the public health and safety, conservation of biodiversity, better understanding of the microorganisms, and using bioinformatics tools for finding solutions of various crippling human/plant diseases with ethical, societal, and environmental considerations.

PO3: Modern Molecular Biology and Bioinformatics tools usage: Develop new technologies, protocols, resources, using modern molecular biology, biotechnology and bioinformatics tools and apply it to solve complex human health problems, plant stress tolerance and conserve floral biodiversity of Himalayan region focusing on medicinally important plants with an understanding of the limitations of this region.

PO4: Post Graduate Student and society: Apply the classic and modern biological theoretical and practical knowledge gained to address societal, health, microbial and plant biodiversity studies, safety, ethical and cultural issues and the consequent responsibilities relevant to the professional up-gradation of the student and society as a whole.

PO5: Ethics: Apply ethical principles established by different government agencies and commit to research ethics, responsibilities and norms to undertake their current and future research and development.

PO6: Individual and team work: Be an independent thinker and researcher effectively as an individual, and as a member or leader of different teams, and in multidisciplinary research Institutions and Universities.

PO7: Life-long learning: Apply the discipline, ethics and knowledge obtained to engage in independent and life-long learning in their respective fields of interest wherever they go for further higher studies or jobs.

Programme Specific Outcome (PSOs): After the successful completion of M.Sc. Microbiology program, the students will able to:

PSO1: Get equipped with a theoretical and practical understanding of microbiology and appreciate how microbiology is applied in manufacture of industrial products

PSO2: Know how to source for microorganisms of industrial importance from the environment

PSO3: Identify techniques applicable for Improvement of microorganisms based on known biochemical pathways and regulatory mechanisms.

PSO4: Appreciate the diversity of microorganism and microbial communities inhabiting a multitude of habitats and occupying a wide range of ecological habitats.

PSO5: Understand in depth the occurrence, abundance and distribution of microorganism in the environment and their role in the environment and also get expertise on different methods for their detection, characterization and industrial applications.

PSO6: To move ahead in entrepreneurship endeavors in microbiology.

PSO7: Appear and successfully qualify the higher level examinations of various agencies, so as to get chance to do research from reputed institutes within country and abroad with sound fellowships.

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for M.Sc. (Microbiology)

M.Sc. Microbiology 1st Year
SEMESTER-I

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
									External Exam		
			L	T	P	CA	TA	Total			
1	STPM-101	Microbial Physiology & Metabolism	4	0	0	20	20	40	60	100	4
2	STPB-102	Principles of Genetics	4	0	0	20	20	40	60	100	4
3	STPB-103	Diversity Of Prokaryotes And Eukaryotes	4	0	0	20	20	40	60	100	4
4	STPM-104	Bacteriology & Virology	4	0	0	20	20	40	60	100	4
5	STPB-105/ TC-1	Bioethics , Biosafety & IPR/ Technical Communication	2	0	0	20	20	40	60	100	2
Practical											
1	SPPM-101	Microbial Physiology & Metabolism Lab	0	0	2			25	25	50	2
2	SPPB-102	Principles of Genetics Lab	0	0	2			25	25	50	2
2	SPPB-103	Diversity Of Prokaryotes And Eukaryotes Lab	0	0	2			25	25	50	2
3	SPPM-104	Bacteriology & Virology Lab	0	0	2			25	25	50	2
Total										**700**	**26**
Note: List of Practical will be supplied at the Start of every Semester											

M.Sc. Microbiology 1st Year

SEMESTER-II

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
									External Exam		
			L	T	P	CA	TA	Total			
1	STPM-201	Biomolecules	4	0	0	20	20	40	60	100	4
2	STPB-202	Molecular Biology	4	0	0	20	20	40	60	100	4
3	STPB-203	Immunotechnology	4	0	0	20	20	40	60	100	4
4	STPB-204	Biostatistics, Computer Applications and Bioinformatics	4	0	0	20	20	40	60	100	4
5	STPM-205	"Seminar" Recent development in microbiology	2	0	0	15	10	25	75	100	2
Practical											
1	SPPM-201	Biomolecules	0	0	2			25	25	50	2
2	SPPB-202	Molecular Biology	0	0	2			25	25	50	2
3	SPPB-203	Immunotechnology	0	0	2			25	25	50	2
4	SPPB-204	Biostatistics, Computer Applications and Bioinformatics	0	0	2			25	25	50	2
Total										**700**	**26**
Note: List of Practical will be supplied at the Start of every Semester											

M.Sc. Microbiology 2nd Year
SEMESTER-III

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
			L	T	P	CA	TA	Total	External Exam		
1	STPM-301	Enzymology and Bioprocess Technology	4	0	0	20	20	40	60	100	4
2	STPM-302	Industrial & Food Microbiology	4	0	0	20	20	40	60	100	4
3	STPM-303	Genetic Engineering	4	0	0	20	20	40	60	100	4
4	STPM-304	Parasitology	4	0	0	20	20	40	60	100	4
5	STPB-305/ STPB-306	CBCS Genomics and Proteomics /Bioinformatics	2	0	0	20	20	40	60	100	2
Practical											
1	SPPB-301	Enzymology and Bioprocess Technology	0	2				25	25	50	2
2	SPPB-302	Industrial & Food Microbiology	0	2				25	25	50	2
2	SPPM-303	Genetic Engineering	0	2				25	25	50	2
3	SPPM-304	Parasitology Lab	0	2				25	25	50	2
Total										**700**	**26**
Note: List of Practical will be supplied at the Start of every Semester											

M.Sc. Microbiology 2nd Year
SEMESTER-IV

S.No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
									External Exam		
			L	T	P	CA	TA	Total			
1	STPM-401	Environmental Microbiology	4	0	0	20	20	40	60	100	4
2	STPB-402	Clinical research and Entrepreneurship	4	0	0	20	20	40	60	100	4
Total										**200**	**8**
Note: List of Practical will be supplied at the Start of every Semester											

S.No	Course Code	Subject	Project Report	Report Presentation	Viva Voce	Subject Total	Credit
1	STPM-403	Project	100	50	50	**200**	**8**

OVERALL CREDIT SCHEME

S. No.	SEMESTER	Theory Total	Practical Total	Subject Total	Total Credit
1	I	400	200	700	26
2	II	500	200	700	26
3	III	500	200	700	26
4	IV	200	200	400	16
			Grand Total	**2500**	**94**

Assessment method:

Assessment method	Theory					Practical	
	Internal assessment	Mid-term examination	End-term examination	Maximum Mark		Practical examination	Maximum Mark
Mark	20	20	60	100		50 Mark	50 Mark
%	20%	20%	60%	100%		100%	100%

M.Sc. Microbiology 1st Year

SEMESTER-I

MICROBIAL PHYSIOLOGY AND METABOLISM (STPM- 101)

L	T	P
4	0	2

Course Name: Microbial Physiology and Metabolism **Course Code:** STPM-101
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The major objective of this paper is to develop clear understanding of various aspects of microbial physiology along with diverse metabolic pathways existing in bacteria in relation to its survival and propagation, and to enable students to better understand courses taught later such as Microbial Pathogenicity and biotechnology-based courses.

Course Description:

In this course the major features of growth and metabolism of microorganisms including determination of growth curve environmental influence on the microbial growth and primary and secondary metabolism, and microbial relationships. In this course, we will explore the vast range of physiologies and metabolisms found throughout the microbial world.

Course Contents:

Unit I: Growth and cell division: Measurement of growth, growth physiology, cell division, growth yields, growthkinetics, steady state growth and continuous growth.

Unit II: Solute Transport: Primary and Secondary transport: Introduction, Kinetics, ABC transporters, Phospho-transferase system, Drug export systems, amino acid transport.

Unit III: Central Metabolic Pathways and Regulation: Glycolysis, PPP, ED pathway, Citric acid cycle: Branched TCA and Reverse TCA, glyoxylate cycle. Utilization of sugars other than glucose and complex polysaccharides
.

Unit IV: Nitrogen metabolism: Metabolism of amino acids: Amino acid biosynthesis and utilization, lysine and glutamine overproduction, stringent response, polyamine biosynthesis and regulation. **Metabolism of lipids and hydrocarbons:** Lipid composition of microorganisms, biosynthesis and degradation of lipids, lipid accumulation in yeasts, hydrocarbon utilization, PHA synthesis and degradation. **Metabolism of nucleotides:** Purine and pyrimidine biosynthesis, regulation of purine and pyrimidine biosynthesis,inhibitors of nucleotide synthesis.

Unit V: Physiological Adaptations and Intercellular signaling: Introduction to two component system, regulatory systemsduring aerobic- anaerobic shifts: Arc, Fnr, Nar, FhlA regulon, response to phosphate supply: The Pho regulon Quorum sensing: A and C signaling system, sporulation in *Bacillus subtilis*, control of competence in *Bacillussubtilis.*Heat-Shock responses, pH homeostasis, osmotic homeostasis.

Course Learning Outcomes (CLOs):

Upon successful completion of the course, the student:
CLO1. Will be acquainted with methods of measuring microbial growth, calculating growth kinetic parameters with understanding of steady state and continuous growth.
CLO2. Will have gained an in-depth knowledge of primary, secondary and group translocation transport systems existing in bacteria, simultaneously learning membrane transport proteins and kinetics of solute transport.
CLO3. Will have learnt central metabolic pathways for carbon metabolism in bacteria enlisting differences with eukaryotic systems and their regulation in diverse physiological conditions. This allows students to apply the acquired knowledge in engineering metabolic pathways for developing industrially useful strains.
CLO4. Will have gathered understanding of inorganic and organic nitrogen assimilation and its regulation. Also knows role of glutathione in cellular redox regulation and biochemistry of glutamate overproducing strains.
CLO5. Will understand details Physiological Adaptations and Intercellular signaling and is conversant with intracellular signaling in bacteria in response to various nutritional and Physiological stresses.

Text Books:
- GM Cooper, Cell: A Molecular approach, 8^{th} edition, Oxford University Press, 9781605358635, 1605358630, 2018
- deRobertis and deRobertis, Cell and Molecular Biology, 8^{th} edition, Lea & Febiger, 9780812110128

Reference Books:
- G. Karp, Cell and Molecular, Biology, 6^{th} Edition, John Wiley & Sons, 9780470578858, 0470578858
- B Alberts et al Molecular Biology of the Cell. 6th edition, Garland Science, Taylor and Francis group, 9781317563754, 1317563751

Online links for study and reference materials:
www.biologydiscussion.com
www.khanacademy.org
https://www.ncbi.nlm.nih.gov/pmc

PRINCILPLES OF GENETICS - (STPB-102)

L	T	P
4	0	2

Course Name: Principles of Genetics **Course Code:** STPB-102
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The objective of this course is to build knowledge on the fundamentals of genetics, heredity, or inheritance. To build the foundation on the understanding of biological principles.

Course Description:

This course provides a detailed understanding of Mendelian and non-Mendelian inheritance; various techniques and methodologies that decipher genetic recombination and gene mapping.

Course Contents:

Unit I: Mendelian principles & Extensions: Dominance, segregation, independent assortment. Co-dominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

Unit II: Concept of gene and Gene mapping methods : Gene Concept, Allele, Multiple alleles, Pseudoallele, Complementation tests, Benzer's work on rII locus in T4 phases. Linkage maps, Tetrad analysis, Three- Point Test cross, Cytological basis of crossing over, Interference and Coincidence, Crossing over and Chiasma formation, Factor affecting recombination frequencies, Mapping with molecular markers, Mapping by using somatic cell hybrids, Development of mapping population in plants.

Unit III: Genetics of Sex Determination and Differentiation: Sex-linked, Sex- limited and Sex-influenced traits in Drosophila and Human beings, Theories of Sex-determination- Chromosomal theory, environmental theory and genic balance theory, Sex- determination in dioeciously plants, Sex reversal and Gynandromorphs, Human sex anomalies (Klinefelter's Syndrome and Turner's Syndrome), brief idea of Dosage Compensation and Lyon's hypothesis.

Unit IV: Extra chromosomal inheritance and Biochemical Genetics: Criteria for extra-chromosomal inheritance, Inheritance of Mitochondrial and chloroplast genes, plastid inheritance in Mirabilis, iojapa in corn, Kappa particles in Paramecium, Coiling in snails, male sterility in plants. Inborn errors of Metabolism in man, eye transplantation in Drosophila, Biochemical mutations in *Neurospora*, Biosynthetic pathways and Biochemical mutations.

Unit V: Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

Course Learning Outcomes (CLOs):
After successful completion of the course the students:

CLO 1. Will have knowledge of Mendelian, non- Mendelian inheritance and an insight of Gene concept and alleles

CLO 2. Will have an understanding of various methods employed in Gene mapping

CLO 3. Insight of differentiation of sex in plants and animals and various diseases associated with improper differentiation of sex. Evaluate difference between extra-chromosomal inheritances from chromosomal inheritance.

CLO 4. Biochemical changes that lead to difference in inheritance of characters & their expression

CLO 5. Various techniques involved in studying human genetics and their quantification

Text Books:

- P. K. Gupta, GENETICS. Rastogi Publication. 9788171338429, 8171338429
- Strickberger M. W., Genetics. Mac Millan Publishing Co., 9780024180902

Reference Books:

- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R., "Molecular Biology of the Gene", 5th Ed., Pearson Education, 9780321762436, 0321762436

Online links for study and reference materials:
www.biologydiscussion.com
www.khanacademy.org
https://www.ncbi.nlm.nih.gov/pmc

DIVERSITY OF PROKARYOTES AND EUKARYOTES - (STPB-103)

L	T	P
4	0	2

Course Name: Diversity of Prokaryotes and Eukaryotes **Course Code:** STPB-103
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The primary objective of the course is to build a strong foundation in the area of prokaryotic cell structure, division, survival and propagation. The course will enable students to understand the taxonomical classification, phenotypic and biochemical identification of food associated molds, yeasts, yeast-like fungi and bacteria.

Course Description:

This course introduces students to the diversity among prokaryotes and eukaryotes. It will make student familiar with various aseptic techniques and isolation methods. This course will introduce the host pathogen interaction.

Course Contents:

Unit I: Beginnings of Microbiology; Contributions of Lister, Koch and Pasteur; Microscopy-brief account of various types and their applications.

Methods in microbiology: Pure culture techniques, theory and practice of sterilization, Principles of microbial nutrition, culture media.

Unit II: Microbial Systematics and Taxonomy: Approaches to bacterial taxonomy, Classification including ribotyping; Ribosomal RNA sequencing, characteristics of primary domains; taxonomy, nomenclature and Bergey's manual (Introduction).

Unit III: Prokaryotic diversity: Bacteria: Purple and green bacteria, cyanobacteria, Mycobacteria, rickettsias, chlamydias and mycoplasms. Archaea: Archaea as earliest life forms: halophiles, methanogens, hperthermomphilic archaea, thermoplasma. Eukarya: An introduction to protista, algae, fungi and slime molds.

Unit IV: Metabolic diversity among microorganisms: Pathways of glucose dissimilation in aerobic and anaerobic microbes, fermentation (alcoholic and acidic), nitrogen metabolism, nitrogen fixation.

Unit V: Microflora of human (skin, oral cavity, gastrointestinal tract) entry of pathogens into the host, types of toxins (exo-, endo-) and their structure, mode of actions-infectious disease transmission; virulence and pathogenesis. Chemotherapy/antibiotics: antimicrobial agents, sulfa drugs, antibiotics: broad-spectrum antibiotics, mode of action.

Course Learning Outcomes (CLOs):

CLO1. Demonstrate theory and practical skills in microscopy and their handling techniques and staining.
CLO2. Procedures and understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea.
CLO3. Know various Culture media and their applications and also understand various physical and chemical means of sterilization and general bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae.
CLO4. Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively.
CLO5. Understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and heterotrophy and know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

Text Books:

- J. Willey, L. Sherwood, C. J. Woolverton, Prescott's Microbiology. 10th edition. McGraw Hill Education. 2017. ISBN No. 9780073375267, 0073375268
- M. Madigan, K. Bender, D. Buckley, W. Sattley, D. Stahl. Brock Biology of Microorganisms. 15th Edition. Pearson Education. 2018. ISBN No. 9781292018317, 1292018313

Reference Books:

- Ricardo Cavicchioli, Archaea Molecular and Cellular Biology. American Society of Microbiology. 2007. ISBN No. 1555813917, 9781555813918
- D. White, J. Drummond, C. Fuqua, The Physiology and Biochemistry of Prokaryotes. 4 th Edition. Oxford University Press. 2011. ISBN No. 9780195393040, 019539304X.

Online links for study & reference materials:
https://www.khanacademy.org/
https://swayam.gov.in/
https://nptel.ac.in/

BACTERIOLOGY AND VIROLOGY – (STPM-104)

L	T	P
4	0	2

Course Name: Bacteriology and Virology **Course Code:** STPM-104
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

Microbiology and Virology - Amidst the current conditions of the global pandemic, we all know the importance of scientists who are capable of learning and implementing the measures required for handling such microorganisms capable of affecting human life. With the advancement in technologies such as electron microscopy and other visual aids, more and more research and studies along with other productive activities are possible in the field of "Microbiology and Virology".

Course Description:

This course focus on the basis of Bacteriology and virology. It basically covers the ultastructure of bacterial, biochemical testing (IMVIC TESTS). It also covers the basis of microbial genetics as well as Classification and replication of viruses.

Course Contents:

Unit I: Introduction to Bacteriology: Introduction and history of bacteriology, Morphology and Ultra structure of bacteria: cell wall, L-form, cell wall synthesis, cell membranes- structure, composition and properties. **Introduction to bacterial structure:** Capsule, flagella, Pilli, gas vacuoles, chromosomes, magnetosomes, endospore, capsules and s-layers, cytoskeleton structure in bacteria, Reserve food materials in bacteria (PHB, Phosphate granules, oil droplets and sulphur inclusions) and bacterial chemo taxis.

Unit II: Bacterial taxonomy and nomenclature: Concept of species and hierarchical taxa, DNA base homology, 16s rRNA and DNA hybridization. General features of Rickettisae, Mycoplasma, and Actinomycetes.

Unit III: Preservation and Maintenance of Bacteria: Low temperature storage, mineral oil, cryopreservation, lypholization, soil and glycerol stocks. **Bacterial Genetics:** General account of prokaryotic genome and plasmid, Conjugation: F-factor, sex Pilli, Hfr cells, mechanism and its role in development of multi drug resistance. Transduction: Lytic cycle, temperate phage, lysogenic cycles, mechanism of transduction, abortive transduction. Transformation and its mechanism.

Unit IV: History and development of Virology: History of virology, general characteristics of Viruses, morphological variations, envelope, capsids and nucleic acids of viruses, replication and classification of viruses, viroid, prions. **Isolation and preservation of Viruses:** Methods of isolation of Viruses, criteria for purification or purity of Viruses, preservation of viruses. **Assay of Viruses:** Biophysical properties of viruses, plaque, pock method and direct count method, Haemagglutination.

Unit V: Bacteriophages: Types, general properties of bacteriophage, detailed description of lambda phage, M13 phage and T phage. One step growth.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept of bacteriology, Morphology and Ultra structure of bacteria and its importance.
CLO2. Discuss the general account of prokaryotic genome and plasmid, Conjugation: F-factor, sex Pilli, Hfr cells, mechanism and its role in development of multi drug resistance.
CLO3. Describe the basic characteristics of general characteristics of Viruses, morphological variations, envelope, capsids and nucleic acids of viruses, replication and classification of viruses, viroids, prions.
CLO4. Discuss the basic concept of bacteriophage, detailed description of lambda phage, M13 phage and T phage. One step growth.

Text Books:

- Black, J.G. (2011) Microbiology: principle and exploration. 7th edition, Wiley publications.
- Cann, A (2011) Principle of molecular Virology. Academic press London
- Microbiology and Parasitology PMFUMicrobiology and Parasitology PMFU B. S. Nagoba, ASHA PICHARE M.B.B.S. M.D. (MICROBIOLOGY)B. S. Nagoba, ASHA PICHARE M.B.B.S. M.D.

Reference Books:

- Davis, B.D Delbecco. R. Eisen, H.N Ginsberg, H.S and Wood, W.B (2007) Microbiology, IInd edition. Vol. II. Harper and Row
- Flint S.J; Enquist, L.W; Skalka, AMK (2004) Principles of Virology; molecular biology; pathogenesis and control, ASM press
- Paniker, CJK (2013) A textbook of Microbiology, 9th edition, University Press
- Stainer, R.Y, Ingraham, J.L, Wheelis, M.L, and Painter, P.R (2013). General Microbiology, MacMillan Press Ltd. UK

Online links for study & reference materials:
https://europe.microbiologyconferences.com

https://nptel.ac.in/courses/102103041/18

CBCS BIOETHICS, BIOSAFETY & IPR - (STPB-105)**

L	T	P
2	0	0

Course Name: Bioethics, Biosafety and IPR
Course Code: STPB-105
Course Credit Hour: 2 hrs
Total Contact hour: 30 hrs

Course Objective:

To apprise the students of the various societal, governance and regulatory issues in biotechnology with special emphasis on ethics, safety and intellectual property rights. Through this course, the students develop a perspective on the importance of these aspects in the success of biotechnology products and services in the market. At the end of the course, they should be able to apply this perspective and the specific principles, laws, regulations etc., in academic and industrial settings for regulatory oversight and enforcement.

Course Description:

This course is mainly focused on the Bioethics, Biosafety and Intellectual Property Rights which includes basic concept of patents, patent regime (in India and abroad) registration aspects and other details.

Course Contents:

Unit I

Biotechnology and social responsibility, public acceptance issues in biotechnology, issues of access, ownership, monopoly, traditional knowledge, biodiversity, benefit sharing, environmental sustainability, public vs private funding, biotechnology in international relations, globalization and development divide.

Unit II

Introduction to bioethics: Social and ethical issues in biotechnology. Principles of bioethics. Ethical conflicts in biotechnology- interference with nature, unequal distribution of risk and benefits of biotechnology, bioethics vs business ethics.

Unit III

Biosafety: Definition of bio-safety, Biotechnology and bio-safety concerns at the level of individuals, institutions, society, region, country and world with special emphasis on Indian concerns.

Unit IV

Biosafety in laboratory institution: laboratory associated infection and other hazards, assessment of biological hazards and level of biosafety. Bio safety regulation: handling of recombinant DNA products and process in industry and in institutions (Indian context).

Unit V

Introduction to IPR: IPR, forms of IPR and Intellectual property protection. Concept of property with respect to intellectual creativity, Tangible and Intangible property. WTO: agency controlling trade among nations, WTO with reference to biotechnological affairs, TRIPs. WIPO, EPO.

Course Learning Outcomes (CLOs):

CLO1. The students shall get an adequate knowledge on patent and copyright. This provide further way for developing their idea or innovations.
CLO2. Identify the role of regulatory committees in controlling the risk.
CLO3. Students should get enough information on ethical issues linked to research on animal models, transgenics, clinical trials.
CLO4. Students to consider Intellectual Property (IP) as a career option as IP Counsel/Patent Examiner/Patent agent.

Text Books:

- Singh K K (2015). Biotechnology and Intelectual Property Rights: Legal and Social Impliocations, Springer India.
- Senthil Kumar Sadhasivam and Mohammed Jaabir, M. S. 2008. IPR, Biosafety and biotechnology Management. Jasen Publications, Tiruchirappalli, India.

Reference Books:

- Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
- Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
- V Sreekrishna, 2017. Bioethics and Biosafety in Biotechnology by New Age International publishers.

Online links for study & reference materials:
http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

M.Sc. Microbiology 1st Year
SEMESTER-II

BIOMOLECULES (STPB-201)

L	T	P
4	0	2

Course Name: Biomolecules
Course Code: STPB-201
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

This course deals with characteristics, properties and biological significance of the biomolecules of life.

Course Description:

This course introduces students to the general families of biomolecules that comprise the science of biochemistry and to the principles that integrate biochemistry with other chemical and biological disciplines. They acquire knowledge in the quantitative and qualitative estimation of biomolecules.

Course Contents:

UNIT-I: Chemical foundations of Biology – pH, pK, acids, bases, buffers, weak bonds and covalent bonds. Classification, structure, properties and biological significance of carbohydrates. Monosaccharides, Disaccharides, and Polysaccharides. Biological role of peptidoglycans, glycosaminoglycans and Lectins. Lipids - classification, structure and properties of fatty acids, triglycerides, phospholipids, sphingolipids and cholesterol.

UNIT-II: Amino acids - Classification, structure and physico-chemical properties. Chemical synthesis of peptides – solid phase peptide synthesis. Proteins - classification, purification and criteria of homogeneity. Structural organization, sequence determination and characterization of proteins. Confirmation of proteins – Ramachandran plots. Denaturation of proteins. Hetero cyclic compounds – Heme and Chlorophylls.

UNIT-III: Structure and properties of purines, pyrimidines, nucleosides, and nucleotides. Covalent structure of DNA and different forms of DNA - A, B and Z. DNA super coiling. Types of RNA and covalent structure of t-RNA. Classification, structure and physiological roles of Vitamins.

UNIT-IV: Hormones- classification and mechanism of action of steroid and protein hormones. Signal transduction cascade by cyclic AMP, Phosphoinositate and calcium (Ca+), G-proteins, growth factors and membrane receptor tyrosine kinases. Phytohormones and their physiological roles.

Course Learning Outcomes:
After studying this paper, Postgraduate students will be able to:

CLO1: Understand biochemistry at the atomic level, draw molecules and reaction mechanisms perfectly and detail about amino acid structures, types of amino acids, classifications, structure of proteins and types of proteins

CLO2: Recognize the structural levels of organization of proteins,3D structure of proteins, its functions, denaturation (hemoglobin, myoglobin etc.) and be able to describe/recognize lipid and porphyrin structures, lipoproteins and functions of porphyrins (heme, chlorophyll etc.).

CLO3: Learn how amino acids and proteins are metabolized, emphasizing the role of few intermediates of their metabolism, monitoring the deficiency and abundance disorders of amino acid metabolisms and the role of enzymes in the regulation of the pathways

CLO4: Understand the structure and function of genetic material.

Text Books:

- A.L., Lehninger, PRINCIPLES OF BIOCHEMISTRY (1982), Worth Publishers, Inc. New York, ISBN: 9780716743392, 0716743396
- L. Stryer , BIOCHEMISTRY (1995) W.H. Freeman Press, San Francisco, USA, ISBN: 9781319248086, 131924808X.

Reference Books:

- Voet, D. and Voet, J.G., Biochemistry, (2004). 3rd Edition, John Wiley & Sons, Inc.USA,
- U. Sathyanarayana, Biochemistry by Books and Allied (P) Ltd. Kolkata, ISBN 0-87893- 214-3, (2014), ISBN: 9788187134800, 8187134801

Online links for study & reference materials:
https://www.khanacademy.org/test-prep/mcat/biomolecules
https://nptel.ac.in/courses/104/105/104105076/

NOIDA INTERNATIONAL UNIVERSITY

MOLECULAR BIOLOGY (STPB-202)

L	T	P
4	0	2

Course Name: Molecular Biology
Course Code: STPB-202
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

To acquaint the students with basic and advanced knowledge of molecular biology. Course objectives is focus discuss the better understanding of molecular Biological processes like DNA replication, transcription and repair systems, different genes regulation and replication.

Course Description:

This course presents the genetics at molecular level Goals: On successful completion of the subject the student should have understood the molecular aspects of Molecular biology

Course Contents:

Unit I: Organization of genetic material - Packing of DNA in to chromatin - protein components of chromatin, histones, nucleosome organization. Solenoids loops, domains & scaffolds. Gene amplification, polytene chromosomes. DNA replication – apparatus, enzymes involved and mechanism. Replication at telomeres. DNA damage and repair mechanism. Nuclear genome.C - value paradox. Mitochondrial & plastid genomes and genes. Fine structure of the eukaryotic gene. Split genes. Different kinds of genes: overlapping, assembled, polyprotein & nested genes.

Unit II: Transcription in prokaryotes and eukaryotes. Mechanism of transcription, enzymes and transcription factors, zinc finger, leucine zipper mechanism. Maturation and processing of mRNA, splicing, 5' end capping & 3' end tailing. RNA editing and transport. RNAi and small RNAs.

Unit III: Translation in prokaryotes and eukaryotes: Genetic code - properties of the genetic code, deciphering of the genetic code. Ribosome as a translation factory. t - RNA as an adaptor, its mode of function. Post translational modifications. Leader sequences & protein targeting.

Unit IV: Regulation of gene expression in prokaryotes - The operon concept, lac &tryp operons. Transcriptional control. Post translational control. Regulation in eukaryotes - Control by promoter, enhancer and silencers. Cis-trans elements. Environmental & developmental regulation. DNA methylation & gene expression. Chromatin structure & gene expression.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept molecular biology especially organization of genetic material.
CLO2. Describe the basic knowledge of transcription in prokaryotes and eukaryotes.
CLO3. Describe the basic knowledge of translation in prokaryotes and eukaryotes.
CLO4. Discuss the basic concept of regulation of gene expression in prokaryotes and eukaryotes.

Text Books:

- Jeff Hardin, Gregory Bertoni, Lewis J. Kleinsmith, Wayne M. Becker. Becker's World of the Cell, 8th edition, Benajmin Cummings, 9780321689634, 0321689631, (2012).
- EDP De Robertis and EMF De Robertis. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, 9780781734936, 0781734932, (2006)

Reference Books:

- Gerald Karp, Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc, 9780470483374, 0470483377 (2010)
- G.M. Cooper, and R.E. Hausman. The Cell: A Molecular Approach. 5th Edition. ASM Press 780878931064, 0878931066 (2009)

Online links for study and reference materials:
http://www.open2study.com/cellbiology
https://nptel.ac.in/courses/102103012/

IMMUNOTECHNOLOGY (STPB-203)

L	T	P
4	0	2

Course Name: Immunotechnology
Course Code: STPB-203
Course Credit Hour: 4 hrs
Total Contact hour: 42 hrs

Course Objective:

This course is mainly focused on the host immune system which includes concept of immunology, Type of immune system, Classes of immune cells, Antigen-Antibody interaction immune cell tolerance, vaccine technology, and other immunotechnology related topics. Basic of immunology and molecular biological techniques are usually two major courses form the essential prerequisites for Immunotechnology.

Course Description:
This course is mainly focused on the host immune system which includes basic concept of immunology, Type of immune system, Classes of immune cells, Antigen-Antibody interaction immune cell tolerance, vaccine technology and other relevant topics. It also discuss the basic concept of Vaccine technology including DNA vaccines, immunodiagnosis of Infectious diseases.

Course Contents:

Unit I: Introduction to immunology: History and scope of immunology; types of immunity; anatomy of lymphoid organs- primary and secondary lymphoid organs; immunoglobulin structure and function; memory cells, lymphocyte differentiation.

Unit II: Biology of complement systems: Structure and function of MHC class I and II molecules; antigen recognition and presentation; humoral and Cell mediated immune responses; hypersensitivity reaction; immune suppression and immune tolerance; auto immune disorders.

Unit III: Antigen & Antibodies: Antigen- isolation, purification and characterization of various antigens and haptens; antibodies- production, purification and quantification of immunoglobulins; antigen - antibody reaction; hybridoma and monoclonal antibody production; immuno-diagnosis and applications; human monoclonal antibodies; complement fixation.

Unit IV: Immunotechnology: Purification of mononuclear cells from peripheral blood; isolation and characterization of T cells subsets; Antigen processing and presentation; fluorescent activated cell sorter (FACs); mitogen and antigen induced lympho-proliferation assay; mixed lymphocyte reaction (MLR); Assay of macrophage activation; Macrophage & Dendritic cells culture.

Unit V: Vaccine Technology: Introduction to Vaccine technology including DNA vaccines - identification of T and B epitopes for vaccine development. immunodiagnosis of Infectious diseases.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept immune system, types of immunity and immunoglobulin structure and function.
CLO2. Discuss Structure and function of MHC class I and II molecules, antigen recognition and presentation.
CLO3. Describe the Basic characteristics of an antigen and Structure, Types, Functions and Properties of antibodies.
CLO4. Explain the isolation and characterization of different immune cells, Antigen processing and presentation.
CLO5. Discuss the basic concept of Vaccine technology including DNA vaccines, immunodiagnosis of Infectious diseases.

Text Books:

- Immunology, V Edition - Richard A.Goldsby, Thomas. J. Kindt, A. Osborne, JanisKuby, 2003. W.H. Freeman and company.
- Arnold, HeinemanAbbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
- Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt’s Essential Immunology.11th edition WileyBlackwellScientific Publication, Oxford.

Reference Books:

- Basic and Clinical Immunology, 2010, D.P. Stities and J.D. Stobo.
- Kuby’s Immunology. 6th edition W.H. Freeman andCompany, New York.
- Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.
- Immunology, Richard A. Goldsby, Thomas J. Kindt. Barbara, A. Osborne, Janis Kuby 5th Edition, 2003. W. H. Freeman & Company.

Online links for study & reference materials:
https://nptel.ac.in/courses/102103038/
https://nptel.ac.in/courses/102103041/18

BIOSTATISTICS, COMPUTER APPLICATIONS AND BIOINFORMATICS (STPB-204)

L	T	P
4	0	2

Course Name: Biostatistics, Computer Applications and Bioinformatics **Course Code:** STPB-204
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

The objective of this course is to impart fundamental knowledge of computers, and biostatistics which is used in population genetics and evolutionary studies and understand how the biological data generated through various biological branches can be assimilated and studied using computer application.

Course Description:

This course provides students with in depth knowledge Bioinformatics, its application and various tools and their usage. It also provides information regarding the various algorithms used in the bioinformatics tools that enable easier processing of biological data and also enables to identify interaction across various or subbranches of bioinformatics like genomics, proteomics, drug designing, chemical interactions between molecules etc.

Course Contents:

Unit I Introduction to Bioinformatics – Genomics and Proteomics. Bioinformatics – Online tools and offline tools. Biological databases. Types of data bases – Gen bank, Swiss port, EMBL, NCBL, and PDB. Database searching using BLAST and FASTA.

Unit II Sequence and Phylogeny analysis - Sequence Alignments, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.

Unit III Dynamic programming- Gene and Genome annotation – Tools used. Physical map of genomes. Molecular phylogeny - Concept methods of tree construction.

Unit IV: Bioinformatics tools in proteomics: Introduction, strategies and methods. Bioinformatics tools in proteomics. Application of proteomics. Protein-protein interactions. Basic introduction of Proteomics technologies: 2D-electrophoresis, MALDI-TOF mass spectrometry. Biological Protein Databases: PDB, SWISSPROT, TREMBL. Protein secondary structure prediction. Protein 3D structure prediction.

Unit V: Basics of Biostatistics: Brief description and tabulation of data and its graphical representation. Measures of central tendency and dispersion - mean, median, mode, range, standard deviation, variance. Simple linear regression and correlation. Types of errors and level of significance. Tests of significance – F & t tests, chi-square tests, ANOVA.

Course Learning Outcomes (CLOs):
After successful completion of the course the students:

CLO1. Outlines the basic background of Bioinformatics, terminology, history and introduction to various databases

CLO2. Describe in detail the various mechanisms involved sequence similarity, algorithm matrices MSA and Phylogenetic analysis

CLO3. Introduces various programming and software tools involved in genome annotation, mol. Phylogeny.

CLO4. Discuss the basic background of proteomic and various tools and their application in understanding the proteome and its analysis

CLO5. Describes the mathematical tools involved in evaluation of the various dataset generated and their evaluation via statistics.

Text Books:

- D. Mount, Bioinformatics – Sequence and Genome Analysis, 2nd Ed. Cold Spring Harbor Laboratory Press, 9780879697129, 0879697121
- William Mendenhall, Robert J. Beaver, Barbara M. Beaver, Introduction to Probability & Statistics, 14th Edition, Cengage Learning,1133103758, 9781133103752,

Reference Books:

- Arthur M.Lesk, Introduction to Bioinformatics, 4th Ed. Oxford press, 9780199651566, 0199651566

Online links for study and reference materials:
https://nptel.ac.in/courses/102/106/102106065/
www.ncbi.nlm.gov

"SEMINAR" (STPM-205)
RECENT DEVELOPMENT IN MICROBIOLOGY

L	T	P
2	0	0

Course Name: Modern Research in Microbiology **Course Code:** STPM-205
Course Credit Hour: 2 hrs **Total Contact hour:** 30 hrs

Course Objective:

Develop an ability to understand and present a seminar on the latest scientific and technological developments in the field of microbiology which enhances writing as well as oral communication skills.

Course Contents:

Every student, who has been enrolled in M.Sc. (Microbiology) course, shall have to deliver a Seminar on a Recent Topic related to Recent and Applied Developments in Microbiology. Seminar will be of 45-minute duration during which the presentation will be followed by questions session by the audience comprising of faculty and students. Every student shall be required to submit the topic of his/her seminar in consultation with the Head of the Department/Faculty members well in advance so that the same may be displayed on the notice board. The speaker has to write an Abstract to be distributed during Seminar in addition to two copies of write-up giving relevant details of the background of the subject, methods used and references/List of sources from where the material for presentation has been collected.

Course Learning Outcomes (CLOs):

After completion of the course, students will understand about the Modern Research in Microbiology and develop presentation skill during the discussion and presentation. Additionally, Student will develop a drafting and writing skill.

M.Sc. Microbiology 2nd Year
SEMESTER-III

ENZYMOLOGY & BIOPROCESS TECHNOLOGY (STPB-301)

L	T	P
4	0	2

Course Name: Basics of Immunology **Course Code:** STPB-301
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

This course focus on the basis of Enzymology, bioprocess technology and their techniques. It basically covers the Bioprocess parameters, spoilage of food stuffs and food processing.

Course Description:

This is a specialized branch of life sciences that deals with the biochemical nature and activity of enzymes and is a subject that has relevance to students from a wide range of disciplines. In addition, it will serve as an individual reference for students pursuing their post graduate degree programmes in life sciences and it could be recommended to anyone wishing to get an idea of the present day scope and applications of enzymology. The present course opens the door to all of the abundant careers in and out of the area of biological sciences including health/medical/ Environmental Sciences.

Course Contents:

Unit I: Isolation, preservation and maintenance of industrial microorganisms, kinetics of microbial growth and death, product decomposition, effect of environmental conditions. Bioreactors; Media for industrial fermentation, types of fermentation processes; Analysis of batch, Fed-batch and continuous bioreactions, stability of microbial reactors, analysis of mixed microbial populations, specialized bioreactors (pulsed, fluidized, photobioreactors etc.).

Unit II: Measurement and control of bioprocess parameters, basic principles of feedback control, proportional, integral and derivative control; Downstream Processing: introduction, removal of microbial cells and solid matter, foam preparation, precipitation, filtration, centrifugation, cell disruptions, liquid-liquid extraction, chromatography, membrane process, drying and crystallization.

Unit III: Enzyme and cell immobilization and their industrial applications; Use of microbes in mineral beneficiation and oil recovery; Industrial production of chemicals: Alcohol (ethanol), acids (citric, acetic and gluconic), solvents (glycerol, acetone, butanol), antibiotics (penicillin, streptomycin, tetracycline), amino acids (lysine, glutamic acid). Effluent treatment: DOC and COD treatment and disposal of effluents.

Unit IV: Introduction to Food Technology- elementary idea of canning and packing, sterilization and Pasteurization, technology of typical Food/Food products (bread, cheese, idli), food preservation, fermented foods and probiotics.

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept preserving and maintenance of industrial microorganisms.
CLO2. Discuss the bioprocess parameters and their feedback control.
CLO3. Describe the basic characteristics of enzyme and cell immobilization and their industrial applications.
CLO4. Explain the Major Food Preserving techniques and their implimentations.

Text Books:

- Stanbury, A.H., A. Whittaker and Hall S.J. 1995. Principles of fermentation technology 2nd edition, Pergamon Press.
- Lehninger, Nelson, D. L. and Cox, M. M 2000. Principle of Biochemistry, Worth Publishers.

Reference Books:

- Stanburry P.P. and Whitaker, A. 1984. Principles of Fermentation Technology. Pergamon Press, OxfordUK.
- R2. Steinkraus, K.H. 1983. Handbook of Indigenous Fermented Foods. Marcel Dekker, New York.

Online links for study & reference materials:
www.bioprocessingsummit.com
https://biopharmaceutics.pharmaceuticalconferences.com

INDUSTRIAL AND FOOD MICROBIOLOGY (STPM-302)

L	T	P
4	0	2

Course Name: Industrial and Food Microbiology **Course Code:** STPM-302
Course Credit Hour: 4 hrs **Total Contact hour:** 60 hrs

Course Objective:

This course aims to provide instruction in the general principles of food microbiology. lt is assumed that students will have received adequate introduction to microbiology per se. The course covers the biology and epidemiology of foodborne microorganisms of public health significance, including bacteria, yeasts, fungi, protozoa and viruses, and food spoilage microorganisms; the microbiology of food preservation and food commodities; fermented and microbial foods; principles and methods for the microbiological examination of foods; micro biological quality control, and quality scheme.

Course Description:

This course deals with the beneficial and harmful association of microorganisms with the food and prospective application of the microorganisms in the food industry. Teaches the methods of controlling the type and number of microorganisms in the food as per requirement. Teaches about the role of food regulatory bodies and measures of food safety and quality control.

Course Contents:

Unit I: Introduction to industrial microbiology: Sources of industrially important microbes, strain development, types of fermentation and fermenters, process optimization, and recent developments in fermentation technology. **Downstream processing of microbial products:** Filtration, centrifugation, cell disruption, liquid-liquid extraction, chromatography, membrane processes, drying (lyophilization and spray drying), and crystallization

Unit II: Fermentation economics: Basic objective for successful economically viable fermentation process, cost break down for well-established fermentation processes, market potential of the products, cost aspects of various stages in the processes development including effluent treatment.

Unit III: Production aspects: Microbial strains, substrates, strain improvement, flow diagrams, product optimization, and applications of industrial alcohol (ethanol and butanol), amino acids (lysine, phenylalanine, tryptophan), antibiotics (cephalosporins, tetracyclines, polyenes), enzymes and immobilized enzymes, SCP, microbial polyesters, biosurfactants, and recombinant products (insulin, somatostatin, thaumatin).

Unit IV: Microbiology of foods: Vegetables, fruits, milk, fermented and non-fermented milk products, fresh meats, poultry and non-dairy fermented foods.

Unit V: Microbial spoilage of foods Food preservation: Chemical, physical and biological methods. Fermentation processes: Production of milk and milk products, plant based products, fish products, meat products and food beverages. Food-borne diseases

Course Learning Outcomes (CLOs):
Upon successful completion of this course the student will be able to:

CLO1. Get equipped with a theoretical and practical understanding of industrial microbiology Appreciate how microbiology is applied in manufacture of industrial products.

CLO2. Know how to source for microorganisms of industrial importance from the environment.

CLO3. Know about design of bioreactors, factors affecting growth and production, heat transfer, oxygen transfer**.**

CLO4. Understand the rationale in medium formulation & design for microbial fermentation, sterilization of medium and air**.**

CLO5. Appreciate the different types of fermentation processes.

Text Books:

- Casida, Industrial Microbiology, (1999) by. LE, New age International (P) Limited, Publishers. ISBN: 9788122438024, 8122438024
- A.H. Patel, Industrial Microbiology (2000) by. Macmillan Publishers India, ISBN: 9780333908426

Reference Books:

- A.H.Patel, Industrial microbiology by, Macillan India Ltd.
- P. Stanbury & Allan Whitekar, Principles of Fermentation Technology by, Pergamon. ISBN: 9781483292915, 1483292916

Online links for study & reference materials:
https://www.khanacademy.org/
https://nptel.ac.in/courses

GENETIC ENGINEERING (STPM-303)

L	T	P
4	0	2

Course Name: Genetic Engineering
Course Code: STPM-303
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

Following are the key course objectives:

- To make the students familiar about the translation machinery and concept of r-DNA technology and their application in advanced research
- To make the student to understood the concept of gene manipulation and gene transfer technologies
- To make aware the students about manipulation of genes, Transfer techniques, Expression systems and methods of selection

Course Description:

Course basically helps in getting basic concept about genetics principles and also to be aware of the tools for genetic engineering such as PCR, Restricting mapping and other relevant topics.

Course Contents:

Unit I: Genetic Engineering and Recombinant DNA technology: Introduction to the scope of genetic engineering. Overview of the principles and progress in genetic engineering. Basic steps involved in recombinant DNA technology: Isolation of DNA from various sources, fragmentation methods, ligation strategies, introduction of the chimeric DNA into various host cells and selection and screening of recombinant clones. Basic enzymes used in RDT.

Unit II: Cloning and expression vectors: Introduction to Plasmids; Lambda based vectors and derivatives (Insertion vectors, replacement vectors, cosmids, phasmids, phagemids, in-vitro packaging, selection schemes); high-cloning capacity vectors: single stranded DNA vectors (M13); YACs, BACs.

Unit III: Polymerase Chain Reaction: Basic principles and its modifications, designing of primers, Different schemes of PCR, application of PCR, Brief introduction to RT- PCR and Real-Time PCR.

Unit IV: Gene Sequencing methods: Introduction to Nucleic acid sequencing methodologies, Sequencing techniques: Maxam & Gilbert degradation method, Sanger's Dideoxy method, Organo-chemical gene synthesis mechanism, cDNA using reverse transcriptase.

Unit V: cDNA Libraries and molecular techniques: Construction and Screening of genomic and cDNA libraries, Different blotting techniques: Southern, Northern, Western blotting, DNA Fingerprinting, RFLP, VNTR, STR and its applications.

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Course Learning Outcomes (CLOs):

CLO1. The students will have knowledge of tools and strategies used in genetic engineering
CLO2. Understanding of applications of recombinant DNA technology and genetic engineering (from academic and industrial perspective)
CLO3. Apply the knowledge of genetic engineering in problem solving and in practice
CLO4. Students will understand the basics of gene cloning, role of enzymes and vectors for genetic engineering.
CLO5. Students will be aquainted with Gene transfer methods, Techniques and safety measures of genetic engineering, genome mapping and gene therapy.

Text Books:

- Principles of Gene Manipulation by S.B. Primrose, RM Twyman and RW Old (6thEdition)
- Recombinant DNA: A Short Course by JD Watson, J. Tooze and DT Kurtz.
- Principles of Gene Manipulation and Genomics SEVENTH EDITION S.B. Primrose and R.M. Twyman

Reference Books:

- Molecular Cloning: a Laboratory Manual, J Sambrook, E F Fritsch and T Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
- Principles of Gene manipulation (1994) Old R.N. and Primrose S.B.
- Recombinant DNA (1992) Watson J.D., Witreowski J., Gilman M. and Zooller M.

Online links for study & reference materials:
www.microbenotes.com
www.nptel.ac.in
www.byjus.com

PARASITOLOGY (STPM-304)

L	T	P
4	0	2

Course Name: Host-pathogen interaction
Course Code: STPM-304
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

This course will enable students to acquire knowledge on the fundamentals of Host-pathogen interaction. It enables them to understand emerging and advanced concept in host pathogen interaction and this course also focuses on the host parasite interaction which include etiology, pathogenicity, life cycle, lab diagnosis and treatment. This program will facilitate the students to acquire knowledge in fields various aspects and molecular tools used in clinical application in alleviation of human disease.

Course Description:

This course is mainly focused to understand emerging and advanced concept in molecular pathogenesis of disease and role of biotechnology in diagnosis, prevention and therapeutics. An understanding of the basic biology and life cycles of human parasites; human parasitic infections, including epidemiology, clinical features, laboratory diagnosis, treatment and prevention.

Course Contents:

Unit I: Introduction: Basic concept of Host-pathogen interaction, Basic concept of Parasites, Classification of Parasites, Host, Types of host, Relationship between host and parasites.

Unit II: Protozoan infection and host response: (introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment): Amoeboids (*Entamoeba histolytica*), Flagellates (*Giardia* spp), Sporozoans (*Plasmodium* spp), Leishmania, Trypanosoma

Unit III: Platyhelminthes infection and host response: (Introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment): Taenia, Echinococcus

Unit IV: Nemathelminthes infection and host response: (introduction, A-etiology, pathogenicity, life cycle, lab diagnosis and treatment): Ascaris, Ancylostoma, Necator, Enterobius, Wuchereria

Unit V: Lab Diagnosis: Different specimens of parasitology, Collection & transportation. Processing of parasitological specimens

Course Learning Outcomes (CLOs):

CLO1. Understand the basic concept Parasitology and its importance.
CLO2. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of protozoan parasite.
CLO3. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of Platyhelminthes.
CLO4. Discuss etiology, pathogenicity, life cycle, lab diagnosis and treatment of Nemathelminthes.
CLO5. Explain the method for collection and processing of parasitological specimens.

Text Books:

- Textbook of Microbiology' by CP Baveja, 2nd edition, 1998, Arya longman Pvt. Ltd
- Textbook of Medical Lab Technology' 2010, by Praful Godkar
- Text book of Medical Laboratory' by Satish Gupta, Edition - latest, 2006, J.P. Bros.

Reference Books:

- Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.
- Medical parasitology' by Chatarjee, 3th edition
- Medical Microbiology and Immunology' by Warren Levinson, eighth Edition, Lange Medical books/ McGraw-Hill Publication

Online links for study & reference materials:

https://www.cdc.gov/parasites/about.html
http://www.onlinebiologynotes.com/
http://www.biologydiscussion.com/parasites/classification-of-parasites-parasitology/62036

CBCS** GENOMICS AND PROTEOMICS (STPB-305A)

L	T	P
2	0	0

Course Name: Genomics and Proteomics
Course Code: STPB-305A
Course Credit Hour: 2 hrs
Total Contact hour: 30 hrs

Course Objective:

It is intended to impart basic postgraduate-level knowledge in the area of Genomics and Proteomics. It also aims to familiarize them with the developments in the experimental approaches used by researchers to understand the complexity and diversity of genomes. Recent advances in genomics have transformed the way in which biologists study cells and biological systems. Furthermore, this course also provides knowledge of the use of high throughput techniques to study the entire range of proteins present in any cell/tissue/organism under specific conditions, to obtain a global view of cellular processes at the protein level.

Course Description:
This course is mainly focused on the Genomics and Proteomics and discuss the basic concept of genomics, such as origin, evolution and application of genomics and proteomics. This course also focuses to elaborates the Genomic and Proteomics techniques; from basic to advance level. It covers basic understanding of Genomics, Annotation of whole genome sequence & functional genomics, Pharmacogenomics and Proteomics.

Course Contents:

Unit I: Origin and Evolution of genomics: Introduction to genomics, type of genome exist in nature, DNA Marker & microsatellite, DNA based phylogenetic trees, genomes and human evolution, Introduction to Shotgun Sequencing methods, evolution of mitochondrial and Chloroplast genome, Anticipated Benefits of Genome Research

Unit II: Annotation of whole genome sequence and functional genomics: Whole genome shotgun sequencing, *In silico* methods, insertion mutagenesis (T-DNA and transport insertion), gene expression and transcript profiling, EST contigs and unigene sets, use of DNA chips and microarrays.

Unit III: Pharmacogenomics: Introduction to Pharmacogenomics, Use in biomedicine involving diagnosis and treatment of diseases, genomics in medical practice, personalized medicine, DNA polymorphism and treatment of diseases, use of SNP in pharmacogenomics, future of pharmacogenomics.

Unit VI: Proteomics: Introduction, definition concepts and approaches of proteomics studies and activities. Introduction proteome analysis tool and technique: Western blotting technique, Separation technique-Polyacrylamide gel electrophoresis (PAGE), 2D PAGE, Mass-spectrophotometery.

Course Learning Outcomes (CLOs):

CLO1. Gain an understanding of the basic concepts of genomics and its scope.
CLO2. Outline the fundamental of DNA based phylogenetic trees.
CLO3. Discuss the Annotation of whole genome sequence and functional genomics.
CLO4. Describe the basic concepts of pharmacogenomics and its future prospective.
CLO5. Explain the fundamentals of proteomics and advance molecular biology techniques.

Text Books:

- Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Campbell AM & Heyer LJ, Benjamin Cummings 2007; CSH Press, NY.
- Introduction to Proteomics: Tools for the New Biology. Daniel C. Liebler, 2002 Humana Press Inc.
- Primrose SB and Twyman RM. Genomics: Applications in human biology. Blackwell Publishing, 2008 Oxford, U.K

Reference Books:

- Genome III – T.A. Brown Garland Science Publ. June 08, 2006
- Bioinformatics and Functional Genomics – Jonathan Pevsner - 2nd edition, Wiley-Blackwell, 2009.
- Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press

Online links for study & reference materials:

http://www.genomenewsnetwork.org/resources
http://www.pss.co.jp/english/sc_bio/contents4.html
http://www.premierbiosoft.com/tech_notes/microarray.html

CBCS** BIOINFORMATICS (STPB-305B)

L	T	P
2	0	0

Course Name: Bioinformatics
Course Code: STPB-305B
Course Credit Hour: 2 hrs
Total Contact hour: 30 hrs

Course Objective:

It is intended to impart basic postgraduate-level knowledge in the area of Bioinformatics. This course is beneficial for students to understand the principles of analyzing biological data, building models and testing hypotheses using computer science algorithms. This course is a survey of algorithms and tools in biological sequence analysis, genome-wide disease association, and precision medicine. Basic concept machine learning and its application in the analysis of biological data are also included in this course.

Course Description:

This course is mainly focused on the basic concept of bioinformatics and discuss the basic overview of various information repositories widely used in biological sciences; and tools for searching or querying those databases. This course will build the foundation of sequence alignment techniques and find evolutionary connections. It will help students to analyze genome data and mRNA expression data and gene annotations.

Course Contents:

Unit I: Introduction to computers and bioinformatics- Types of operating systems, concepts of networking and remote login, basic fundamentals of working with unix.

Unit II: Biological databases- Overview, modes of database search , mode of data storage (Flat file format, db-tables), flatfile formats of GenBank, EMBL, DDBJ, PDB.

Unit III: Sequence alignment –Concept of local and global sequence alignment, Pairwise sequence alignment, scoring an alignment, substitution matrices, multiple sequence alignment. **Phylogenetic analysis-** Basic concepts of phylogenetic analysis, rooted/uprooted trees, approaches for phylogenetic tree construction (UPGMA, Neighbour joining, Maximum parsimony, Maximum likelihood).

Unit VI: Generation and analysis of high throughput sequence data- Assembly pipeline for clustering of HTGS data, format of ".ace" file, quality assessment of genomic assemblies, International norms for sequence data quality, Clustering of EST sequences, concept of Unigene.

Unit V: Annotation procedures for high through-put sequence data- Identification of various genomic elements (protein coding genes, repeat elements, strategies for annotation of whole genome, functional annotation of EST clusters, gene ontology (GO) consortium.

Course Learning Outcomes (CLOs):

CLO1. Basic concept of computational analyses of biological sequences, genome-wide studies and relate the results to core principles of biology; use computational methods to help execute a biological research plan.
CLO2. Outline the fundamental of DNA based phylogenetic trees.
CLO3. Discuss the Annotation of whole genome sequence and functional genomics.
CLO4. Describe the basic concepts of pharmacogenomics and its future prospective.
CLO5. learn to align sequences using dot matrices, dynamic programming and heuristic approach; understand the notion of similarity, identity, and gaps in the context of sequence alignment and deduce evolutionary relationships among sequences.

Text Books:

- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by Baxevanis A.D. and Ouellette, Third Edition. John Wiley and Son Inc., 2005.
- Bioinformatics Sequence and Genome Analysis by Mount D.W., CSHL Press, 2004
- Jonathan Pevsner. Bioinformatics and Functional Genomics, 2nd Edition. ISBN: 978-0-470-08585-1.
- Greg Gibson and Spencer V. Muse. A Primer of Genome Science, Third Edition. ISBN: 978-0-87893-309-9.

Reference Books:

- Bioinformatics and Functional Genomics – Jonathan Pevsner - 2nd edition, Wiley-Blackwell, 2009.
- Introduction to Bioinformatics by Tramontano A., Chapman & Hall/CRC, 2007.
- Understanding Bioinformatics by Zvelebil, M. and Baum, Chapman & Hall/CRC, 2008.

Online links for study & reference materials:

http://www.genomenewsnetwork.org/resources
http://www.pss.co.jp/english/sc_bio/contents4.html
http://www.ncbi.nic.

M.Sc. Microbiology 2nd Year
SEMESTER-IV

ENVIRONMENTAL MICROBIOLOGY (STPB-401)

L	T	P
4	0	0

Course Name: Environmental Microbiology
Course Code: STPB-401
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

The course provides the students with a conceptual and experimental background in the broad discipline of environmental microbiology. The students will be introduced to the major groups of microorganisms and their diversity in structure and functions and microbial interactions. Emphasis has been laid on Microorganisms and their Habitats. The course also introduces the students to the scope of Biogeochemical Cycling, Waste Management and Microbial Bioremediation.

Course Description:

This course is mainly focused on the Environmental Microbiology which includes basic concept of patents, patent regime (in India and abroad) registration aspects and other details.

Course Contents:

Unit I: Microorganisms and their Habitats: Structure and function of ecosystems; Terrestrial Environment: Soil profile and soil microflora; Aquatic Environment: Microflora of fresh water and marine habitats; Atmosphere: Aeromicroflora and dispersal of microbes; Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body. Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic& osmotic pressures, salinity, & low nutrient levels. Microbial succession in decomposition of plant organic matter

Unit II: Microbial Interactions: Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation, Microbe-Plant interaction: Symbiotic and non-symbiotic interactions. Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic luminescent bacteria.

Unit III: Biogeochemical Cycling: Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin, Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction, Phosphorus cycle: Phosphate immobilization and solubilisation, Sulphur cycle: Microbes involved in sulphur cycle, Other elemental cycles: Iron and manganese

Unit IV: Waste Management: Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill), Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary, sewage treatment

Unit V: Microbial Bioremediation: Principles and degradation of common pesticides, organic (hydrocarbons, oil spills) and inorganic (metals) matter, biosurfactants.

Course Learning Outcomes (CLOs):

CLO1. Discuss the basic concept of ecosystems, microorganisms and their Habitats: Terrestrial and Aquatic Environment.
CLO2. Understand microbe-microbe interactions, microbe-Plant interaction and Microbe-animal interaction
CLO3. Describe the Basic concept of Biogeochemical Cycling, such as Carbon cycle, Nitrogen cycle, Phosphorus cycle, Sulphur cycle and others.
CLO4. Discuss the Solid Waste management, Liquid waste management, primary, secondary and tertiary sewage treatment.
CLO5. Discuss the basic concept and importance of Microbial Bioremediation; Principles and degradation of common pesticides: organic and inorganic matter

Text Books:

- Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition.Benjamin/Cummings Science Publishing, USA
- Microbial Ecology: Fundamentals & Applications. 4th edition.Benjamin/Cummings Science Publishing, USA (2000)
- Textbook for Environmental Studies, University Grants Commission, New Delhi and Bharati Vidyapeeth Institute of Environmental Education and Research, Pune. 361 (2003)

Reference Books:

- Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, AcademicPress
- Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition.Pearson/ Benjamin Cummings

Online links for study & reference materials:
www.highveld.com/ environmental microbiology
https//onlinecourse.nptel.ac.in

CLINICAL RESEARCH AND ENTREPRENEURSHIP (STPB-402)

L	T	P
2	0	0

Course Name: Clinical Research and Entrepreneurship
Course Code: STPB-402
Course Credit Hour: 4 hrs
Total Contact hour: 60 hrs

Course Objective:

To enrich the understanding of clinical data management procedure in clinical research which sponsor, CRO and Hospital use for clinical trials. To know the latest technology of clinical data management used in clinical trials.

Course Description:

This course provides students with insight into the issues, challenges and opportunities involved in the creation and management of a new venture over its full life cycle. Typically, entrepreneurs are consumed with their product or service and are not prepared to strategically nor tactically lead the venture.

Course Contents:

Unit I: Clinical Research: Basic conventional drug design approaches, Drug development process (Preclinical, clinical and toxicological studies). Past, Present and future Importance, Mile stones of regulations. FDA, US, Indian clinical research, global scenario of clinical research, Regulatory agency. Designing clinical trials- History, principles, scheme for conducting clinical trials, planning defining, objectives, variables, study populations, testable hypothesis.

Unit II: Ethical Issues in clinical research- Introduction, codes, declaration and guidelines, informed concent, special issues, Roles and responsibilities of IRBS, issues with ethics review

Unit III: Introduction of Entrepreneurship: definition, history and scope of Biotechnology Entrepreneurship. **Biotechnology Marketing & Companies:** Biotechnology in capital market; Initial Public Offering (IPO) in the capital market; examples of success and failure of biotechnology companies and the possible reasons.

Unit IV: Patenting, licensing and partnership in biotechnology industry: Patents on biological inventions, licensing revenue, selection of right partner; negotiations of the terms of the terms of the deal.

Unit IV: Entrepreneurship Skills: Entrepreneurship Skills of bio-entrepreneur, bio-entrepreneurial training; research experience, creativity, communication skills and other attributes; participation in conferences, training and educational courses; institutes offering entrepreneurship courses.

Course Learning Outcomes (CLOs):

After completion of the course the students will be able to:
CLO1. Learn how to build a business in healthcare based on their own research, demonstrate an understanding of the opportunities of health innovation and entrepreneurship for utilization of research.
CLO2. Apply scientific background and new knowledge of health innovation to address challenges and develop services and products within a clinical setting and a biopharma/medtech setting and use various business tools for ideation and feasibility studies; to develop, prototype and test solutions in response to user needs.
CLO3. Develop a business plan based upon a novel idea and communicate a business plan to people within the startup world and demonstrate an understanding of how Tech Transfer Offices and other innovation support actors can support the commercialization process.
CLO4. Discuss and argue for different types of intellectual property and intellectual assets, and understand different patent strategies and apply the basics in financing a startup company from private and governmental funding bodies.
CLO5. Discuss and argue for different types of intellectual property and intellectual assets, and establish patent strategies and assess their skills in health innovation and reflect on the exploitation of their own research combine being a scientist and a health innovator/entrepreneur.

Text Books:

- Richard K. Rondel, Sheila A. Varley, Colin F. Webb, Clinical Data Management, 2nd Edition ISBN No. 9780471983293, 0471983292
- Susanne Prokscha, Practical Guide to Clinical Data Management, Taylor & Francis, ISBN no. 9781439848296, 1439848297

Reference Books:

- Raymond G Hill, Drug Discovery and Development , 2nd Edition by, ISBN No. 9780443064203, 0443064202
- Hisrich, Robert D., Michael P. Peters, and Dean A. Shepherd. Entrepreneurship. McGraw-Hill Education, 2017, ISBN No. 9783319487014, 3319487019

Online links for study & reference materials:
https://www.khanacademy.org/
https://swayam.gov.in/
https://nptel.ac.in/

PROJECT (STPB-403)

L	T	P
0	0	8

Course Name: Research Project in Microbiology
Course Credit Hour: 8 hrs

Course Code: STPB-403
Total Contact hour: 120 hrs

Course Objective:

Develop an ability to understand the basic requirement to conduct a research project. Student also develop skill of writing and presentation on the assigned research topics in the field of microbiology.

Course Contents:

Every student will be required to undertake a research project based on any of the areas of Microbiology. The research project should have applied significance. The project report will be submitted in the form of dissertation duly certified by the supervisor of the Department of Microbiology or at national institutes and Universities in India, by seeking the placement. The project will be presented for evaluation at the end of semester by external experiments.

Course Learning Outcomes (CLOs):

After completion of the course, students will understand about the Research in Microbiology and develop presentation skill during the conduction of research, discussion and presentation. Additionally, Student will develop a drafting and writing skill.

NOIDA INTERNATIONAL UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

POSTGRADUATE PROGRAMME

MASTER OF COMPUTER APPLICATION

Choice Based Credit System (CBCS)

(Academic Year 2021-22)

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching–learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So, it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
   - **2.1 Discipline Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
   - **2.2 Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
   - **2.3 Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

     P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
   - **3.1** AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
   - **3.2** AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Course and programme outcome of MCA

Profile

- The mission is to apply the knowledge of mathematics and computing fundamentals to various real life applications for any given requirement to prepare an employable professional for the IT field.
- Experienced faculty members with good capabilities.
- Faculty members with ample Industry experience and profound caliber.
- State-of-the-art teaching resources, and well equipped labs, library etc.
- Students' seminar to increase the presentation, skills and their leadership qualities.
- Effective Industry Institute interaction is achieved through seminars, workshops and guest lectures. This encourages the professional discussion between the students and the participating managers from the industry. This also gives the students a chance to envisage their roles in the industry beforehand.
- Enhancing the knowledge of the students by interacting with the Industry skills, and their leadership qualities.

Program Offered: Post Graduate

- M.C.A : Masters of computer applications - 2 Years

PEOs of M.C.A Programme

M.C.A program of Noida International University will prepare its students for :

- PEO1: Involve in perennial learning for a continued career development and progress as a computer professional
- PEO 2: Communicate effectively and present technical information in oral and written reports
- PEO3: Create and design innovative methodologies to solve complex problems for the betterment of the society and Understand professional, ethical, security and social issues, work with appropriate societal and environmental considerations
- PEO4: To utilize technical knowledge of students towards problem solving using technical skills.

PSOs of M.C.A Programme

- PSO1: To create and design innovative methodologies to solve complex computational problems.
- PSO2: To prepare computer applications professionals for the booming information technology industry.
- PSO3: To integrate and apply efficiently the contemporary IT tools.

PROGRAM OUTCOMES (POs) - MCA

After completion of program, the students are able to

- PO1: Computational Knowledge - apply knowledge of computing, mathematics, principals of accounting, management and fundamental of software engineering appropriate to the discipline.
- PO2: Problem Analysis – Identify and analyze problems and formulate the requirements appropriate to its solution.
- PO3: Design Development of Solutions – Design, implements and evaluates a computer-based system to meet the desired needs.
- PO4: Conduct Investigations of Complex Computing Problems – Conduct investigations and experiments to analyze and interpret data of complex applications to find valid solutions.
- PO5: Modern Tool Usage – Select and apply current trends, techniques and modern tools that suit the computing requirements like UML diagrams.
- PO6: Lifelong learning - Build up the passion for continuing professional development.
- PO7: Project Management and Finance - Incorporate scientific, financial and management principles for the development of feasible projects.
- PO8: Communication Efficacy - Communicate effectively across multidisciplinary teams to accomplish a common goal.
- PO9: Societal and Environmental concern - Develop systems that meets the desired solutions considering.

1st Semester													
S. No	**Course Code**	**Subject**	**Period**			**Evaluation Scheme**				**Subject Total**	**Credit**	**CBCS**
			L	**T**	**P**	**CA**	**TA**	**Total**	**External Exam**			
1	MCA101/ C01	Problem solving with C	4	0	0	20	20	40	60	100	4	C1
2	MCA102/ C02	Data mining and warehousing	4	0	0	20	20	40	60	100	4	C2
3	MCA103/ CO3	Computer Organizationand Architecture	4	0	0	20	20	40	60	100	4	C3
4	MCA104/ SEC1	Discrete Mathematics Structure	4	0	0	20	20	40	60	100	4	SEC1
5	MCA105/ DSE1	Optimization techniques/ Natural Language Processing	4	0	0	20	20	40	60	100	4	DSE1
Practical												
1	MCA151/ LAB1	Problem solving with C Lab	0	0	2			40	60	100	2	C1
2	MCA152/ LAB2	Optimization/NLP lab	0	0	2			40	60	100	2	DSE1
Total										**700**	**24**	

Note: List of Practical will be supplied at the Start of every Semester

2nd Semester

S. No	Course Code	Subject	Period			Evaluation Scheme			External Exam	Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total				
1	MCA201/ C04	Cloud computing	4	0	0	20	20	40	60	100	4	C4
2	MCA202/ C05	Computer networks	4	0	0	20	20	40	60	100	4	C5
3	MCA203/ CO6	OOPS with Java	4	0	0	20	20	40	60	100	4	C6
4	MCA204/ SEC2	Entrepreneurship and Corporate Communications	2	0	0	20	20	40	60	100	4	SEC2
5	MCA205/ DSE2	Artificial intelligence /Cryptography and network security/information security	4	0	0	20	20	40	60	100	4	DSE2
Practical												
1	MCA251/ LAB1	OOPS with java lab	0	0	2			40	60	100	2	C6
2	MCA252/ LAB2	Cryptography /information security lab	0	0	2			40	60	100	2	DSE2
Total										**700**	**24**	

Note: List of Practical will be supplied at the Start of every Semester

3rd Semester

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total	External Exam			
1	MCA301/ C07	Operating System	4	0	0	20	20	40	60	100	4	C7
2	MCA302/ C08	Theory of Computation	4	0	0	20	20	40	60	100	4	C8
3	MCA303/ SEC3	Advance Data Base Management System	4	0	0	20	20	40	60	100	4	SEC3
4	MCA304/ SEC4	Python Programming	4	0	0	20	20	40	60	100	4	SEC4
5	MCA305/ GE1	Compiler Design/multimedia application/software testing	4	0	0	20	20	40	60	100	4	GE1
Practical												
1	MCA351/ LAB-1	Python lab	0	0	2			40	60	100	2	SEC4
2	MCA352/ LAB-2	Adbms Lab	0	0	2			40	60	100	2	SEC3
Total										**700**	**24**	

Note: List of Practical will be supplied at the Start of every Semester

4th Semester

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit	CBCS
									External Exam			
			L	T	P	CA	TA	Total				
1	MCA401/ C09	Big Data analytic	4	0	0	20	20	40	60	100	4	C9
2	MCA402/ C10	Software Engineering	4	0	0	20	20	40	60	100	4	C10
3	MCA403/ C11	Full Stack Technologies	4	0	0	20	20	40	60	100	4	C11
4	MCA404/ DSE3	Distributed Systems	2	0	0	20	20	40	60	100	4	DSE3
Practical												
1	MCA451/ Lab1	Full stack technologies lab	0	0	2			40	60	100	2	C11
2	MCA452 /DSE4	Major project	0	0	6			50	150	200	6	DSE4
Total										**700**	**24**	

Note: List of Practical will be supplied at the Start of every Semester

SEMESTER 1

Course Code: MCA101 **Course Name:** Problem Solving with C
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- The course is intended to create an understanding of the fundamentals of high-level structural programming concepts through the medium of C language.
- C language is a general purpose, procedural computer programming language.

Course Outcome:

- The students will be able to solve problems systematically and to implement the solution in C language.
- Develop programming skills.
- Develop the knowledge of how to learn a programming language, which will help in learning other Computer Languages in the curriculum

Course Description:

- The course is used to demonstrate the understanding of computer programming languages.
- Able to define data types and use them in simple data processing applications also student must be able to understand the concept of array of structures.

Course Contents:

- **Unit – I: C Fundamentals:** Character Set, Identifier & Keywords, Data Types, Variables, Operators and expressions, Symbolic Constants, Preprocessor Directives, and Library Functions.
- **Unit – II: Control Structure and Functions:** If statement, if-else statement, nested if-else, conditional operators, while, do-while and for loop, multiple initializations of for loop, break and continue statement. Function definition, passing values between functions, call by value and call by reference.
- **Unit – III: Arrays and Structure:** Definition and classification of arrays, string definition and standard library string functions, defining a structure, Array vs Structure, Initialization of a structure, Nested structure.
- **Unit – IV: Pointers and File Handling:** Pointers variables, Pointer operator, array of pointer, pointers to functions, dynamic allocation functions, File I/O: Types of I/O, console I/O functions sfrintf() and sscanf() functions, file operations, file opening modes, record I/O in files

Course learning Outcome:

- **CLO1:** this unit is to develop an understanding of basic character sets keywords and identifiers used for the c programming dataset. Learning objective of this unit is defining data types and uses them in simple data processing applications.

- **CLO2:** the learning objective here is to identify and put to use basic loops, conditional loops and iterative loops. Various break statements and call by value and reference are understandable in this unit.
- **CLO3:** This unit is to classify basic arrays and structures, various standard library functions, nested structures etc.
- **CLO4:** this unit is for learning console I/O, various functions and modes for file opening closing and recording I/O.

Textbooks:

1.Let Us C: Yashvint Kanitkar[BPB]
2.C The Complete Reference,rdSchildt, TMH
3.Practical C Programming,3 Ed,Oualline,SPD/O'REILLY

Reference books:

1. Programming in C, Schaum Outline, McGraw-Hill 3
2.Lab Manual for Basic Linux commands, to be provided by the department

Online links for study & reference materials:

https://lecturenotes.in/download/note/18532-note-for-cprogramming-by-anshuman

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCA102 **Course Name :** Data Mining and Warehousing
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- This course gives an introduction to methods and theory for development of data warehouses and data analysis using data mining. Data quality and methods and techniques for preprocessing of data. Modeling and design of data warehouses. Algorithms for classification, clustering and association rule analysis.

Course outcome :

- Understand theoretical and practical aspects of information and data mining
- Understand the quantitative evaluation methods for the IR systems and data mining techniques

Course Description :

- Data preprocessing and data quality.
- Modeling and design of data warehouses.
- Algorithms for data mining.

Course Contents :

- **UNIT-1: Introduction to Data mining**, types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data: Data Set, Summary Statistics, Visualization, OLAP and multi-dimensional data analysis.
- **UNIT-II: Classification:** Basic Concepts, Decision Trees and model evaluation: General approach for solving a classification problem, Decision Tree induction, Model over fitting: due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier. Nearest Neighborhood classifier, Bayesian Classifier, Support vector Machines: Linear SVM, Separable and Non Separable case.
- **UNIT-III: Association Analysis:** Problem Definition, Frequent Item-set generation, rule generation, compact representation of frequent item sets, FP-Growth Algorithms. Handling Categorical, Continuous attributes, Concept hierarchy, Sequential, Sub graph patterns
- **UNIT-IV: Clustering:** Over view, K-means, Agglomerative Hierarchical clustering, DBSCAN, Cluster evaluation: overview, Unsupervised Cluster Evaluation using cohesion and separation, using proximity matrix, Scalable Clustering algorithm
- **UNIT-V: Web data mining:** Introduction, Web terminology and characteristics, Web content mining, Web usage mining, web structure mining, Search Engines: Characteristics, Functionality, Architecture, Ranking of WebPages, Enterprise search

Course learning outcome:

- **CLO1 :** to have an Overview and Definition of Data Warehousing Components, 8 Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse
- **CLO2:** : Data Cleaning: Missing Values, Noisy Data,(Binning, Clustering, Regression, Computer and Human inspection),Inconsistent Data, Data

Integration and Transformation. Data Reduction:-Data Cube Aggregation, Decision Tree.

- **CLO3**: To familiar with principles Warehousing Strategy, Warehouse mananagement and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, , Data Extraction, Cleanup & Transformation Tools, Warehouse Metadata

- **CLO4** :To familiar with Classification: Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases
- **CLO5:** To familiar with Data Visualization and Overall Perspective: Aggregation, Historical 8 information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery

Text books :

1.Alex Berson, Stephen J. Smith "Data Warehousing, Data-Mining & OLAP", TMH
2.mark Humphries, Michael W. Hawkins, Michelle C. Dy, " Data Warehousing: Architectureand Implementation", Pearson

Online links for study & reference materials :

https://www.dei.unipd.it/~capri/SI/MATERIALE/DWDM0405.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MCA103 **Course Name:** Computer organization and Architecture

Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- To facilitate the students, learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design.
- To facilitate the students to be familiarized with the hardware components and concepts related to the input-output organization.
- To facilitate the students to be familiarized with the hardware components and concepts related to the memory organization.
- To facilitate the students to be familiarized with the concepts related to the 8086-micro controller like pin diagram, different types of registers and addressing modes.

Course Outcome:

- The students will be capable of using the methods to study of physical memory and various machine language codes.
- The students will get an overall view of computer architecture

Course Description:

- Computer architecture is a specification detailing how a set of software and hardware technology standards interact to form a computer system or platform. Computer architecture refers to how a computer system is designed and what technologies it is compatible with. There are three categories of computer architecture:
- System Design: This includes all hardware components in the system, including data processors aside from the CPU, such as the graphics processing unit and direct memory access. It also includes memory controllers, data paths and miscellaneous things like multiprocessing and virtualization
- Instruction Set Architecture (ISA): This is the embedded programming language of the central processing unit. It defines the CPU's functions and capabilities based on what programming it can perform or process. This includes the word size, processor register types, memory addressing modes, data formats and the instruction set that programmers use.
- Micro architecture: Otherwise known as computer organization, this type of architecture defines the data paths, data processing and storage elements, as well as how they should be implemented

Course Contents:

- **Unit-I:** Basis Computer Architecture, Functional Organization, Register Organization, Arithmetic and Logic Unit, Central Processing unit, Instruction Formats. CPU architecture, instruction format, addressing mode, stacks and handling of interrupts. Assembly language - Elementary problems

- **Unit-II:** Addressing Modes. Data Transfer and Manipulation, interrupts RISC/CISC architecture. Register transfer and macro-operations, Register Transfer Languages (RTL). Arithmetic, Logic and Shift Macro-operations, Sequencing, Micro-program sequences.

- **Unit-III:** Memory & Storage: Processor Vs. Memory speed: Cache memory. Associative memory, Virtual memory and Memory management. Pipeline & vector processing
- **Unit-IV:** Input/ Output organization: Peripheral devices, I/O Asynchronous Data Transfer: Strobe Control, Data Transfer Schemes (Programmed, Initiated, DW, Transfer)
- **Unit-V:** Memory Hierarchy, Main Memory, Auxiliary Memory, Cache Memory

Course learning Outcome:

- **CO1.** This unit is for understanding function and structure of a computer, Functional components of a computer, Interconnection of components, Performance of a computer.
- **CO2.** Machine instructions, Operands, addressing modes, Instruction formats, Instruction sets, Instruction set architectures - CISC and RISC architectures.
- **CO3.** Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Microprogrammed control unit
- **CO4.** Semiconductor memories, Memory cells - SRAM and DRAM cells, Internal Organization of a memory chip, Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory unit - Concept of cache memory, Mapping methods, Organization of a cache memory unit, Fetch and write mechanisms, Memory management unit - Concept of virtual memory, Address t l ti H d t f t translation, Hardware support for memory manage.
- **CO5.** Access of I/O devices, I/O ports, I/O control mechanisms - Program controlled I/O Interrupt controlled I/O and DMA controlled I/O I/O interfaces Program controlled I/O, Interrupt controlled I/O, and DMA controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, USB bus, Firewall and Infini Band, I/O peripherals - Input devices, Output devices, Secondary storage devices.

Text books :

- Moris Mano, “Computer System Architecture”, PHI Publications, 2002
- R. P. Jain, “Modern Digital Electronics”, TMH, 3rd Edition, 2003

Reference Books:

- Computer System Architecture (Third Edition),. Morris Mono - Pearson Prentice Hall,2007.

Online links for study & reference materials :

- http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MCA104 **Course Name:** Discrete Mathematics Structure

Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- The course is aimed at general introduction to the subject of discrete mathematics and its relevance to computer science. We start with elements of logic with emphasis on propositional logic and predicate calculus. Next we discuss sets and functions and develop the concepts of floor and ceiling functions and their use in computer science. The important topic of growth of functions and the methods of estimating the order of growth with the big-O, big-Omega, and big-Theta are discussed. After introducing algorithms, we pass on to principle of mathematical induction which is an important tool for proving general results. Counting techniques, relations, graphs and trees are also discussed at some length.

Course Outcome:

- The students will be capable of using the mathematical methods and algorithms learned for analyzing and solving problems related to Computer Science.
- The students will get an overall view of concepts in probability and statistics.

Course Description:

- The subject is very important in forming the basics for algorithms, complexity and computational theory. The concept of Boolean algebra is useful in not only creating logical solution but is very important as a critical programming skill too.

Course Contents:

- **Unit - I: Mathematical Logic:** Statements and notations, Connectives, Well-formed formulas, Truth tables, tautology, equivalence implication, Normal forms, Theory of inference for the statement calculus, Rules of inference, Consistency of premises and indirect method of proof, Automatic Theorem Proving Predicate calculus: Predicates, statement functions, variables and quantifiers, predicate formulas, free & bound variables, universe of discourse, inference theory of predicate calculus

- **Unit - II: Set theory & Relations:** Introduction, Relations and ordering, Properties of binary Relations, Equivalence, Compatibility Relations, Partial ordering, Hasse diagram. **Functions:** composition of functions, Inverse Function, Recursive Functions, Lattice and its Properties, Pigeon-hole Principles and its application.
  Algebraic structures: Algebraic systems, Examples and general properties, Semi groups and monoids, groups, sub groups, Definitions, Examples, homomorphism, Isomorphism and related problems.

- **Unit - III: Elementary Combinatorics:** Basis of counting, Enumeration of Combinations & Permutations, Enumerating of Combinations & Permutations with repetitions and constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, principles of Inclusion – Exclusion.

- **Unit - IV: Recurrence Relations:** Generating Function of Sequences, Calculating Coefficient of generating functions, Recurrence relations, Solving recurrence relation by substitution and Generating functions, the method of Characteristic roots, Solution of Inhomogeneous Recurrence Relation.

- **Unit - V: Graph Theory:** Representation of Graph, Spanning Trees, BFS, DFS, Krushkal's Algorithm, Binary trees, Planar Graphs, Graph Theory and Applications, Basic Concepts, Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers.

Course learning outcome:

- **CO1.** The students will be able to understand the concept of functions and various relations as well as function mappings performed. The concept of algebraic structures and manipulations using various axioms is performed Introduction to partially ordered sets and conditions necessary for a poset to qualify as a lattice. Lattice homomorphism and practice problems on the same.

- **CO2.** Concept of mathematical logic, arguments and reasoning. Conjunction, disjunction and negation of statements. Wff, the concept of free and bounded variables. Tautology and equivalence relations and proof of contradiction.

- **CO3.** This unit is for introduction to the basics of counting. Permutations and combinations. Principal of inclusion- exclusion and practice for the same.

- **CO4.** Students will be able to have an understanding of various methods of generating coefficient of functions. Recurrence relation by substitution and generating root solution for homogeneous recurrence relation.

- **CO5.** This unit covers the graph representation. Various types of graphs and graph isomorphism, paths circuits and sub graphs. Multi-graphs, Euler circuits Euler paths, Hamiltonian graphs and chromatic representation of graphs.

Text books:

- Discrete mathematical structures with applications to computer science Trembly J.P. & Manohar. P, TMH
- Discrete mathematics and its applications, Kenneth H. Rosen, 5th edition. TMH

Reference Books:

- Discrete mathematical structures, bernand kolman, roberty C.
- Discrete maths and problems thomas koshey, Elsevier.

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Online links for study & reference materials :

- https://mathworld.wolfram.com/DiscreteMathematics.html

- https://mls.cs.fiu.edu/fajkkmnmh/16-lonzo-mayert-i-1/BRe4S4kyV-discrete-mathematics-with-graph-theory-9789382127185.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

MCA-151- C-Programming Lab- (Based ON Theory-MCA 101)

MCA-152- NLP- (Based ON Theory MCA 105)

SEMESTER 2

Course Code: MCA201 **Course Name:** Cloud Computing
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objectives:

- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- Broadly educate to know the impact of engineering on legal and societal issues involved.

Course Outcomes (COs): At the end of the course, student will be able to

- Interpret the key dimensions of the challenge of Cloud Computing
- Examine the economics, financial, and technological implications for selecting cloud computing for own organization.
- Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications
- Evaluate own organizations' needs for capacity building and training in cloud computing related IT areas.
- To Illustrate Virtualization for Data-Center Automation

Course Description:

- This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), and Business Process as a Service (BPaaS).

Course Contents:

- **Unit - I: Introduction:** Network centric computing, Network centric content, peer-to –peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing. Parallel and Distributed Systems: introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, and model concurrency with Petri Nets.
- **Unit -II: Cloud Infrastructure:** At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing, Cloud Computing : Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research
- **Unit -III: Cloud Resource virtualization:** Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades, Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feedback control based on dynamic thresholds, coordination,

resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling

- **UNIT-IV: Storage Systems:** Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system. Apache Hadoop, Big Table, Megastore (text book 1), Amazon Simple Storage Service(S3) (Text book 2), Cloud Security: Cloud security risks, security – a top concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks
- **UNIT-V: Cloud Application Development:** Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming (Text Book 1), Google: Google App Engine, Google Web Toolkit (Text Book 2), Microsoft: Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book 2)

Course learning outcome:

- **CO1.** This unit is for introducing students to basic concept of cloud computing
- **CO2.** This unit is for understanding cloud infrastructure.
- **CO3.** This unit is for understanding cloud resource virtualization
- **CO4.** This unit is for understanding storage system in cloud.
- **CO5.** This unit is for understanding cloud application development.

Text books:

- Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier
- Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH

Reference book:

- Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammarai selvi, TMH

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCA202 **Course Name :** Computer Networks
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- The main emphasis of this course is on the organization and management of local area networks (LANs). The course objectives include learning about computer network organization and implementation, obtaining a theoretical understanding of data communication and computer networks, and gaining practical experience in installation, monitoring, and troubleshooting of current LAN systems.
- The course introduces computer communication network design and its operations. The course includes the following topics: Open Systems Interconnection (OSI) communication model; error detection and recovery; local area networks; bridges, routers and gateways; network naming and addressing; and local and remote procedures.

Course outcome :

- The students will gain proficiency in various network protocols and models.

Course Description :

- Describe how computer networks are organized with the concept of layered approach.
- Implement a simple LAN with hubs, bridges and switches.
- Describe how packets in the Internet are delivered.
- Analyze the contents in a given Data Link layer packet, based on the layer concept. Design logical sub-address blocks with a given address block.
- Decide routing entries given a simple example of network topology

Course Contents :

- **Unit – I: Data communications concepts**: Digital and analog , parallel and serial, synchronous and asynchronous, simplex, half duplex, duplex, multiplexing, Transmission media: Wired(physical): Twisted pair, Coaxial cable, Optical Fiber.

Communication switching techniques: Circuit switching, message switching, packetswitching.

- **Unit – II: .Introduction to Computer Network** : Network Topologies, Types of Network, OSI and TCP/IP Models: Layers and their functions, comparison of models. **Data Link Layer Fundamentals**: Framing, Basics of Error Detection, Forward ErrorCorrection, Cyclic Redundancy Check codes for Error Detection.

- **Unit – III: Media Access Protocols :** The advantages of Multiple-Access Sharing of Channel Resource, ALOHA, Carrier Sense Multiple Access (CSMA), CSMA with Collision Detection (CSMA/CD), Token Ring, Token Bus, Asynchronous Transfer Mode (ATM).
- **Unit – IV: Network Layer:** Host to Host Delivery: IP Addressing and Routing, Gateway, N/W Layer Protocols: ARP, IPV4, ICMP, IPV6. **Transport Layer:** Process-to-Process Delivery: UDP, TCP Congestion Control & Quality of Service**.**

- **Unit - V :Application Layer:** Client Server Model, Domain Name System (DNS), E-mail (SMTP), File Transfer (FTP) and Model TCP/IP.

Course learning outcome :

- **CLO1 :**Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
- **CLO2:** : Have a basic knowledge of the use of cryptography and network security.
- **CLO3**: Specify and identify deficiencies in existing protocols, and then go onto formulate new and better protocols.
- **CLO4** : Analyze, specify and design the topological and routing strategies for an IP based networking infrastructure
- **CLO5:** Have a working knowledge of datagram and internet socket programming

Text books :

- A.S. Tanebaum : Computer Networks (4th ed.), Prentice-Hall of India.
- W. Tomasi : Introduction to Data Communications and Networking, Pearson, Education.
- P.C. Gupta : Data Communications and Computer Networks, Prentice-Hall of India.

Reference books :

- Behrouz Forouzan and S.C., Fegan : Data Communications and Networking, McGrawHill.
- L.L. Peterson and B.S. Davie : Computer Networks : A system Approach, MorganKaufmann.
- William Stalilngs : Data and Computer Communications, Pearson Education

Online links for study & reference materials :

http://www.svecw.edu.in/Docs%5CCSECNLNotes2013.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCA203 **Course Name :** oops using JAVA
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- This course focuses on the advantages of the OO paradigm and domain modeling in reducing the representational gap between a target domain and the software application itself. Minimizing this gap leads to more effective solutions that are both flexible and robust. The modeling notation taught and used in conjunction with the course is the industry standard UML (Unified Modeling Language) 2.0.
- UML provides a programming language independent framework for the analysis, design, programming and testing of software applications. Using a combination of UML and various techniques for analysis and design.
- the course relates Object Oriented concepts to modeling complex problems. Models built using these techniques have a very high success rate when turned into working code.

Course outcome :

- Design the classes needed, given a problem specification.
- Implement the designed classes using the object oriented programming language.
- Learn how to test, verify, and debug object-oriented programs and create programs using object oriented principals

Course Description :

- Learn the three pillars of building a system; The Model, The Process, The Best Practices
- Have a good, working definition of object-oriented programming
- Understand the object oriented model, including types, objects, encapsulation, abstraction, messaging, protocols, inheritance, polymorphism, relationships, and coupling, strengths and weaknesses
- Understand the concept of representational gap between an application and its targeted domain
- Relate how Domain Modeling minimizes the representational gap between domain and application
- Learn how to read and create the most important UML diagrams

Course Contents :

- **UNIT–I: Basics of Object Oriented Programming (OOP):** Need for OO paradigm , A way of viewing world- Agents, responsibility, messages, methods, classes and instances, class hierarchies (Inheritance), method binding, overriding and exceptions, summary of OOP concepts, coping with complexity, abstraction mechanisms.

  Java Basics: Data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects- concepts of classes, objects, constructors methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.

- **UNIT–II: Inheritance:** Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance- specialization, specification, construction, extension, limitation, combination, benefits of inheritance costs of inheritance. Member access rules, super uses, using final with inheritance, polymorphism, abstract classes.

  Packages and Interfaces: Defining, Creating and Accessing a package, Understanding CLASSPATH, Importing packages, differences between classes and interfaces, defining an interface, Implementing interface, applying interfaces variables in interface and extending interfaces.
- **UNIT–III: Exception handling and Multithreading**: Concepts of exception handling, benefits of exception handling, Termination or presumptive models, exception hierarchy, usage of try, catch, throws and finally, built in exceptions, creating own exception sub classes. Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups
- **UNIT–IV: Event Handling:** Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes. The AWT class hierarchy , user-interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, list panes- scroll pane, dialogs, menu bar, graphics, layout manager- layout manager types- boarder, grid, flow, card and grid bag.
- **UNIT-V: Applets:** Concepts of Applets, differences between applets and applications, lifecycle of an applet, types of applets, creating applets, passing parameters to applets,

  Swings: Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons-The JButton class, Check boxes, Radio Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees and Tables.

Course learning outcome :

- **CLO1 :** basics of object learning medhology and concepts of class creation and object interaction
- **CLO2:** : Have a basic knowledge of the use of attributes , objects, methods etc.
- **CLO3**: To understand Class Modeling and Design Approaches: Three approaches for identifying classes - using Noun phrases, Abstraction, Use Case Diagram. Comparison of approaches. Using combination of approaches
- **CLO4** :Techniques for Interaction diagrams: Sequence diagram - Sequence diagram notations and examples, iterations, conditional messaging, branching, object creation and destruction, time constraints, origin of links, Activations in sequence diagram
- **CLO5:** developing dynamic systems: Top - down approach for dynamic systems. Bottom - up approach for dynamic systems. Flexibility Guidelines for Behavioral Design

Text books :

- Designing Flexible Object Oriented systems with UML - Charles Ritcher
- object Oriented Analysis & Design, Sat/.inger. Jackson, Burd Thomson
- Object oriented Modeling and Design with UML - James Rumbaugh. Micheal Blaha (secondedition)

Reference books :

- The Unified Modeling Language User Guide - Grady Booch, James Rumbaugh, IvarJacobson.
- Oriented Modeling and Design - James Rumbaugh
- Teach Yourself UML in 24 Hours - Joseph Schmuilers

Online links for study & reference materials :

https://www.vssut.ac.in/lecture_notes/lecture1423183198.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCA204 **Course Name:** Entrepreneurship and Corporate Communications
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- To create an understanding in the mind of the student regarding formal and professional communication practiced in a professional environment .

Course outcome :

- Master the art of a professional business presentation •
- Distinguish different communication process and its practical application

Course Description:

- In the present industrial scenario the role of instrumentation is becoming more vital day by day specially in case of industrial automation. More advanced, precise and complex instrumentations are being employed in the industry. These advance instruments requires communication of data from equipment/machines to instruments and vice versa for process and quality control.

Course Contents :

- **Unit - I: (Business Communication) :**Difference between general and business communication, this should cover general and technical writing, oral communications and listening skill
- **Unit - II : (Expression)** Practical communication skill development, business presentation with multimedia,speaking skill, prepared speech, extempore speech
- **Unit - III :(Reading Skills)** Reading skill: comprehension test, technical report writing: precise, technical/business letter, organization of writing material, poster presentation
- **UNIT-IV (Literature) :**Of Studies: Francis Bacon
- **UNIT-V (Presentation) :**Writing technical document, preparing software user manual, preparing project documentation.

Course learning outcome :

- **CO1.** this unit is for understanding general business communication.
- **CO2.** this unit is for understanding skill development and confidense development.
- **CO3.** reading skills are extremely important for any type of business communication.
- **CO5.** writing technical documentation

Text books :

- Business Correspondence & Report Writing, Sharma, TMH 2.Business Communication Strategies, Monipally, TMH
- English for Technical Communication ,Laxminarayanan,Scitech
- Business Communication, Kaul,PHI

Online links for study & reference materials :

- https://mgdic.files.wordpress.com/2016/12/3361704-industrial-data-communication.pdf

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MCA205 **Course Name:** Artificial Intelligence
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Experience AI development tools such as an ‘AI language’, expert system shell, and/or data mining tool. Experiment with a machine learning model for simulation and analysis.
- Explore the current scope, potential, limitations, and implications of intelligent systems.

Course outcome: At the end of the course, student will be able to

- Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents
- Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
- Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing
- Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
- Solve problems with uncertain information using Bayesian approaches.

Course Contents:

- **Unit – I: Introduction to artificial intelligence:** Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of AI languages, current trends in AI,
  Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening a*, constraint satisfaction
- **Unit – II: Problem reduction and game playing:** Introduction, problem reduction, game playing, alpha-beta pruning, two-player perfect information games,
  Logic concepts: Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic
- **Unit – III: Knowledge representation:** Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames.
  Advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web.
  Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools
- **Unit – IV: Uncertainty measure: probability theory:** Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory.

Fuzzy sets and fuzzy logic: Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.

- **Unit - V Machine learning paradigms:** Introduction, machine learning systems, supervised and unsupervised learnings, inductive learning, deductive learning, clustering, support vector machines, case based reasoning and learning.

  Artificial neural networks: Introduction, artificial networks, single layer feed forward networks, multi layered forward networks, design issues of artificial neural networks

Course learning outcome:

- **CLO1:** compare AI with human intelligence and traditional information processing and discuss its strengths and limitations as well as its application to complex and human-centred problems.
- **CLO2:** apply the basic principles, models, and algorithms of AI to recognize, model, and solve problems in the analysis and design of information systems.
- **CLO3**: analyze the structures and algorithms of a selection of techniques related to searching, reasoning, machine learning, and language processing.
- **CLO4**: review research articles from well-known AI journals and conference proceedings regarding the theories and applications of AI.
- **CLO5:** design AI functions and components involved in intelligent systems such as computer games, expert systems

Text books:

- Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
- Artificial intelligence, A modern Approach, 2nd ed, Stuart Russel, Peter Norvig, PEA
- Artificial Intelligence- 3rd ed, Rich, Kevin Knight, Shiv Shankar B Nair, TMH
- Introduction to Artificial Intelligence, Patterson, PHI

Reference books:

- Artificial intelligence, structures and Strategies for Complex problem solving, 5th ed, George F Lugar, PEA
- Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
- Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

MCA-251: OOPS with java- Lab

MCA-252: Artificial intelligence /cryptography and network security Lab

SEMESTER 3

Course Code : MCA301 **Course Name :** Operating System

Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- To study concepts related to operating systems, like process management, concurrency and control of processes, deadlocks, memory management, processor and disk scheduling, parallel processing, and file system organization and implementation. Also to study different methods for protection and security that is becoming vital now-a-days.

Course outcome :

- The students will understand Operating System concepts and design Operating Systems

Course Description :

- To master the basic concepts related to operating systems. To learn in detail about process management.
- To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.
- To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.

Course Contents :

- **Unit – I:** Operating system and function, Evolution of operating system, Batch, Interactive, multiprogramming, Time Sharing and Real Time System, multiprocessor system, Distributed system, System protection. Operating System structure, Operating System Services, System Program and calls.

- **Unit – II:** Process concept, State model, and process scheduling, job and process synchronization, structure of process management, Threads interprocess Communication and Synchronization: Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Hardware Synchronization, Critical Regions, Conditional critical region, Monitor, Inter Process Communication. CPU Scheduling: Job scheduling functions, Process scheduling, Scheduling Algorithms, Non Preemptive and preemptive. Strategies, Algorithm Evaluation, Multiprocessor Scheduling.Deadlock: System Deadlock Model, Deadlock Characterization, Methods for handling deadlock, Prevention strategies, voidance and Detection, Recovery from deadlockcombined approach.

- **Unit – III:** Single Contiguous Allocation: H/W support, S/W support, Advantages and disadvantages, Fragmentation, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Swapping, Overlays

- **Unit – IV:**Principles of I/O hardware, Device controller, Device Drivers, Memory mapped I/O, Direct Access Memory, Interrupts, Interrupt Handlers, Application I/O interface, I/O Scheduling, Buffering, Caching, Spooling, Disk organization, Disk space management, Disk allocation Method, Disk Scheduling, Disk storage.
- **Unit - V :**File Concept, File Organization and Access Mechanism, File Directories, Basic file system, File Sharing,Allocation method, Free space management. Policy Mechanism, Authentication, Internalexcess Authorization.

Course learning outcome :

- **CLO1 :** To master the basic concepts related to operating systems. To learn in detail about process management.
- **CLO2:** : To master concurrency and control of processes like critical-section problems and its solution. To understand memory management functions of operating systems.
- **CLO3**: To familiar with principles of deadlock and its prevention. To understand the concepts of file system interface.
- **CLO4** :To familiar with file system implementation. To understand mass storage management functions of operating systems.
- **CLO5:** To familiar with Protection and security aspects of operating systems. To expose to other operating systems like distributed OS, Multi-processor OS, RTOS and Mobile OS.

Text books :

1. Operating systems concepts , galvin gagne , TATA-Mcgrawhill
2. Operating systems and applications , william stallings

Online links for study & reference materials :

https://www.cse.iitb.ac.in/~mythili/os/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCA302 **Course Name :** Theory of Computation
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- Theory provides a simple, elegant view of the complex machine that we call a computer. Theory possesses a high degree of permanence and stability, in contrast with the ever-changing paradigms of the technology, development, and management of computer systems. Further, parts of the theory have direct bearing on practice, such as Automata on circuit design, compiler design, and search algorithms; Formal Languages and Grammars on compiler design; and Complexity on cryptography and optimization problems in manufacturing, business, and management.

Course outcome :

- Learn the theory and foundations of machine learning
- Learn the different process of syntax creation of low level language

Course Description :

- introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
- enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.

Course Contents :

- **Unit – I:** Introduction; Alphabets, Strings and Languages; Automata and Grammars, Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition tabl e, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transi ion, Language of NFA, Equi valence of NFA and DFA, Minimization of Finite Automata, Distinguis hing one string from other, Myhill-Nerode Theorem
- **Unit – II:** Regular expression (RE) , Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Non Regular Languages, Pumping Lemma for regular Languages . Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.
- **Unit – III:** Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation , Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure proper ties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Membership, Pumping lemma for CFLs.

- **Unit – IV:**Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA

- **Unit - V :**Turing machines (TM): Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis, Recursive and recursively enumerable languages, Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory

Course learning outcome :

- **CLO1 :** automata, computability, and complexity ,Mathematical tools, Definitions, theorems, and proofs
- **CLO2:** .Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression toFA, DFA to Regular expression

- **CLO3**: Understand recursive and recursively enumerable languages.
- **CLO4** :Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack
- **CLO5:** Understand Turing Machines and the simple primitive mechanisms needed for all computation

Text books :

1.Hopcroft, Ullman, "Introduction to Automata Theory,Languages andComputation", Pearson Education .
2K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science : Automata, Languages and Computation", PHI Learning Private Limited, Delhi India.

Reference books:

1.Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishing house.
2.Y.N.Singh "Mathematical Foundation of Computer Science", New Age International.

Online links for study & reference materials :

http://www.cs.virginia.edu/~robins/cs3102/CS3102

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MCA303 **Course Name:** Advance Database Management system

Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- This course introduces database design and creation. Emphasis is on data dictionaries, normalization, data integrity, data modelling, and creation of simple tables, queries, reports, and forms. Upon completion, students should be able to design and implement normalized database structures by creating simple database tables, queries, reports, and forms.

Course Outcome:

- The students will understand the fundamentals of relational, object-oriented, and distributed database systems including data models, database architectures, and database manipulations.
- Understand the theories and techniques in developing database applications and be able to demonstrate the ability to build databases.

Course Description:

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
- To understand and use data manipulation language to query, update, and manage a database
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Contents:

- **Unit - I:** Data base system vs. file system, data models, relational model, database languages, DDL, DML, database access for applications programs, data base users and administrator, transaction management, history of data base systems, data base design and ER diagrams, attributes and entity sets, relationships and relationship sets, additional features of ER model, concept design with the ER model, and conceptual design for large enterprises, Codds Rules.
- **Unit - II:** Data Base Design: Functional Dependency and Decomposition - Functional Dependency - Decomposition. Normalization - Introduction - Normalization - Normal Forms INF, 2NF, 3NF - BCNF - 4 NF - 5 NF.
- **Unit - III:** Examples of basic SQL queries, nested queries, correlated nested queries set, comparison operators, aggregative operators, NULL values, comparison using null values, logical connectivity, AND, OR and NOTR, impact on SQL constructs, outer joins, disallowing NULL values, complex integrity constraints in SQL triggers and active data bases.
- **Unit - IV:** Data Base Recovery Systems: Introduction - Recovery Concepts - Types of Failures - Types of Recovery - Recovery Techniques - Buffer Management. Data Base Security: Goals - Firewalls - Data Encryption
- **Unit - V:** ACID properties, transactions and schedules, concurrent execution of transaction, lock based concurrency control, performance locking, and transaction

support in SQL, crash recovery, concurrency control, Serializability and recoverability, lock management, lock conversions, dealing with dead locks, specialized locking techniques, concurrency without locking, crash recovery:

Course learning outcome:

- **CLO1** : this unit is to create understanding of Defining program-data independence, data models for database systems, database schema
- **CLO2:** the learning objective here is to Recall Relational Algebra concepts, and use it to translate queries to Relational Algebra statements and vice versa. Identify Structure Query Language statements used in creation and manipulation of Database Identify the methodology of conceptual modeling through Entity Relationship model.
- **CLO3:** Identify the methodology of logical model. Identify the methodology of physical model
- **CLO4:** Develop an understanding of the differences between OODBMS, ORDBMS and RDBMS and the practical implications of each approach.
- **CLO5 :**Analyze and design a real database application. Develop and evaluate a real database application using a database management system

Text books:

1. Elmasri Navathe, Data Base Management System, Pearson Education, 2008.

2.S.K. Singh, "Database Systems Concepts, Design and Applications", Pearson Education Pte.Ltd., New Delhi: 2006.

3.C. J. Date, Introduction to Database Systems, Pearson Education, 2009.

Reference books:

1. Silberschatz, Korth, Database System Concepts, McGraw hill, 5th edition, 2005.

2. Rob, Coronel & Thomson, Database Systems Design: Implementation and Management,2009.

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Online links for study & reference materials:

https://lecturenotes.in/subject/38/database-management-system-dbms

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MCA304 **Course Name:** Python Programming

Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- To acquire programming skills in core Python.
- To acquire Object Oriented Skills in Python.
- To develop the skill of designing Graphical user Interfaces in Python.
- To develop the ability to write database applications in Python.

Course outcome: At the end of the course, student will be able to

- Understand and comprehend the basics of python programming.
- Demonstrate the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
- Explain the use of the built-in data structures list, sets, tuples and dictionary.
- Make use of functions and its applications.
- Identify real-world applications using oops, files and exception handling provided by python.

Course Description:

- This **course** includes an **overview** of the various tools available for writing and running **Python**, and gets students **coding** quickly. It also provides hands-on **coding** exercises using commonly used data structures, writing custom functions, and reading and writing to files.

Course Contents:

- **Unit – I: Introduction:** History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

- **Unit – II: Types, Operators and Expressions**: Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass

- **Unit – III: Data Structures**-Lists- Operations, Slicing, Methods, Tuples, Sets, Dictionaries, Sequences, Comprehensions.

- **Unit – IV: Functions** - Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables, **Modules:** Creating modules, import statement, from. Import statement, name spacing.

  Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages

- **Unit - V Object Oriented Programming OOP in Python:** Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.
  Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User defined Exceptions.
  Brief Tour of the Standard Library - Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics**.**
  Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

Course learning outcome:

- **CLO1:** To acquire programming skills in core Python.
- **CLO2:** To acquire Object Oriented Skills in Python
- **CLO3**: To develop the skill of designing Graphical user Interfaces in Python
- **CLO4**: To develop the ability to write database applications in Python
- **CLO5:** To develop the ability to write database applications in Python

Text books:

1Yang, "Applied Numerical Methods using MATLAB", Wiley India
2Pradip Niyogi, "Numerical Analysis and Algorithms", TMH, 1st Edition. Gerald & Whealey, "Applied Numerical Analyses"

Reference books :

1Grewal B S, "Numerical methods in Engineering and Science",
2KhannaPublishers, Delhi.

Online links for study & reference materials :

https://ocw.mit.edu/courses/mathematics/18-330-introduction-to-numerical-analysis-spring-2012/lecture-notes/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCA305 **Course Name :** Compiler Design
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective :

- This course introduces the basic concepts and mechanisms traditionally employed in language translators, with emphasis on compilers. Topics include strategies for syntactic and semantic analysis, techniques of code optimization and approaches toward code generation.

Course outcome :

- Understand basic concepts of Usability Engineering
- Understand the fundamental aspects of interaction and designing the interaction
- Understand basic concepts of Dialog Designing aspects in Human Computer Interaction

Course Description :

- Introduction to Compilers
- Lexical Analysis
- Syntax Analysis
- Parsers Implementation
- Semantic Analysis

Course Contents :

- **Unit – I:** Introduction to Compiler, Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX-compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.

- **Unit – II:** Basic Parsing Techniques: Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables.

- **Unit – III:** Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements.

- **Unit – IV:**Symbol Tables: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.

- **Unit - V** Code Generation: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis

Course learning outcome :

- **CLO1 :** Understand the structure of compilers - Understand the basic techniques used in compiler construction such as lexical analysis, top-down, bottom-up parsing, context-sensitive analysis, and intermediate code generation - Understand the basic data structures used in compiler construction such as abstract syntax
- **CLO2:** : Code generation and Code optimization • Error Detection and Recovery Error Repair, Compiler Implementation
- **CLO3**: To understand Syntax-directed Translation: Syntax-directed Translation schemes, Implementation of Syntax directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements
- **CLO4** :Data structure for symbols tables, representing scope information. Run-Time Administration
- **CLO5:** Code Generation: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator

Text books :

- Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", PearsonEducation
- V Raghvan, " Principles of Compiler Design", TMH

Reference books :

- Kenneth Louden," Compiler Construction", Cengage Learning.
- Charles Fischer and Ricard LeBlanc," Crafting a Compiler with C", Pearson EducationOriented Modeling and Design - James Rumbaugh

Online links for study & reference materials :

https://www.uu.se/en/admissions/master/selma/kursplan/?kKod=1DL321&lasar=

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

MCA 351: ADBMS LAB

MCA 352: python programming Lab

SEMESTER 4

Course Code: MCA401 **Course Name:** Big Data Analytics
Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective: The main objective of this course is to

- Provide an overview of an exciting growing field of Big Data analytics
- Introduce the tools required to manage and analyze big data like Hadoop, MapReduce etc.,

Course outcome: At the end of the course, student will be able to

- Understand the programming requirements viz., generic types and methods to perform data analysis
- Understand the existing technologies and the need of distributed files systems to analyze the big data
- To understand and analyze Map-Reduce programming model for better optimization
- Collect, manage, store, query, and analyze big data; and identify the need of interfaces to perform I/O operations in Hadoop
- Identify the need based tools, viz., Pig and Hive and to handle
- Formulate an effective strategy to implement a successful Data analytics project

Course Contents :

- **UNIT-I: Data structures in Java:** Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization

- **UNIT-II: Working with Big Data:** Google File System, Hadoop Distributed File System (HDFS), Building blocks of Hadoop (Name node, Data node, Secondary Name node, Job Tracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.

- **UNIT-III: Writing Map Reduce Programs:** A Weather Dataset, Understanding Hadoop API for Map Reduce Framework (Old and New), **Basic programs of Hadoop Map Reduce:** Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioner

- **UNIT-IV: Hadoop I/O:** The Writable Interface, Writable Comparable and comparators.

  Writable Classes: Writable wrappers for Java primitives, Text, Bytes Writable, Null Writable, Object Writable and Generic Writable, Writable collections, Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators

- **UNIT-V: Pig:** Hadoop Programming Made Easier, Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin,

Applying Structure to Hadoop Data with Hive: Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data

Course learning outcome: The course learning outcomes are designed to specify what the students will be able to perform after completion of the course:

- Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.
- Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.
- Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.
- Ability to understand and apply scaling up machine learning techniques and associated computing techniques and technologies.
- Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

Text Books:

- Big Java 4th Edition, Cay Horstmann, Wiley John Wiley & Sons, INC
- Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'Reilly
- Hadoop in Action by Chuck Lam, MANNING Publ
- Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown and Rafael Coss

Reference Books:

- Hadoop in Practice by Alex Holmes, MANNING Publ
- Hadoop MapReduce Cookbook, Srinath Perera, Thilina Gunarathne

Web Resources:

- Hadoop:https://hadoop.apache.org/
- Hive: https://cwiki.apache.org/confluence/display/Hive/Home/
- Piglatin: https://pig.apache.org/docs/r0.7.0/tutorial.html

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code: MCA402 **Course Name:** Software Engineering

Course Credit Hour: 4hr **Total Contact Hour:** 60hr

Course Objective:

- Software Engineering (SE) comprises the core principles consistent in software construction and maintenance: fundamental software processes and life-cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools. iterative development, interpretation of requirements and use case documents into code; application of design notation in UML and use of commonly-used design patterns. Current industry-strength programming languages, technologies and systems feature highly in the practical components, electives and projects of the course, but they are also taught with a view to understanding and applying principles underlying their more ephemeral character.

Course outcome :

- Learn the theory and foundations of software engineering.
- Learn the different process models and choose the best model for their project
- Be able to construct requirement models
- Be able to Understand the different development practices and its advantages.
- Be able to create test cases and implement different testing strategies

Course Description :

- Knowledge of basic SW engineering methods and practices, and their appropriate application.
- . Describe software engineering layered technology and Process frame work. 3
- . A general understanding of software process models such as the waterfall and evolutionary models. Understanding of software requirements and the SRS documents. Understanding of the role of project management including planning, scheduling, risk management, etc.
- Describe data models, object models, context models and behavioural models. Understanding of different software architectural styles. Understanding of implementation issues such as modularity and coding standards. Understanding of approaches to verification and validation including static analysis, and reviews.

Course Contents :

- **Unit-I: Introduction** Software life cycle models: Waterfall, Prototype,Evolutionary andSpiral models, Overview of Quality Standards like ISO 9001, SEI-CMM.

- **UNIT-II Software Metrics and Project Planning** Size Metrics like LOC, Token Count, Function Count, Design Metrics, Data Structure Metrics, Information Flow Metrics. Cost estimation, static, Single and multivariate models, COCOMO model, Putnam Resource Allocation Model, Risk management.

- **UNIT- III Software Requirement Analysis, design and coding** Problem Analysis, Software Requirement and Specifications, Behavioural and non-behavioural requirements, Software Prototyping Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design Top-down and bottom-up Structured programming, Information hiding.

- **UNIT- IV : Software Reliability, Testing and Maintenance** Failure and Faults, Reliability Models: Basic Model, Logarithmic Poisson Model, Software process, Functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing: path testing, Data flow and mutation testing, unit testing, integration and system testing, Debugging, Testing Tools, & Standards. Management of maintenance, Maintenance Process, Maintenance Models, Reverse Engineering, Software RE-engineering.

- **UNIT- V : UML:** Introduction to UML, Use Case Diagrams, Class Diagram: State Diagram in UML Activity Diagram in UML. Sequence Diagram in UML Collaboration Diagram in UML

Course learning outcome :

- **CLO1 :** Understand basic SW engineering methods and practices, and their appropriate application.
- **CLO2:** Understand u of software process models such as the waterfall and evolutionary 10. models.
- **CLO3**: problem analysis and description, This unit is to introduce Discuss data models, object models, context models and behavioural models.
- **CLO4** : Understand of different software architectural styles and Process frame work
- **CLO5:** this unit is for learning different modes of file storage. Records and there usage .

Text books :

- K. K. Aggarwal & Yogesh Singh, .Software Engineering., 2nd Ed, New AgeInternational, 2005.
- R. S. Pressman, ―Software Engineering – A practitioner's approach‖, 5th Ed., McGrawHill Int. Ed., 2001.

Online links for study & reference materials :

https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCA403 **Course Name :** Full Stack Development Technologies
Course Credit Hour : 4hr **Total Contact Hour :** 60hr

Course Objective : From the course the student will learn

- Translate user requirements into the overall architecture and implementation of new systems and Manage Project and coordinate with the Client.
- Write backend code in Python/Java, PHP languages and Writing optimized front end code HTML and JavaScript.
- Understand, create and debug database related queries and Create test code to validate the applications against client requirement.
- Monitor the performance of web applications & infrastructure and Troubleshooting web application with a fast and accurate a resolution.

Course outcome: At the end of the course, student will be able to

- Identify the Basic Concepts of Web & Markup Languages
- Develop web Applications using Scripting Languages & Frameworks
- Creating & Running Applications using JSP libraries
- Creating Our First Controller Working with and Displaying in Angular Js and Nested Forms with ng-form
- Working with the Files in React JS and Constructing Elements with Data

Course Contents:

- **UNIT – I: HTML** Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers.
  Markup Languages: XHTML an Introduction to HTML, History, Versions, Basic, XHTML Syntax and Semantics Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-HTML 5.0.

- **UNIT – II: Cascading Style Sheets (CSS)** Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML- Style Rule Cascading and Inheritance-Text Properties-Box Model Normal Flow Box Layout beyond the Normal Flow-CSS3.0, Boot strap basics, Boot strap CSS3, Introduction to Java Script, Jscript basics, JScripts objects, JSON, Don.

- **UNIT – III: Jscript** Separating Programming and Presentation: JSP Technology, Introduction to JSP and Servlets-Running JSP Applications, Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm- Mongo DB, JQuery, Mean stack Fundamentals

- **UNIT – IV: Angular Js** Introducing AngularJS, Starting Out with AngularJS, Basic AngularJS, Directives and Controllers, AngularJS Modules, Creating First Controller, working with and Displaying, Arrays, more Directives, working with ng-repeat, Unit Testing in AngularJS, Forms, Inputs, and Services, Working with ng-model, Working with Forms, Leverage Data-Binding and Models, Form Validation and States, Error Handling with Forms, ngModelOptions, Nested Forms with ng-form, Other Form Controls.

- **UNIT – V: React JS** Introduction to React, Obstacles and Roadblocks, keeping Up with the Changes, Working with the Files, Pure React, Page Setup, The Virtual DOM, React Elements, ReactDOM, Children, Constructing Elements with Data, React Components, DOM Rendering, Factories

Course learning outcome:

- **CLO1:** Introduction to HTML (web essential and markup languages).
- **CLO2:** Introduction to Cascading Style sheets
- **CLO3**: Introduction to Jscript
- **CLO4**: Introduction to Angular Js**.**
- **CLO5:** Introduction to React Js**.**

Text Books:

- Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006
- Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007
- AngularJS: Up and Running Enhanced Productivity with Structured Web Apps By Brad Green, Shyam Seshadri Publisher: O'Reilly Media
- Learning React Functional Web Development with React and Redux By Alex Banks, Eve Porcello Publisher: O'Reilly Media
- Head First Java, 2nd Edition by Bert Bates, Kathy Sierra Publisher: O'Reilly Media, Inc

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%

Course Code : MCA404

Course Name : Distributed Systems

Course Credit Hour : 4hr

Total Contact Hour : 60hr

Course Objective :

- List the principles of distributed systems and describe the problems and challenges associated with these principles.
- Understand Distributed Computing techniques, Synchronous and Processes.
- Apply Shared Data access and Files concepts

Course outcome :

- To provide hardware and software issues in modern distributed systems.
- To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.

Course Description :

- Apply Distributed web-based system.
- Understand the importance of security in distributed systems

Course Contents :

- **Unit – I: Fundamentals** Evolution of Distributed Computing Systems, System models, issues in design of Distributed- computing environment, web based distributed model, computer networks related to distributed systems and web based protocols
- **Unit – II: Message Passing** Inter process Communication, Desirable Features of Good Message-Passing Systems, Issues in IPC by Message, Synchronization, Buffering, Multi datagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication
- **Unit – III: Distributed Shared Memory** Design and Implementation Issues of DSM, Granularity, Structure of shared memory space, Consistency Models, replacement Strategy, Thrashing, Other Approaches to DSM, Advantages of DSM
- **Unit – IV: Synchronization** Clock Synchronization, Event Ordering, Mutual Exclusion, Election Algorithms.
- **Unit - V Distributed File Systems** Desirable Features of a good Distributed File Systems, File Models, File-Accessing Models, File- sharing Semantics, File-caching schemes, File Replication, Fault Tolerance, Design Principles, Sun's network file system, Andrews file system, comparison of NFS and AFS

Course learning outcome :

- **CLO1 :**Review of Networks, Operating Systems, Concurrent Programming, and Characteristics & Properties of Distributes Systems – Taxonomy - Design goals – Transparency Issues
- **CLO2:** : basic Message Passing Model – The Client Server, Message Passing, RPC basics, RPC implementation, RPC communication
- **CLO3**:Communication in Distributed Systems, Socket Programming - Client Server examples, I/O Multiplexing, Inetd Super Server – Secure Sockets – The SSL & the Java Secure Socket Extension
- **CLO4** :Motivation, Object Replication, Consistency Models, Distribution Protocols –5Consistency Protocols
- **CLO5:** Desirable Features of a good Distributed File Systems, File Models, File-Accessing Models

Text books :

- Distributed OS by Pradeep K. Sinha (PHI)
- Tanenbaum S. : Distributed Operating Systems, Pearson Education

Reference books :

- Tanenbaum S. Maarten V.S.: Distributed Systems Principles and Paradigms. (Pearson Education)
- George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems concepts and design

Online links for study & reference material

https://www.ict.gnu.ac.in/content/2cse50e2-distributed-systems-elective-i

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

MCA 451: Full Stack Development Technologies lab

Industrial Project MCA 452

NOIDA INTERNATIONAL UNIVERSITY

GREATER NOIDA

School of Sciences

Department of Mathematics

COURSE SYLLABUS

AS PER CBCS

M.Sc. (Mathematics)

(ALL SEMESTERS)

w.e.f., 2019-2020

NOIDA INTERNATIONAL UNIVERSITY
SCHOOL OF SCIENCES
Study & Evaluation Scheme for M.Sc. (Mathematics) 1st Year

SEMESTER-I

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			External Exam		
			L	T	P	CA	TA	Total			
1	STPGM-101	Algebra	4	1	0	20	20	40	60	100	5
2	STPGM-102	Real Analysis	4	1	0	20	20	40	60	100	5
3	STPGM-103	Ordinary Differential Equations	4	1	0	20	20	40	60	100	5
4	STPGM-104	Mechanics	4	1	0	20	20	40	60	100	5
TOTAL										400	20

SEMESTER-II

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			External Exam		
			L	T	P	CA	TA	Total			
1	STPGM-201	Complex Analysis	4	1	0	20	20	40	60	100	5
2	STPGM-202	Difference Equations	4	1	0	20	20	40	60	100	5
3	STPGM-203	Partial Differential Equations	4	1	0	20	20	40	60	100	5
4	STPGM-204	Optimization Techniques and Control Theory	4	1	0	20	20	40	60	100	5
5	STPGM-205	Seminar	2	0	0	15	10	25	75	100	2
TOTAL										500	22

NOIDA INTERNATIONAL UNIVERSITY

SCHOOL OF SCIENCES

Study & Evaluation Scheme for M.Sc.(Mathematics) 2nd Year

SEMESTER-III

S. No	Course Code	Subject	Period			Evaluation Scheme				Subject Total	Credit
						Sessional Exam			External Exam		
			L	T	P	CA	TA	Total			
2	STPGM-301	Topology	4	1	0	20	20	40	60	100	5
3	STPGM-302	Probability Theory and Statistics	4	1	0	20	20	40	60	100	5
4	STPGM-303	Operation Research	4	1	0	20	20	40	60	100	5
5	STPGM-304	Computer Fundamentals &C Programming	4	0	0	20	20	40	60	100	4
PRACTICAL											
1	SPPGM-304	Computer Fundamentals &C Programming (Practical)	0	0	2			50	50	100	2
TOTAL										500	21

SEMESTER-IV

			Period			Evaluation Scheme					
						Sessional Exam			External Exam		
S. No	Course Code	Subject	L	T	P	CA	TA	Total		Subject Total	Credit
1	STPGM-401	Integral Equations	4	1	0	20	20	40	60	100	5
2	STPGM-402	Functional Analysis	4	1	0	20	20	40	60	100	5
4	Specialization Paper I (Choose any one)		4	1	0	20	20	40	60	100	5
	STPGM 411	Fluid Dynamics									
	STPGM 412	Regression Analysis									
	STPGM 413	Algebraic Number Theory									
	STPGM 414	Discrete Mathematics									
5	Specialization Paper II (Choose any one)		4	1	0	20	20	40	60	100	5
	STPGM 421	Mathematical Modeling									
	STPGM 422	Calculus on $\Re^n$									
	STPGM 423	Differential Geometry									
PRACTICAL											
1	SPPGM 401	Dissertation	2	0	0			25	75	100	2
TOTAL										500	22

PAPERS OF SPECIALIZATION IN SEMESTER IV	
SPECIAL PAPER I **(Choose Any One Elective Paper)**	
STPGM 411	Fluid Dynamics
STPGM 412	Regression Analysis
STPGM 413	Algebraic Number Theory
STPGM 414	Discrete Mathematics
SPECIAL PAPER II **(Choose Any One Elective Paper)**	
STPGM 421	Mathematical Modeling
STPGM 422	Calculus on $\Re^n$
STPGM 423	Differential Geometry

OVERALLSCHEME

S. No.	Semester	TheoryTotal	Practical	SubjectTotal	TotalCredits
1.	I	400	-	400	20
2.	II	400	100	500	22
3.	III	400	100	500	21
4.	IV	400	100	500	22
GrandTotal				1900	85

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-101

Course Name: ALGEBRA

Course Credit Hour: 5hr

Total Contact Hour: 60hr

Course Objective:

The main aim of this course is to understand finite groups, finite abelian groups , modules, finite fields and galois theory. The course gives the student a good mathematical maturity and enables to build mathematical thinking and skill.

Course Description:

This course includes Class equation for finite groups and its applications**,** Finite abelian groups. Solvable groups, types of Modules, Finite fields and Elements of Galois theory.

Course Contents :

Unit I **-** Class equation for finite groups and its applications, Cauchy`s theorem, Sylow p-subgroups, Sylow's theorems.

Unit II **-** Direct products, Finite abelian groups. Solvable groups, Insolvability of Sn for n≥5

Unit III **-** Modules, Submodules, Simple and Semi-simple modules, Quotient Modules, Cyclic modules, Free modules

Unit IV **-** Finite fields, Extension fields, Field automorphisms, Splitting fields, Roots of Polynomials, Wedderburn's theorem on finite division rings.

Unit V **-**Elements of Galois theory, Fundamental Theorem of Galois Theory.

Course Learning Outcomes(CLOs) :

CLO-1 :To understand different theorem like Cauchy`s theorem and Sylow's theorem.
CLO-2: To solve the problems on abelian groups.
CLO-3: To understand the Modules.
CLO-4 :Interpret basic concept of fields.
CLO-5 :To understand the Elements of Galois theory and Fundamental Theorem of Galois Theory.

Text books :

1. Joseph A. Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa Publishing House, New Delhi, 1999.
2. I.N. Herstein. Topics in Algebra (II Edition) Wiley Eastern Limited, New Delhi, 1975.

Reference books :

1. P.M. Cohn, Classic Algebra, John Wiley & Sons Ltd., 2000.
2. P.M. Cohn, Basic Algebra: Groups, Rings and Fields, Springer, 2005.
3. N. Jacobson, Basic Algebra, Volumes I & II, Second Edition, Dover Publications, 2009.
4. T.W. Hungerford, Algebra, Springer-Verlag, 1981

Online links for study & reference materials :

https://youtu.be/yevjmxGQqgo
https://youtu.be/8Z4Cmhji_FQ

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-102
Course Credit Hour: 5hr

Course Name: Real Analysis
Total Contact Hour: 60hr

Course Objective:

The main aim of this course is to understand the convergence of the improper Integral, Riemann - Stieltjes integral, Necessary conditions for the existence of Riemann-Stieltjes integrals and Pointwise convergence of sequences of functions With Examples of sequences of real - valued functions.

Course Description:

Students will learn Convergence of Improper Integral, Comparison Test,Riemann's condition Comparison theorems, Mean value theorems for Riemann - Stieltjes integrals, The integrals as a function of the interval and Uniform convergence and Riemann - Stieltjes integration.

Course Contents:

Unit I - Improper Integral, Convergence of Improper Integral, Comparison Test, Dirichlet's test and Abel's test - Rearrangement of series - Riemann's theorem on conditionally convergent series, Differentiation under Integral Sign.

Unit II - Riemann - Stieltjes integral - Linear Properties - Integration by parts- Change of variable in a Riemann - Stieltjes integral - Reduction to a Riemann Integral - Euler's summation formula - Monotonically increasing integrators, Upper and lower integrals - Additive and linearity properties of upper and lower integrals - Riemann's condition - Comparison theorems.

Unit III - Integrators of bounded variation-Sufficient conditions for the existence of Riemann-Stieltjes integrals, Necessary conditions for the existence of Riemann-Stieltjes integrals- Mean value theorems for Riemann - Stieltjes integrals - The integrals as a function of the interval - Second fundamental theorem of integral calculus-Change of variable in a Riemann integral-Second Mean Value Theorem for Riemann integral, Riemann-Stieltjes integrals depending on a parameter-Differentiation under the integral sign - Lebesgue criterion for the existence of Riemann integrals.

Unit IV - Pointwise convergence of sequences of functions - Examples of sequences of real - valued functions - Definition of uniform convergence - Uniform convergence and continuity - The Cauchy condition for uniform convergence - Uniform convergence of infinite series of functions - Uniform convergence and Riemann - Stieltjes integration - Non-uniform Convergence and Term-by-term Integration - Uniform convergence and differentiation - Sufficient condition for uniform convergence of a series - Mean convergence.

Course Learning Outcomes(CLOs) :

CLO-1: Understand the concept Improper integrals and various comparison tests
CLO-2: Discuss the Riemann-Stieltjes integral and to solve its related problems.
CLO-3: Understand the Second fundamental theorem of integral calculus and Second Mean Value Theorem for Riemann-Stieltjes integrals.
CLO-4: Have knowledge of uniform convergence of sequence and series

Text books :

Rudin,W. Principles of Mathematical Analysis, 3rd Edition. McGraw Hill Company, New York, 1976.

Reference books :

Malik,S.C. and Savita Arora. Mathematical Anslysis, Wiley Eastern Limited.New Delhi, 1991.

Online links for study & reference materials :

https://youtu.be/WyoMpdh7f0c https://youtu.be/DO0Dzz07DNI

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-103 **Course Name:** Ordinary Differential Equations
Course Credit Hour: 5hr **Total Contact Hour :** 60hr

Course Objective: The main aim of this course is to understand various analytical methods to find exact solution of system of the second order linear equations and Boundary value problems and their implementation to solve real life problems.

Course Description:

Students will learn D' Alembert's principle, Two-body central force problem, Principle of least action, Derivation of Hamilton's equations of motion for holonomic systems from Hamilton's principle, Generating functions, Poisson bracket and Small Oscillations.

Course Contents:

Unit I - The existence and uniqueness solution: The method of successive approximation, Picard's theorem, system of the second order linear equations, Linear systems, homogeneous linear system with constant coefficient, Nonlinear system.
Unit II - Qualitative properties of solution: Sturm separation theorem, Sturm comparison theorem, The Cauchy problem, Homogeneous wave equation, Non homogeneous wave equations, Fourier transform, Properties of Fourier transform.
Unit III - Sturm-Liouvill systems, eigen values and eigen functions, Greens function for ordinary differential equation, construction of green function, Autonomous system, types of critical points, stability critical points and stability for linear system, stability by Liapunovs direct method.
Unit IV - Boundary value problem, maximum and minimum principle, uniqueness and continuity theorem, Dirichlet problem for a circle, Neumann problem for a circle, Dirichlet problem involving the Poisson equation.
Unit V - Greens function and boundary value problem, the Dirac-Delta function Properties of Greens function, method of Greens function, Dirichlets problem for the Laplace operator, Method of eigen functions.

Course Learning Outcomes(CLOs) :

CLO-1 : knowledge of Picard's theorem.
CLO-2: Difference between Homogeneous wave equation and Non homogeneous wave equations
CLO-3: Understand Autonomous system and types of critical points,
CLO-4 : How to solve Dirichlet problem and Neumann problem for a circle
CLO-5 : Understands the Dirichlets problem for the Laplace operator

Text books :

S.L.Ross, Differential Equation, Wiley India, 2004.

Reference books :

E.A. Coddington, An Introduction to Ordinary Differential Equations, Dover, 1989.

Online links for study & reference materials :

https://youtu.be/gps3wHq87nw
https://youtu.be/t4poDybjZ-I

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-104
Course Credit Hour: 5hr

Course Name: Mechanics
Total Contact Hour: 60hr

Course Objective:

The primary objectives of a mechanics course is to help the student develop this ability to visualize, which is so vital to problem formulation. Indeed, the construction of a meaningful mathematical model is often a more important experience than its solution.

Course Description:

Students will learn D' Alembert's principle, Two-body central force problem, Principle of least action, Derivation of Hamilton's equations of motion for holonomic systems from Hamilton's principle, Generating functions, Poisson bracket and Small Oscillations.

Course Contents:

Unit I - Newtonian mechanics and its limitations. Constrained motion. Constraints and their classification. Principle of virtual work. D' Alembert's principle. Generalised coordinates. Deduction of Lagrange's equations from D' Alembert's Principle. Generalised momenta and energy. Cyclic or ignorable coordinates. Rayleigh' s dissipation function. Integrals of motion. Symmetries of space and time with conservation laws.

Unit II - Central force, Definition and properties of central force. Two-body central force problem. Stability of orbits. Conditions for closure. General analysis of orbits. Kepler's laws. Kepler's equation. Artificial satellites. Rutherford scattering.

Unit III - Principle of least action. Hamilton's principle. The calculus of variations. Derivation of Hamilton's equations of motion for holonomic systems from Hamilton's principle. Hamilton's principle and characteristic functions.

Unit IV - Canonical Transformations. Generating functions. Poisson bracket. Poisson's Theorem. Invariance of PB under canonical transformations. Angular momentum PBs. Hamilton-Jacobi equation. Connection with canonical transformation. Problems.

Unit V - Small Oscillations. Normal modes and coordinates. Problems.

Course Learning Outcomes(CLOs) :

CLO-1 : knowledge of Newtonian mechanics and its limitations.
CLO-2 : Understands the Kepler's laws. Kepler's equation.
CLO-3 : Knowledge of Principle of least action and Hamilton's principle.
CLO-4 : Knowledge of Generating functions and Poisson bracket.
CLO-5 : Problems based on the Small Oscillations.

Text books :

H. Goldstien (Addition Wesley, 1980) : Classical Mechanics

Reference books :

N.C. Rana and P.S. Joag, (Tata McGrae-Hill, 1991) : Classical Mechanics.

Online links for study & reference materials :

https://youtu.be/SZbNx4VfMzg
https://youtu.be/kx1Qau_hhnw

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-201 **Course Name:** COMPLEX ANALYSIS
Course Credit Hour: 5hr **Total Contact Hour:** 60hr

Course Objective:

Complex analysis is the study of complex numbers together with their derivatives, manipulation, and other properties. Complex analysis is an extremely powerful tool with an unexpectedly large number of practical applications to the solution of physical problems. The key result in complex analysis is the Cauchy integral theorem, which is the reason that single-variable complex analysis has so many nice results. A fundamental result of complex analysis is the Cauchy-Riemann equations, which give the conditions a function must satisfy in order for a complex generalization of the derivative, the so-called complex derivative, to exist. When the complex derivative is defined "everywhere," the function is said to be analytic.

Course Description:

Students will learn Cauchy's Integral Formula, The General Form Of Cauchy's Theorem, Evaluation Of Definite Integrals And Harmonic Functions, Harmonic Functions And Power Series Expansions, Partial Fractions And Entire Functions Partial fractions.

Course Contents:

Unit I - Cauchy's Integral Formula: The Index of a point with respect to a closed curve - The Integral formula - Higher derivatives. Local Properties of Analytic Functions: Removable Singularities - Taylors's Theorem - Zeros and poles – The local Mapping - The Maximum Principle.

Unit II - The General Form Of Cauchy's Theorem: Chains and cycles- Simple Continuity - Homology - The General statement of Cauchy's Theorem - Proof of Cauchy's theorem - Locally exact differentials- Multilplply connected regions - Residue theorem – The argument principle.

Unit III - Evaluation Of Definite Integrals And Harmonic Functions: Evaluation of definite integrals - Definition of Harmonic function and basic properties - Mean value property - Poisson formula.

Unit IV - Harmonic Functions And Power SeriesExpansions: Schwarz theorem - The reflection principle - Weierstrass theorem - Taylor's Series - Laurent series.

Unit V - Partial Fractions And Entire Functions Partial fractions: Infinite products - Canonical products - Gamma Function - Jensen's formula - Hadamard's Theorem.

Course Learning Outcomes(CLOs):

CLO-1: knowledge of the Integral formula of Higher derivatives.
CLO-2: Understands the General statement of Cauchy's Theorem and its Proof.
CLO-3: Able to evaluate of definite integrals.
CLO-4: Knowledge of Schwarz theorem and Weierstrass theorem.
CLO-5: Able to solve infinite products, Canonical products and Gamma Function.

Text books:

1. L.V. Ahlfors, Complex Analysis, Mc Graw Hill Co., Indian Edition, 2017.
2. J.B. Conway, Functions of One Complex Variable, Second Edition, Narosa, New Delhi, 1996.

Reference books:

1. T.W. Gamelin, Complex Analysis, Springer, 2001.
2. L. Hahn, B. Epstein, Classical Complex Analysis, Jones and Bartlett, 1996.
3. D.C. Ullrich, Complex Made Simple, American Mathematical Society, 2008.

Online links for study & reference materials:

https://youtu.be/BsDGcJN_1TU
https://youtu.be/79-ESkh5_f0

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-202 **Course Name: DIFFERENCE** EQUATIONS
Course Credit Hour: 5hr **Total Contact Hour:** 60hr

Course Objective:

Difference equation, mathematical equality involving the differences between successive values of a function of a discrete variable.The student will able to solve linear homogenous equations with constant coefficients and the System of difference equations of autonomous system.

Course Description:

Students will learn Linear Difference Equations of Higher Order, System of Difference Equations Autonomous System, The Z-Transform Method, Asymptotic Behavior Of Difference Equation and Oscillation Theory.

Course Contents:

Unit I - Linear Difference Equations of Higher Order: Difference Calculus - General Theory of Linear Difference Equations - Linear Homogeneous Equations with Constant coefficients - Linear non-homogeneous equations - Method of Undetermined coefficients, the method of variation of constants - Limiting behavior of solutions.

Unit II - System of Difference Equations Autonomous System: The Basic Theory - The Jordan form - Linear periodic system.

Unit III - The Z-Transform Method: Definition, Example and properties of Z-transform - The Inverse Z-transform and solution of Difference Equations: Power series method, partial fraction method, the inverse integral method - Volterra Difference Equation of convolution types - Volterra systems.

Unit IV- Asymptotic BehaviourOf Difference Equation: Tools and Approximations - Poincare's Theorem - Second order difference equations - Asymptotic diagonal systems - Higher order Difference Equations.

Unit V - Oscillation Theory: Three-term difference Equation - Non-linear Difference Equations - Self-Adjoint second order equations.

Course Learning Outcomes(CLOs) :

CLO-1: Understand the concept of Theory of Linear Difference Equations.
CLO-2: Knowledge of the System of Difference Equations Autonomous System.
CLO-3: Problems based on the Z-Transform Method.
CLO-4: Knowledge of Second order difference equations.
CLO-5: Understand Three-term difference Equation and Non-linear Difference Equations

Text books :

R.P.Agarwal., Difference Equations and Inequalities, Marcel Dekker, 1999.

Reference books :

Saber N. Elaydi, An Introduction to Difference Equations, Springer Verlag, New York, 1996.
S. Goldberg, Introduction to Difference Equations, Dover Publications, 1986
V. Lakshmi kantham and Trigiante, Theory of Difference Equations, Academic Press, New York, 1988.

Online links for study & reference materials :

https://youtu.be/8nsoSdqmNpE
https://youtu.be/6o7b9yyhH7k

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-203 **Course Name:** PARTIAL DIFFERENTIAL EQUATIONS
Course Credit Hour: 5hr **Total Contact Hour:** 60hr

Course Objective:

The primary objectives of a Partial Differential Equations (PDEs) course are to learn the degree, order, classification, different types of PDEs, existence and uniqueness of solution and different analytical methods for solving PDEs.

Course Description:

Students will Partial Differential Equations of First Order, Elliptic Differential Equations, Parabolic Differential Equations, Hyperbolic Differential Equations, Green's Function.

Course Contents:

Unit I - **Partial Differential Equations of First Order:** Formation and solution of PDE- Integral surfaces - Cauchy Problem order eqn - Orthogonal surfaces - First order non-linear - Characteristics - Csmpatible system - Charpit method. Fundamentals: Classification and canonical forms of PDE.

Unit II - **Elliptic Differential Equations**: Derivation of Laplace and Poisson equation - BVP - Separation of Variables - Dirichlet's Problem and Newmann Problem for a rectangle - Interior and Exterior Dirichlets's problems for a circle - Interior Newmann problem for a circle - Solution of Laplace equation in Cylindrical and spherical coordinates - Examples.

Unit III - **Parabolic Differential Equations:** Formation and solution of Diffusion equation - Dirac-Delta function - Separation of variables method - Solution of Diffusion Equation in Cylindrical and spherical coordinates – Examples

Unit IV - **Hyperbolic Differential Equations:** Formation and solution of one-dimensional wave equation - canocical reduction - IVP- d'Alembert's solution - Vibrating string - Forced Vibration - IVP and BVP for two-dimensional wave equation - Periodic solution of one-dimensional wave equation in cylindrical and spherical coordinate systems - vibration of circular membrane - Uniqueness of the solution for the wave equation - Duhamel's Principle - Examples.

Unit V - **Green's Function:** Green's function for laplace Equation - methods of Images - Eigen function Method - Green's function for the wave and Diffusion equations. Laplace Transform method: Solution of Diffusion and Wave equation by Laplace Transform.

Course Learning Outcomes(CLOs):

CLO-1: Able to solve Partial Differential Equations of First Order.
CLO-2: Understands the Laplace and Poisson equation.
CLO-3: Knowledge of Diffusion equation and Dirac-Delta function
CLO-4: Understand the concept of Hyperbolic Differential Equations.
CLO-5: Knowledge of the Green's function for laplace Equation.

Text books :

S, Sankar Rao, Introduction to Partial Differential Equations, 2nd Edition, Prentice Hall of India, New Delhi. 2005.
M.D.Raisinghania, Advanced Differential Equations, S.Chand& Company Ltd., New Delhi, 2001

Reference books :

R.C.McOwen, Partial Differential Equations, 2nd Edn. Pearson Eduction, New Delhi, 2005.
I.N.Sneddon, Elements of Partial Differential Equations, McGraw Hill, New Delhi, 1983.
R. Dennemeyer, Introduction to Partial Differential Equations and Boundary Value Problems, McGraw Hill, New York, 1968.

Online links for study & reference materials :

https://youtu.be/xNqLZnM-PPY
https://youtu.be/gps3wHq87nw

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-204 **Course Name:** OPTIMIZATION TECHNIQUES AND CONTROL THEORY
Course Credit Hour: 5hr **Total Contact Hour:** 60hr

Course Objective:

The primary objectives of a optimization techniques and control theory that it provides techniques for finding a control for a dynamical system over a period of time such that an objective function is optimized. The dynamical system could be a nation's economy, with the objective to minimize unemployment.

Course Description:

Students will learn extended real valued functions, Conjugate functions, Optimality conditions and Lagrange multipliers, Dynamic programming and optimal control problem and formulations

Course Contents:

Unit I - Extended real valued functions, Proper convex functions, Subgradients, Directional derivatives

Unit II - Conjugate functions, Dual convex programs, Optimality conditions and Lagrange multipliers, Duality and optimality for standard convex programs, Gradient descent method, Gradient projection method.

Unit III - Newton's method, Conjugate gradient method, Dynamic programming, Bellman's principle of optimality, Allocation problem, Stage coach problem.

Unit IV - Optimal control problem and formulations, Variational approach to the fixed-time free endpoint problem, Pontryagin's maximum principle, Dynamic programming and Hamilton-Jacobi-Bellman equation.

Course Learning Outcomes(CLOs):

CLO-1: knowledge of Extended real valued functions
CLO-2: Understands the Conjugate functions, Dual convex programs.
CLO-3: Able to solve problems based on Newton's method and Conjugate gradient Method.
CLO-4: Understand the Optimal control problem and formulations.

Text books:

1. F.S. Hillier, G.J. Lieberman, P. Nag and P. Basu, Introduction to Operations Research, Tata McGraw-Hill, 2012.

Reference books:

1.M. Avriel, Nonlinear Programming: Analysis & Methods, Dover Publications, New York, 2003.
2. O. Güler, Foundations of Optimization, Springer 2010.
3. Liberzon, Calculus of Variations and Optimal Control Theory: A Concise Introduction, Princeton University Press, 2012

Online links for study & reference materials:

https://youtu.be/Qneah_lyQ0o
https://youtu.be/LL20TZGXp3Q

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-4	- 05%
Assessment-5	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code : STPGM-301 **Course Name :** TOPOLOGY
Course Credit Hour: 5hr **Total Contact Hour:** 75hr

Course Objective:

Objective 1: Students will learn the fundamentals of point-set topology.
Objective 2: Students will learn the fundamentals of algebraic topology. .
Objective 3: Students will be prepared to begin thesis research.

Course Description:

Solving equations is a crucial aspect of working in mathematics, physics, engineering, and many other fields. These equations might be straightforward algebraic statements, or complicated systems of differential equations, but there are some fundamental questions common to all of these settings: does a solution exist? If so, is it unique? And if we know of the existence of some specific solution, how do we determine it explicitly or as accurately as possible? This course develops the foundations required to rigorously establish the existence of solutions to various equations, thereby laying the basis for the study of such solutions. Through an understanding of the foundations of analysis, we obtain insight critical in numerous areas of application, such areas ranging across physics, engineering, economics and finance. Topics covered are: sets, functions, metric spaces and normed linear spaces, compactness, connectedness, and completeness. Banach fixed point theorem and applications, uniform continuity and convergence. General topological spaces, generating topologies, topological invariants, quotient spaces.Introduction to Hilbert spaces and bounded operators on Hilbert spaces.

Course Contents :

Unit1: Topological Spaces

Definition and examples of topological spaces, Closed sets, Closure, Dense sets. neighborhoods,interior,exterior,andboundary,Accumulationpointsandderivedsets,Basesandsub-bases,Subspaces and relative topology, Alternative methods of defining a topology in terms of Kuratowskiclosureoperator and neighborhoodsystems.

Unit2: Continuous Functions

Continuousfunctionsandhomeomorphism,Firstandsecondcountablespace,Lindelöfspaces,Separablespaces,Theseparationaxioms*T0*,*T1*,*T2*,*T3½*,*T4*,theircharacterizationsandbasicproperties,Urysohn's lemma, Tietzeex tension theorem.

Unit3: Connectedness

Connected spaces and their basic properties, Connectedness of the real line, Components, Locally connected spaces.

Unit4: Compactness
Compactness,Basicpropertiesofcompactness,Compactnessandfiniteintersectionproperty,Sequential,countable,andB-Wcompactness,Localcompactness,One-point compactification.

Unit 5: ProductTopology
Tychonoff product topology in terms of standard sub-base and its characterizations, Product topologyand separation axioms, connected-ness and compactness (incl. the Tychonoff's theorem), productspaces.

Unit6: Nets and filters
Netsandfilters,theirconvergence,andinterrelation,Hausdorffnessandcompactnessintermsofnet/filterconvergence.

Course Learning Outcomes(CLOs) :

CLO1: Demonstrate an understanding of the concepts of metric spaces and topological spaces, and their role in mathematics. Demonstrate familiarity with a range of examples of these structures.

CLO2: Prove basic results about completeness, compactness, connectedness and convergence within these structures. Use the Banach fixed point theorem to demonstrate the existence and uniqueness of solutions to differential equations.

CLO 3: Demonstrate an understanding of the concepts of Hilbert spaces and Banach spaces, and their role in mathematics. Demonstrate familiarity with a range of examples of these structures.

CLO4: Prove basic results about Hilbert spaces and Banach spaces and operators between such spaces.

CLO5: Apply the theory in the course to solve a variety of problems at an appropriate level of difficulty.

CLO6: Demonstrate skills in communicating mathematics orally and in writing.

Text books :

1. G.E.Bredon,TopologyandGeometry,Springer, 2014.
2. J.Dugundji,Topology,Allynand BaconInc.,Boston,1978.
3. J.L.Kelley,GeneralTopology,Dover Publications,2017.

Reference books :

1. J.R.Munkres,Topology,Second Edition,Pearson,2015.
2. T.B.Singh, ElementsofTopology,CRCPress,Taylor&Francis, 2013
3. S.Willard,GeneralTopology,Dover Publications,2004.

Online links for study & reference materials :

https://www.uio.no/studier/emner/matnat/math/MAT4500/h18/dokumenter/topology.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-302 **Course Name:** PROBABILITY THEORY &STATISTICS
Course Credit Hour : 5hr **Total Contact Hour :** 75hr

Course Objective:

This course is intended for students who have completed one semester of calculus and who wish to take an introductory course in probability and statistics. Statistics 50 concentrates on the fundamentals of probability, sample spaces, combinatorics, and random variables. Density and distribution functions, expectation, variance, and covariance, the binomial, uniform poisson, negative binomial, hypergeometric, exponential, and normal distributions, gamma beta, central limit theorem, confidence interval estimation, and hypothesis tests. Students will be given periodic writing assignments which encourage them to think through concepts of the course.

Course Description:

Sample spaces, combinatorics, and random variables.Density and distribution functions.Expectation, variance, and covariance.The binomial, uniform, poisson, negative binomial, hypergeometric, exponential, and normal distributions.Sampling distributions, estimation, and hypothesis tests.Graded: Graded Student.

Course Contents:

Unit 1: Probability Theory and Characteristic Function

Introduction to Probability Theory, Bayes' Theorem, Random Variables and Distribution Functions, Probability mass function, Probability density function Two Dimensional Random Variables-Joint,MarginalandConditionalDistributions,IndependenceofRandomVariables.MomentsofRandomVariables-Expectation,Variance,momentgeneratingfunction,cumulantsgeneratingfunction,characteristicgeneratingfunction.

Unit2: Distributions

Binomial,Poissondistributions,NegativeBinomialDistribution,Polynomialdistribution,Hypergeometricdistribution, Uniform(continuous),Normaldistribution,Beta-IandBeta-II,GammaDistribution, Laplace distributions, distribution of mean and variance, distribution of differences of means and variances, t distribution, F distribution, Chi-Square distribution.

Unit3: Survey Sampling

Probability sampling designs, sampling schemes, inclusion probabilities and estimation; Fixed (Design-based)andSuperpopulation(model-based)approaches;Reviewofimportantresultsinsimpleandstratified random sampling; Sampling with varying probabilities (unequal probability sampling) with orwithout replacement – ps sampling procedures and estimation based on them; Non-negative variance psand non-ps,estimation; Two-way stratification, post-stratification, controlled sampling; Estimationbased on auxiliary data (involving one or more auxiliary variables) under design-based and model-basedapproaches;Double(two-phase)samplingwithspecialreferencetotheselectionwithunequalprobabilitiesinatleastoneofthephases;systematicsamplinganditsapplicationtostructuredpopulations; Cluster sampling (with varying sizes of clusters); Two-stage sampling (with varying sizes offirst-stageunits).

Unit4:Design of Experiments

Review of linear estimation and basic designs. ANOVA: Fixed effect models (2-way classification with unequal and proportional number of observations per cell), Random and Mixed effect models (2-wayclassification with m (>1) observations per cell), Incomplete Block Designs, Concepts of Connectedness, Orthogonally and Balance, Intra block analysis of General Incomplete Block design, B.I.B designs with and without recovery of inter block information.

Course Learning Outcomes (CLOs) :

At the end of the course students should be able to:

CLO1: Develop problem-solving techniques needed to accurately calculate probabilities.

CLO2: Apply problem-solving techniques to solving real-world events.

CLO3: Apply selected probability distributions to solve problems.

CLO4: Present the analysis of derived statistics to all audiences.

Text books:

1. MeyerP.L.,IntroductoryProbabilityandStatisticalApplications(AddisonWesley)
2. Goon,A.M.,Gupta,M.K.andDasgupta.B.(1985):AnOutlineofStatisticalTheory,Vol.I(WorldPress).

Reference books:

1. FreundJ.E. -MathematicalSatistics(PrenticeHall)
2. MukhopadhyayaP.(1996)Mathematical Statistics(NewCentralBookAgency)

Online links for study & reference materials :
http://www.utstat.toronto.edu/mikevans/jeffrosenthal/book.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-303 **Course Name:** OPERATION RESEARCH
Course Credit Hour: 5hr **Total Contact Hour:** 75hr

Course Objective:

Objective 1: Methodology of Operations Research. Linear programming: solving methods, duality, and sensitivity analysis.
Objective 2:Integer Programming. Network flows. Multi-criteria decision techniques.
Objective 3 Decision making under uncertainty and risk.Game theory. Dynamic programming

Course Description :

1 .To impart knowledge in concepts and tools of Operations Research
2. To understand mathematical models used in Operations Research
3. To apply these techniques constructively to make effective business decisions

Course Contents:

Unit 1:

Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem – Formulation of LPP, Graphical solution of LPP.SimplexMethod,Artificialvariables,big-Mmethod,twophasemethod,degeneracyandunboundsolutions.

Unit 2:

TransportationProblem.Formulation,solution,unbalancedTransportationproblem.Findingbasicfeasible solutions – Northwest corner rule, least cost method, Assignment model, Hungarian method foroptimalsolution.Solvingunbalancedproblem.Travelingsalesmanproblemandassignment problem.

Unit 3:
GamesTheory.Competitivegames,rectangulargame,saddlepoint,minimax(maximin)methodofoptimalstrategies,valueofthegame.Solutionofgameswithsaddlepoints,dominanceprinciple.Rectangulargameswithoutsaddlepoint–mixedstrategyfor2X2games.ReplacementModels.Replacement of Items that Deteriorate whose maintenance costs increase with time without change in themoney value. Inventory models. Inventory costs. Models with deterministic demand and probabilisticdemand

Unit 4:

Integer linear programming: Modeling using ,Branch and bound technique, Gomory's cutting plane algorithm, 0-1 programming problem, E-Bala's additive algorithm,Lineargoalprogramming:Modelingusinggoalprogramming,Archimedeangoalprogramming,Preemptivegoalprogramming,Graphicalmethod, Lexicographic simplex method.
Linear fractional programming:Generalizedconvexityverification,Simplexmethod,Charne'sandCooper method, Mathematical programming algorithms: Penalty functions method, Barrier functions method, Frankand Wolfe's method, Method ofreduced gradient, Convex simplex method.

Unit5:

Geometric Programming: Constrained and Unconstrained Minimization Problems.
Stochastic Programming: Stochastic Linear and Stochastic Nonlinear Programming, Netwok Schedulig by PERT/CPM.

Course Learning Outcomes (CLOs) : Students will be able to know :

CLO1: Identify and develop operational research models from the verbal description of the real system. CLO2: Understand the mathematical tools that are needed to solve optimization problems.

CLO3: Use mathematical software to solve the proposed models.

CLO4: Develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

Text Books:

1. Gass,S.I.(1985).Linearprogramming-methodsandapplications(5thed.).New York:McGrawHill(Doveredition2003isalsoavailable).
2. Hadley,G.(2002).Linearprogramming.NewDelhi:NarosaPublishingHouse.
3. Hillier,F.S.,&Lieberman,G.J.(2010).Introductiontooperationsresearch-conceptsandcases(9thed.). New Delhi:TataMcGraw Hill (Indian print).

Reference books :

1. Ravindran,A.,Phillips,D.T.,&Solberg,J.J.(2005).Operationsresearch-principlesandpractice(2nd ed.). New Delhi:WileyIndia (P.) Ltd. (Indianprint).
2. Taha,H.A.(2007).Operationsresearch-anintroduction(8thed.).NewDelhi:PearsonPrenticeHall(Indian print).
3. Hadley,G.,&Whitin,T.M. (1963).Analysisofinventorysystems.Prentice-Hall.
4. Bazara,M.S.,Sherali,H.D.,&Shetty,C.M.(2006).Nonlinearprogramming-theoryandalgorithms(3rded.).New Delhi:John Wiley&Sons (Indian print).

Online links for study & reference materials :

https://web.itu.edu.tr/topcuil/ya/OR.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-304 **Course Name:** COMPUTER FUNDAMENTALS AND C PROGRAMING
Course Credit Hour: 4hr **Total Contact Hour :** 60hr

Course Objective:

Programming forms the core of Computer Science. Other aspects of the subject are either side-issues, or specializations from the basic programming core. Therefore Introduction to Programming is the core first-year course in all our Computer Science degrees, and is an essential prerequisite to almost all that follows in the second and third year.

Programming is about writing the instructions which a computer follows to enable it to store knowledge, process knowledge, and communicate knowledge with the outside world. Stemming from storing knowledge we can move into data structures and databases. Stemming from processing knowledge we can move into algorithms and computations. Stemming from communicating knowledge we can move into human-computer interaction and network issues. We can look in more detail at what is actually happening when a computer runs programs, considering how the instructions we write are translated to real changes in the electronic mechanisms of computer machinery. We can step back and consider more generally how we can organize the process of writing computer programs. We can develop mathematics to help us describe and analyze the behavior of computer programs. We can look at some of the common applications of computers, and methods of programming those applications. We can think of new things we would like computers to do for us, and try and work out how we can write programs to make them do those things.

Course Description:

In a Computer Science degree we aim to teach you skills that will be relevant many years in the future. That is not always easy because we know computers and computing are changing rapidly. The machines, computer applications and even the role of computers in society today are very different from what they were ten, twenty or thirty years ago, and we can be sure that they will be different again ten, twenty or thirty years into the future. That is why we don't see our job as giving detailed training in whatever are the current leading systems on the market. Instead we are concerned with teaching more general principles. However, programming is a practical subject: you will be taught enough to be able to write real working programs, albeit ones on a much smaller scale than those used in industry or sold as commercial software applications.

Course Contents:

Unit-I

Fundamental: H/W and S/W part of computer system, Computer Block Diagram, online processing,time sharing system, real time system, batch system, multiprogramming, multiprocessing, SPOOLING,distributed data processing. Element of computer file, types of files, file processing activities, file designfactors,access methods, prosandcons offile organization

Unit-II

MS office: Introduction to MS Office; Introduction to MSWord; Features & area of use. Working withMS Word.; Menus & Commands; Toolbars & Buttons; Shortcut Menus, Wizards & Templates; Creatinga New Document; Different Page Views and layouts; Applying various Text Enhancements; Workingwith – Styles, Text Attributes; Paragraph and Page Formatting; Text Editing using various features ;Bullets,Numbering, Auto formatting,Printing&various printoptions

Unit-III

MSExcel: Introductionandareaofuse;WorkingwithMSExcel.;conceptsofWorkbook&Worksheets; Using Wizards; Various Data Types; Using different features with Data, Cell and Texts;Inserting, Removing & Resizing of Columns & Rows; Working with Data & Ranges; Column Freezing,Labels,Hiding,Splittingetc.;UsingdifferentfeatureswithDataandText;UseofFormulas,Calculations & Functions; Cell Formatting including Borders & Shading; Working with Different ChartTypes;Printingof Workbook.

Unit-IV

Elements ofC: Ccharacterset, identifiers andkeywords,Data types:declaration anddefinition,storageclassesin C,Type conversion, Typesoferror,'C' macro, macrovs function.
Operators: Arithmetic,relational,logical,bitwise,unary,assignmentandconditionaloperatorsandtheirhierarchy&associativity. Datainput/output.
Controlstatements: Sequencing,Selection:ifandswitchstatement;alternation,Repetition:for,while,anddo-whileloop;break, continue, goto.

Unit-V

Functions: Definition,prototypes,passingparameters,recursion.
DataStructures: arrays,structure,union,string.
Pointers: Declaration,operationsonpointers,arrayofpointers,pointerstoarrays.
String&filehandling,Streams,StringI/O,FileOperations,FormattedI/O,CharacterI/O,**LineI/O,BlockI/O,File positioning, File handling.**

Course Learning Outcomes(CLOs) : This course will enable the students to:

CLO1: UnderstandandapplytheprogrammingconceptsofC++forsolvingmathematicalproblems.

CLO2: Apply to find greatest common divisors, generator and numbers, understand Cartesian geometry and algebraic concepts through programming.

CLO3: Representtheoutputsofprogramsvisuallyintermsofwellformattedtextandplots.

Text Books:

1. JoeHabraken,Microsoft Office2000,8in1by,PrenticeHallofIndia
2. Deitel&Deitel:CHowtoProgram(PrenticeHall),1996.
3. YashwantKanetker,LetusC,BPBPublications.

Reference books :

1. R.B.Patel,FundamentalofComputersandProgramminginC,KhannaBookPublishingCompanyPVT. LTD.Delhi,India,1stedition,2008,ISBN: 13: 978-81-906988-7-0, pp.1-962.
2. Gottfried,ProgrammingwithC,TataMcGrawHill.
3. BrianW.Kernighan,DennisM.Ritchie,TheCProgrammingLanguage,2ndEd.,PrenticeHallofIndia

Online links for study & reference materials :

https://vardhaman.org/wp-content/uploads/2018/12/Computer%20Programming.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-401
Course Credit Hour : 5hr

Course Name: Integral Equations
Total Contact Hour : 75hr

Course Objective :

The integral equation, its classification, different types of kernals.and the relationship between the integral equations and ordinary differential equations and how to solve the linear and non linear integral equations by different methods with some problems which give rise to integral equations.

Course Description:

This course emphasizes concepts and techniques for solving integral equations from an applied mathematics perspective. Material is selected from the following topics: Volterra and Fredholm equations, Fredholm theory, the Hilbert-Schmidt theorem; Wiener-Hopf Method; Wiener-Hopf Method and partial differential equations; the Hilbert Problem and singular integral equations of Cauchy type; inverse scattering transform; and group theory. Examples are taken from fluid and solid mechanics, acoustics, quantum mechanics, and other applications.

Course Contents:

Unit1:

Preliminaryconceptsofintegralequations,Someproblemswhichgiverisetointegralequations,Conversion of ordinary differential equations into integral equations, Classification of linear integralequations.

Unit2:

Fredholm integral equations of second kind with separable kernels, Eigen Values and Eigen functions,Reductiontoasystemofalgebraicequations,AnapproximateMethod,Methodofsuccessiveapproximations, Iterative scheme, Condition of convergence and uniqueness of series solution, Resolventkernel and itsresults, Fredholmtheorems.

Unit3:

Solution of Volterra's integral equations by iterative scheme, Successive approximation, Resolvent kernel,Integral transform methods: Fourier transform, Laplace transform, Convolution integral, Application toVolterraintegralequationswith Convolution typekernels.

Unit4:

Symmetric kernel, Complex Hilbert space, Orthonormal system of functions, Fundamental properties ofeigen values and eigen functions for symmetric kernels. Expansion in eigen function and bilinear form,HilbertSchmidttheorem,SolutionofintegralequationswithsymmetrickernelsSingularIntegralEquations

- Inversion formula for singular integral equation with kernel of type (h(s) - h(t) - a, 0< a <1).DiracDelta Function.

Course Learning Outcomes (CLOs) :

On successful completion of the course students will be able to

CLO1: recognize difference between Volterra and Fredholm Integral Equations, First kind and Second kind, homogeneous and inhomogeneous etc.

CLO2: They apply different methods to solve Integral Equations.

CLO3: Students will have much better and deeper understanding of the fundamental concepts of the space of admissible variations and concepts of a weak and a strong relative minimum of an integral.

CLO4: demonstrate a depth of understanding in advanced mathematical topics in relation to geometry of curves and surfaces

Text books :

1. R.P.Kanwal,Linear Integral Equation.TheoryandTechniques, AcademicPress, NewYork,1971.
2. S.G.Mikhlin,LinearIntegral Equations(translatedfromRussian),HindustanBookAgency,1960.
3. AbdulJ.Jerri,IntroductiontoIntegralEquationswithApplications.

Reference books :

1. Hildebrand.F.B-MethodofAppliedMathematics.
2. L.G.Chambers,IntegralEquations: AshortCourse,Int. Text BookCompanyLtd. 1976.
3. HarryHochsdedt,*IntegralEquations*.

Online links for study & reference materials :

https://services.math.duke.edu/~jtwong/math551-2019/lectures/Integrals1_Fredholm_IEs.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM-402
Course Name: FUNCTIONAL ANALYSIS
Course Credit Hour: 5hr
Total Contact Hour: 75hr

Course Objective:
This course provides students with results and methods that are applicable to other areas of mathematics, and are the foundations for more advanced topics in functional analysis.

The Hahn-Banach theorem, the open mapping and closed graph theorems, the Banach-Steinhaus theorem, dual spaces, weak convergence, the Banach-Alaoglu theorem, and the spectral theorem for compact operators.

Course Description:

1. The student has knowledge of central concepts from functional analysis, including the Hahn-Banach theorem, the open mapping and closed graph theorems, the Banach-Steinhaus theorem, dual spaces, weak convergence, the Banach-Alaoglu theorem, and
   The spectral theorem for compact self-adjoint operators.
2. The student is able to apply his or her knowledge of functional analysis to solve mathematical problems.

Course Contents :

Unit 1:Banach Spaces

Definition-Someexamples-ContinuousLinearTransformations-TheHahn-BanachTheorem-Thenatural embeddingofNin N**

Unit2:BanachSpacesAndHilbertSpaces

Openmappingtheorem-conjugateofanoperator-Definitionandsomesimpleproperties-Orthogonalcomplements-Orthonormalsets

Unit3:Hilbert Space

ConjugatespaceH*- Adjointofanoperator- Self-adjointoperator- NormalandUnitaryOperators-Projections

Unit4: Preliminaries On Banach Algebras

Definitionandsomeexamples-Regularandsingleelements-Topologicaldivisorsofzero-spectrum-the formula forthe spectralradius-the radicaland semi-simplicity.

Unit5:StructureOfCommutativeBanachAlgebras

Gelfandmapping-Applicationsoftheformular(x)=lim7x^n7$^{1/n}$-InvolutionsinBanachAlgebras-Gelfand-NeumarkTheorem.

Course Learning Outcomes(CLOs) :

Students will able to know as

CLO1: work comfortably with Banach spaces.

CLO2: Exposure embedded of a normed linear spaces and their compatibilities.

CLO3: Enhance the knowledge regarding L p spaces and its application.

CLO4: Able to understand Hilbert space and its applications.

CLO5: Ability to acquire knowledge of orthogonal sets and operators.

Text books :

1. G.F.Simmons, *IntroductiontoTopologyandModernAnalysis*,McGraw-Hill,1963.
2. G.BachmanandL.Narici,*Functional Analysis*,AcademicPress,1966.
3. A.E.Taylor,*IntroductiontoFunctional Analysis*,JohnWiley,1958.
4. B.V.Limaye,*Functional Analysis*,WileyEastern.

Reference books :

1. N.DunfordandJ.T.Schwartz, *LinearOperators*, Part-I,Interscience,1958.
2. R.E.Edwards,*FunctionalAnalysis*,Holt RinehartandWinston, 1965.
3. C.GoffmanandG.Pedrick,*FirstCourseinFunctionalAnalysis*,Prentice-HallofIndia,1987.
4. K.K.Jha,*FunctionalAnalysisandItsApplications*,Students' Friend,1986

Online links for study & reference materials :

https://www.mimuw.edu.pl/~aswiercz/AnalizaF/lecture.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM- 411
Course Name: FLUID DYNAMICS
Course Credit Hour: 5hr
Total Contact Hour: 75hr

Course Objective:

To give the student 1) a foundation in the fundamentals of fluid mechanics; 2) practice in the analytical formulation of fluid mechanics problems using Newton's Laws of motion and thermodynamics; 3) an introduction to experimental methods; and 4) an exposure to practical applications, work on a small design project, and the writing of a technical report related to the design project.

Course Description:

Covers properties of fluids, laws of fluid mechanics and energy relationships for incompressible fluids. Studies flow in closed conduits, including pressure loss, flow measurement, pipe sizing and pump selection.

Course Contents:

Unit1:

Kinematics of fluid-Lagrangian and Eulerian methods, Stream lines, Path lines, Streak lines, Velocitypotential,Irrotational and rotational motions.Vortexlines,Equation ofContinuity.

Unit2:

Lagrangian and Eulerian approach, Euler's equation of motion, Bernoulli's theorem, Kelvin circulationtheorem,Vorticityequation, Energyequation for an incompressibleflow.

Unit3:

Boundary conditions, Kinetic energy of liquid, Axially symmetric flows, Motion of a sphere through aliquid at rest at infinity, Liquid streaming past a fixed sphere, Equation of motion of a sphere, Sources,Sinksanddoublets,Imagesinarigidimpermeableinfiniteplaneandinimpermeablesphericalsurfaces.

Unit4:

Two-dimensional irrotational motion produced by motion of circular, co-axial and elliptic cylinders in aninfinitemassof liquid,Streamfunctions,Stokesstreamfunctions,Complex velocitypotential.

Unit5:

Conformal mapping, Milne-Thomson Circle theorem, Blasius theorem, Vortex Motion and its elementary properties, Kelvin's proof of permanence, Motion due to rectilinear vortices.

Course Learning Outcomes (CLOs) :

On successful completion of the course students will be able to

CLO1: Identify how properties of fluids change with temperature and their effect on pressure and fluid flow.

CLO2: Describe fluid pressure and its measurement.

CLO3: Define the relationship between pressure and elevation as it relates to manometers, barometers and other pressure measuring devices.

CLO4: Calculate forces on a plane submerged in static fluid. Calculate buoyancy on a body submerged in a static fluid.

CLO5: Use the general energy equation to calculate changes in fluid flow for circular and non-circular pipes for in-compressible fluids. Select a pump type and pump size to meet capacity and other pumping requirements.

Text books:

1. F.Chorlton,TextBookofFluidDynamics,CBSPublisher,2005.
2. R.W.Fox,P.J.PritchardandA.T.McDonald,IntroductiontoFluidMechanics,SeventhEdition,John Wiley&Sons, 2009.

Reference books :

1. P.K.Kundu,I.M.Cohen,D.R.Dowling,FluidMechanics,SixthEdition,AcademicPress,2016.

Online links for study & reference materials :

https://www.meteo.physik.uni-muenchen.de/lehre/roger/manuskripte/Fluid_Dynamics.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**-**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM- 412
Course Name: DIFFERENTIAL GEOMETRY
Course Credit Hour: 5hr
Total Contact Hour: 75hr

Course Objective:

The course introduces the fundamentals of differential geometry primarily by focussing on the theory of curves and surfaces in three space. The theory of curves studies global properties of curves such as the four vertex theorem. The theory of surfaces introduces the fundamental quadratic forms of a surface, intrinsic and extrinsic geometry of surfaces, and the Gauss-Bonnet theorem.

Course Description:

Students should acquire knowledge about the application of methods of differential and integral calculus to the study of geometry with emphasis on the differential geometry of surfaces. They should be able to apply this knowledge independently to analyze and solve mathematical problems in contexts where methods of differential geometry are relevant.

Course Contents:

Unit 1: Curves with torsion: Tangent, Principal Normal, Curvature, Binomial, Torsion, Serret Frenet formulae, Locus of center of spherical Curvature.

Unit2: Envelopes: Surfaces,Tangent plane, Envelope, Characteristics, Edge of regression

Unit3: Curvilinear Co-ordinates : First order magnitude, Directions on a surface, Second order magnitudes, Derivative of unit normal, Principal directions and curvatures.

Unit4: Geodesics: Geodesic property, Equations of geodesics, Torsion of a geodesic

Course Learning Outcomes (CLOs) :

On successful completion of the course students will be able to

CLO1: Calculate the curvature and torsion of a curve.

CLO2: Find the moving trihedron of a curve and write its intrinsic and canonical equations.

CLO3: Find the osculating surface and the osculating curve at any point of a given curve.

CLO4: Calculate the first and the second fundamental forms of a surface.

Text books:

1. C.E.,Weatherburn,Differential GeometryofThreeDimensions.
2. J. A. Thorpe, Elementary Topics in Differential Geometry, Springer-Verlag, New York, 1979.
3. B. O'Neill, Elementary Differential Geometry. (Revised Second Edition), Elsevier/Academic Press, San Diego CA, 2006

Reference books :

1. R. S. Millman and G. D. Parker, Elements of Differential Geometry, Prentice-Hall, Englewood Cliffs, NJ, 1977.
2. M. P. doCarmo, Differential Geometry of Curves and Surfaces, Prentice-Hall, Saddle River NJ, 1976.

Online links for study & reference materials :

http://www.wisdom.weizmann.ac.il/~yakov/scanlib/hicks.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM- 413
Course Credit Hour: 5hr

Course Name: ALGEBRIC NUMBER THEORY
Total Contact Hour: 75hr

Course Objective:

Object 1: The concept (definition and significance) of algebraic numbers and algebraic integers.

Object 2: How to factories an algebraic integer into irreducible.

Object 3: How to find the ideals of an algebraic number ring. The definition of the Class Group.

Course Description:

Algebraic Numbers, including bases, norm, trace, and the ring of integers. Modules, Integral Dependence and Noetherian Domains.

Factorisation in rings of integers, discriminant, examples of uniqueness and non-uniqueness of factorisation.Factorisation of ideals, the Class Group and the Class Number.

Course Contents:

Unit1: Primesincertainarithmeticalprogressions.FermatnumbersandMersennenumbers.Approximation of irrational numbers by rationals. Hurwitz's theorem, irrationality of e and π. System oflinearcongruencesChineseRemainderTheorem.Quadraticresiduesandnonresidues.Legendre'sSymbol.Gauss Lemmaand itsapplications.QuadraticLawofReciprocityjacobi'sSymbol.

Unit 2: Riemann Zeta Function ξ(s) and its convergence. Application in prime numbers. ξ(s) as Euler'sproduct. Evaluation of ξ(2) and ξ(2k). Dirichlet series with simple properties. Dirichlet series as analyticfunctionandits derivative.Eulers products.Introduction to modularforms.

Unit3: Euler'ssummationformulaandsomeelementaryasymptoticformula.Averageorderofthearithmeticalfunctionsd(n),σa(n),φ(n),μ(n)andΛ(n).PartialsumsofaDirichletproductandtheir
α
applicationtoμ(n)andΛ(n).

Unit4: Chebyshev'sfunctionsΨ(x)andv(x)andrelationbetweenv(x)andπ(x).Shapiro'sTauberiantheoremanditsapplications.Partialsumsof theMobiusfunction.Selberg'sasymptoticformula.

Course Learning Outcomes (CLOs) :

On successful completion of the course students will be able to

CLO1: define the key notions of algebraic number theory and outline their interrelation;

CLO2: calculate the most important number theoretical quantities introduced during the course;

CLO3: give an account of the fundamental theorems of the course and apply them in specific cases;

CLO4: outline important parts of the theory presented during the course, such as the deduction of the four-squares theorem from Minkowski's theorem and Kummer's proof of Fermat's great theorem for regular prime exponents;

Text books:

1. T.M.Apostol.IntroductiontoAnalyticnumbertheory(NarosaPublishingHouse1980).
2. T.M.Apostol.ModularfunctionsandDirichletseriesin NumberTheory(Springer-Verlag1976).

Reference books :

1. J.P.Serre. ACourse inArithmetic G.T.M.Vol.7(SpringerVerlag1973).

Online links for study & reference materials :

http://people.math.gatech.edu/~mbaker/pdf/ANTBook.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM- 414
Course Name: DISCRETE MATHEMATICS
Course Credit Hour: 5hr
Total Contact Hour: 75hr

Course Objective :

To develop logical thinking and its application to computer science (to emphasize the importance of proving statements correctly and de-emphasize the hand-waving approach towards correctness of an argument). The subject enhances one's ability to reason and ability to present a coherent and mathematically accurate argument. About 40% of the course time will be spent on logic and proofs and remaining 60% of the course time will be devoted to functions, relations, etc.

Course Description:
Basic set theory and symbolic logic.Methods of proofs, including mathematical induction.Relations, functions, and partitions; modular arithmetic.

Course Contents :

Unit1: Lattices

1. PropertiesandexamplesofLattices
2. Distributivelattices
3. Booleanalgebras
4. Booleanpolynomials
5. MinimalFormsof BooleanPolynomials.

Unit2: Applicationsoflattices

6. SwitchingCircuits

7. ApplicationsofSwitchingCircuits

Unit3: Finite fields and polynomials

8. Finitefields

Unit4:Finite fields and polynomials

9. IrreduciblePolynomialsoverFinitefields
10. FactorizationofPolynomialsoverFinitefields

Unit 5:Coding theory

11. LinearCodes
12. CyclicCodes

Course Learning Outcomes (CLOs) :

On successful completion of the course students will be able to

CLO1: Learn about partially ordered sets, lattices and their types.

CLO2: Understand Boolean algebra and Boolean functions logic gates, switching circuits and their applications.

CLO3: Solve real-life problems using finite-state and Turing machines.

CLO4: Assimilatevariousgraphtheoreticconceptsandfamiliarizewiththeirapplications.

Text books:

1. Rudolf Lidl & Gunter Pilz. Applied Abstract Algebra, Second Indian Reprint2006,SpringerVerlag, NewYork.
2. A.Gill,AppliedAlgebraforComputerScience,PrenticeHallInc.,NewJersey.

Reference books:

1. J.L.Gersting,MathematicalStructuresforComputerScience(3rdEdn.),ComputerSciencePress,NewYork.
2. S.Wiitala,DiscreteMathematics-AUnifiedApproach,McGrawHillBookCo.

Online links for study & reference materials:

https://home.iitk.ac.in/~arlal/book/mth202.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM- 421
Course Name: MATHEMATICAL MODELLING
Course Credit Hour: 5hr
Total Contact Hour: 75hr

Course Objective:

The objectives of this course are to:
1. Enable students understand how mathematical models are formulated, solved, and interpreted.
2. Make students appreciate the power and limitations of mathematics in solving practical real-life problems.
3. Equip students with the basic mathematical modeling skills.

Course Description:

This course is an introductory course on Mathematical Modeling. It is designed for students studying mathematical sciences (i.e. Mathematics and Statistics). It may, however, be useful to students in sciences, engineering and other related fields. It introduces students to basic concepts in mathematical modeling. It also equips the students with mathematical modeling skills with emphasis on using mathematical models to solve real-life problems. Topics to be covered in this course includes: methodology of model building, problem identification and definition, model formulation and solution, consideration of varieties of models involving equations like algebraic, ordinary differential equation, partial differential equation, difference equation, integral and functional equations, consideration of some specific applications of mathematical models to biological, social, and behavioral sciences.

Course Contents:

Unit1:

Introduction, basic steps of Mathematical Modeling, its needs, types of models, limitations. Elementary ideas of dynamical systems, autonomous dynamical systems in the plane-linear theory. Equilibrium point, node,saddle point, focus,centre and limit-cycleide as with simple illustrations and figures.

Unit2:

Linearizationofnon-linearplaneautonomoussystems.MathematicalModelinginthebiologicalenvironment.Bloodflowandoxygentransfer.Modelingbloodflow,viscousity,Poiseuillelaw,mathematicalformulationoftheproblem,solutionandinterpretation.Oxygentransferinredcells,diffusion,mathematicalformulation,solution,interpretation,andlimitations.

Unit3:

Single species population models.Basic concepts. Exponential growth model, formulation, solution,interpretation,andlimitations.Compensationanddepensation.Logisticgrowthmodel,formulation,solution,interpretation, andlimitations.

Unit4:

Gompertz growth model, formulation, solution, interpretation, and limitations.Two species populationmodels.Types of interaction between two species.Lotka-VolteiTa prey-predator model, formulation,solution, interpretation, arid limitations.Lotka-Volterra model of two competing species, formulation,solution,interpretation, andlimitations.

Unit5:

Mathematical modeling of epidemics.Basic concepts.Simple epidemic model, formulation, solution,interpretation,andlimitations.Generalepidemicmodel,formulation,solution,interpretation,andlimitations.

Course Learning Outcomes (CLOs) :

On successful completion of the course students will be able to

CLO1: understand what a mathematical model is and explain the series of steps involved in a mathematical modeling process. state and explain the different classifications of mathematical models stating examples in each classes

CLO2: explain the essential features of a good model and discuss the benefits of using a mathematical model.

CLO3: Identify some simple real-life problems that can be solved using mathematical models, model the problem(s), solve the resulting problem, and interpret the solution.

CLO4: Mention and discuss some applications of mathematical modeling in solving problems in engineering, physical, biological, social and behavioral sciences

CLO5: Acquire basic mathematical modeling skills that will enable them carry out simple modeling tasks individually or as a group.

Text books:

1. RutherfordAris,MathematicalModellingTechniques,DoverPublicationsInc.;1994.
2. Berry J. And Houston K. (1995). Mathematical Modelling. Edward Arnord , London, United Kingdom. 142p.

Reference books:

1. Finkelstein, L and Carson E.R. (1985). Mathematical Modelling of Dynamic Biological Systems (2nd Edition). Research Studies Press, Herfordshire, England. 355p

Online links for study & reference materials:

https://core.ac.uk/download/pdf/12518237.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM- 422
Course Credit Hour: 5hr

Course Name: CALCULUS ON R^n
Total Contact Hour: 75hr

Course Objective :

This course desined in the form of a knowledge which gives homotopy, BrouwerFixedPointTheorem and gives a brief intro about Van Kampen's Theorem and gives the application of homology.

Course Description:

Be able to analyze, test, interpret and form independent judgments in both academic and non-academic contexts and Recognize and appreciate the connections between theory and applications Have an appropriate set of professional skills to ensure a productive career.

Course Contents:

Unit1:

Pathsandhomotopy,homotopyequivalence,contractibility,deformationretracts,Basicconstructions:cones, mappingcones, mappingcylinders,suspension.

Unit2:

Cellcomplexes,subcomplexes, CWpairs. Fundamentalgroups.Examplesandapplications,BrouwerFixedPointTheoremandBorsuk-UlamTheorem.

Unit3:

Van Kampen's Theorem, Covering spaces, lifting properties, deck transformations.universal coverings.Simplicialcomplexes,barycentricsubdivision,starsandlinks,simplicialapproximation.SimplicialHomology.

Unit4:

Singular Homology.Mayer-Vietoris Sequences.Long exact sequence of pairs and triples.Homotopyinvarianceand excision,Degree.Cellular Homology.

Unit5:

Applicationsofhomology:Jordan-Brouwerseparationtheorem,Invarianceofdimension,Hopf'sTheorem for commutative division algebras with identity, Borsuk-Ulam Theorem, Lefschetz Fixed PointTheorem.

Course Learning Outcomes (CLOs) :

On successful completion of the course students will be able to

CO1: Apply the logic theory to practical situations for drawing conclusions

CO2: Analyze statements of Simplicial complexes.

CO3: Write and interpret mathematical notation and mathematical definitions
CO4: Construct and restate various theorems using logical arguments of Cellular Homology.
CO5: Unravel abstract definitions, create intuition-forming examples or Borsuk-Ulam Theorem examples, and prove Lefschetz Fixed PointTheorem.

Text books:

1. EdwinH.Spanier,AlgebraicTopology,SpringerVerlag,1966.

Reference books:

1. **B**ittinger,Surgent, Addison-Wesley "Calculus and its Applications"10ed ,2012

Online links for study & reference materials:

http://people.math.harvard.edu/~shlomo/docs/Advanced_Calculus.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Structure Template

L	T	P
4	1	0

Course Code: STPGM- 423
Course Credit Hour: 5hr

Course Name: REGRESSION ANALYSIS
Total Contact Hour: 75hr

Course Objective:

Regression is perhaps the most widely used statistical technique. It estimates relationships between independent variables and dependent variables. Regression models can be used to help understand and explain relationships among variables; they can also be used to predict actual outcomes.

In this course you will learn how to derive multiple linear regression models, how to use software to implement them, and what assumptions underlie the models. You will also learn how to test whether your data meets those assumptions, what can be done when those assumptions are not met, and strategies to build and understand useful models.

Course Description:

A conceptual and practical introduction to the basic concepts and techniques of regression analysis:
1. Learn how to apply linear regression models in practice: identify situation where linear regression is appropriate; build and fit linear regression models with software; interpret estimates and diagnostic statistics; produce exploratory graphs.
2. Learn about the theory underlying point estimation, hypothesis and confidence intervals for linear regression models.

Course Contents:

Unit 1
Simple and multiple linear regression models %G—%@ estimation, tests and confidence regions. Checkfornormalityassumption.
Likelihoodratiotest,confidenceintervalsandhypothesestests;testsfordistributional assumptions.

Unit 2
Collinearity,outliers;analysisofresiduals,Selectingthe$(B!H(BBest$(B!I(Bregressionequation,transformationofresponsevariables.Ridge's regression.

Unit 3
Natureofeconometrics.Thegeneral linear model(GLM)anditsextension.Ordinaryleast squares (OLS)estimationandprediction.Generalizedleastsquares(GLS)estimationandprediction.Heteroscedasticdisturbances.

Course Learning Outcomes(CLOs) :

On successful completion of the course students will be able to

CLO1: Interpretation of linear regression models

CLO2: Relationship between correlation and linear regression and Regression coefficients

CLO3: Interpretation of interaction termsInterpretation of linear regression models

Text books :

1. B.L.BowermanandR.T.O'Connell,LinearStatisticalModels:AnAppliedApproach,PWS-KENTPub.,Boston, 1990
2. N.RDraper.AndH.Smith.,AppliedRegressionAnalysis,JohnWileyandSons(Asia)Pvt.Ltd.,Seriesin Probabilityand Statistics,2003.

Reference books :

1. D.C.Montgomery,E.A.Peck,G.G.Vining,IntroductiontoLinearRegressionAnalysis,JohnWiley NY, 2003
2. A.A.SenandM.Srivastava,RegressionAnalysis%G–%@Theory,Methods&Applications,
3. Springer-Verlag,Berlin,1990.

Online links for study & reference materials:

http://spartan.ac.brocku.ca/~jvrbik/MATH3P82/notes.pdf

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

MUKESH KUMAR PARASHAR

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Date: 2023.04.16 16:50:11 +05'30'