

# **NOIDA INTERNATIONAL UNIVERSITY**

## **DEPARTMENT OF COMPUTER SCIENCE**

### **SYLLABUS OF COURSES TO BE OFFERED**

**Core Courses, Elective Courses & Ability Enhancement Courses**

**B.Sc. (Hons)-Computer Science  
Choice Based Credit System (CBCS)**



**(Academic Session: 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
<b>I. Core Course (14 Papers)</b>	14X4= 56	14X5=70
Core Course Practical / Tutorial* <b>(14 Papers)</b>	14X2=28	14X1=14
<b>II. Elective Course (8 Papers)</b>		
A.1. Discipline Specific Elective <b>(4 Papers)</b>	4X4=16	4X5=20
A.2. Discipline Specific Elective		
Practical/ Tutorial* <b>(4 Papers)</b>	4 X 2=8	4X1=4
B.1. Generic Elective/ Interdisciplinary <b>(4 Papers)</b>	4X4=16	4X5=20
B.2. Generic Elective		
Practical/ Tutorial* <b>(4 Papers)</b>	4 X 2=8	4X1=4
<b>*Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6<sup>th</sup> Semester.</b>		
<b>III. Ability Enhancement Courses</b>		
<b>1. Ability Enhancement Compulsory</b>		
<b>(2 Papers of 2 credit each)</b>		
Environmental Science		
English/MIL Communication	2 X 2=4	2 X 2=4
<b>2. Ability Enhancement Elective (Skill Based)</b>		
<b>(Minimum 2) (2 Papers of 2 credit each)</b>	2 X 2=4	2 X 2=4
<b>Total credits</b>	<b><u>140</u></b>	<b><u>140</u></b>

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

**SCHEME FOR CHOICE BASED CREDIT SYSTEM**  
**B. Sc. (H)-COMPUTER SCIENCE**

<b>Semester</b>	<b>CORE COURSE(14) - Credit:06 each</b>	<b>Ability Enhancement Compulsory Course(AECC) (2) Credit:02 each</b>	<b>Skill Enhancement Elective Course (SEEC) (2) Credit:02 each</b>	<b>Elective: Discipline Specific DSE (4): Credit:06 each</b>	<b>Elective: Generic (GE)(4): Credit:06 each</b>
<b>I</b>	Programming Fundamentals using C	AECC -1 Environmental Science			GE – 1
	Computer System Architecture				
<b>II</b>	Introduction to OOPs	AECC -2 English/MIL Communication			GE – 2
	Java Programming				
<b>III</b>	Data Structures using C		SEC – 1		GE – 3
	Operating Systems				
	Computer Networks				
<b>IV</b>	Design and Analysis of Algorithms		SEC – 2		GE – 4
	Software Engineering				
	Database Management Systems				
<b>V</b>	Visual Dot (.) NET			DSE – 1	
	Management Information Systems			DSE – 2	
<b>VI</b>	Artificial Intelligence			DSE – 3	
	Computer Graphics			DSE – 4	

**NOIDA INTERNATIONAL UNIVERSITY**  
**SCHOOL OF SCIENCES**  
 Effective from the Session: 2021-2022  
 B.Sc. (H)-Computer Science 1<sup>st</sup> 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	Programming Fundamentals using C	4	0	0	20	20	40	60	100	4	C1
2	STUGCS1/C02	Computer System Architecture	4	0	0	20	20	40	60	100	4	C2
3		GE-1	5	1	0	20	20	40	60	100	6	GE1
4	STUGCS1/AECC1	Environmental Science	2	0	0	20	20	40	60	100	2	AECC1
Practical												
1	SPUGCS1/C01	Programming Fundamentals using C Lab	0	0	4			25	25	50	2	C1
2	SPUGCS1/C02	Computer System Architecture Lab	0	0	4			25	25	50	2	C2
<b>Total</b>										<b>500</b>	<b>20</b>	

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	Introduction to OOPs	4	0	0	20	20	40	60	100	4	C3
2	STUGCS2/C04	Java Programming	4	0	0	20	20	40	60	100	4	C4
3		GE-2	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	Introduction to OOPs Lab	0	0	4			25	25	50	2	C3
2	SPUGCS2/C04	Java Programming Lab	0	0	4			25	25	50	2	C4
3		GE-2	0	0	4			25	25	50	2	GE-2
<b>Total</b>										<b>550</b>	<b>20</b>	

**Note:** List of Practical will be supplied at the Start of every Semester

\* Ability Enhancement Compulsory Course(AECC-2)

\*Generic Elective Papers (GE)

### B.Sc. (H)-Computer Science 2<sup>nd</sup> Year

SEMESTER-III												
S. No	Course Code	Subject	Period			Evaluation Scheme			External Exam	Subject Total	Credit	CBCS
			L	T	P	CA	TA	Total				
1	STUGCS3/C05	Data Structures using C	4	0	0	20	20	40	60	100	4	C5
2	STUGCS3/C06	Computer Networks	4	0	0	20	20	40	60	100	4	C6
3	STUGCS3/C07	Operating Systems	4	0	0	20	20	40	60	100	4	C7
4		SEEC-1	2	0	0	20	20	40	60	100	2	SEEC1
5		GE-3	4	0	0	20	20	40	60	100	4	GE3
Practical												
1	SPUGCS3/C05	Data Structures using C	0	0	4			25	25	50	2	C5
2	SPUGCS3/C06	Computer Network Lab	0	0	4			25	25	50	2	C6
3	SPUGCS3/C07	Operating Systems Lab	0	0	4			25	25	50	2	C7
4		GE-3 Lab	0	2	0			25	25	50	2	GE3
Total										700	26	

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

\* Ability Enhancement Compulsory Course(AECC-2)

\*Generic Elective Papers (GE)

**B.Sc. (H)-Computer Science 3<sup>rd</sup> 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	Visual Dot (.) NET	4	0	0	20	20	40	60	100	4	C11
2	STUGCS5/C12	Management Information Systems	5	1	0	20	20	40	60	100	6	C12
3		DSE-1	4	0	0	20	20	40	60	100	4	DSE1
Practical												
1	SPUGCS5/C11	Visual Dot (.) NET Lab	0	0	4			25	25	50	2	C11
2		DSE-1 Lab	0	0	4			25	25	50	2	DSE1
3		DSE-2 Lab (Minor Project)	0	0	12			50	100	150	6	DSE2
Total										550	24	
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	Computer Graphics	4	0	0	20	20	40	60	100	4	C14
3		DSE-3	4	0	0	20	20	40	60	100	4	DSE3
Practical												
1	SPUGCS6/C13	Artificial Intelligence	0	0	4			25	25	50	2	C13
2	SPUGCS6/C14	Computer Graphics Lab	0	0	4			25	25	50	2	C14
3		DSE-3 Lab	0	0	4			25	25	50	2	DSE3
4		DSE-4 (Major Project)	0	0	12			100	100	200	6	DSE4
Total										650	24	
Note: List of Practical will be supplied at the Start of every Semester												



### **List of Skill Enhancement Elective Courses**

<b>Skill Enhancement Elective Courses (SEEC): -Credit: 02 each</b>		
<b>Semester</b>	<b>Paper Code</b>	<b>Subject Name</b>
<b>Semester-3</b>	STUGCS3/SEEC1X	1. HTML Programming 2. UNIX/LINUX Programming 3. Machine Learning 4. Software Testing 5. Mobile Computing
<b>Semester-4</b>	STUGCS4/SEEC2X	1. Introduction to ORACLE/SQL 2. Introduction to Microprocessor 3. XML Programming 4. Web Technology 5. R programming

### **Discipline Specific Elective Papers**

<b>Discipline Specific Elective Papers (DSE)-Credit: 06 each</b>		
<b>Semester</b>	<b>Paper Code</b>	<b>Subject Name</b>
<b>Semester-5</b>	STUGCS5/DSE1X	DSE-1 1. Data Mining & Data Warehousing (4) + Lab (2) 2. Cloud Computing (4) + Lab(2) 3. Information Security (4) + Lab(2) 4. Introduction to Python (4) + Lab(2)
	STUGCS5/DSE2X	DSE-2 1. Minor Project (Lab 6) 2. Operation Research (4) + Lab(2) 3. Cyber Security (4) + Lab(2)
<b>Semester-6</b>	STUGCS6/DSE3X	DSE-3 1. Big Data (4) + Lab (2) 2. Cryptography & Network Security (4) + Lab(2) 3. Web Technology (4) + Lab(2) 4. Network Programming (4) + Lab(2)
	STUGCS6/DSE4X	DSE-4 1. Major Project (Lab 6) 2. Digital Image Processing (4) + Lab(2) 3. Computer Based Numerical Analysis(4) + Lab(2)

#### **Generic Elective-Other Discipline (1to 4)**

1. Mathematics+ Tutorial
2. Chemistry + Lab
3. Biotechnology + Tutorial
4. Agriculture+ Tutorial
5. Physics +Lab
6. Environment + Lab
7. Electronics + Lab
8. Statistics + Tutorial

**Note: Choices from the other department/School can also be considered.**

## **LIST OF GENERIC ELECTIVE COURSES**

Generic Elective Papers (GE): -Credit: 06 each		
Semester	Paper Code	Subject Name
Semester-1	STUGCS1/GE1X	1. Computer Fundamental (4) +Lab (2) 2. C programming (4) +Lab (2)
Semester-2	STUGCS2/GE2X	1. Introduction to Internet Technologies (4) + Lab (2) 2. Web Technologies (4) + Lab (2)
Semester-3	STUGCS3/GE3X	1. Introduction to Python (4) + Lab (2) 2. Information Security & Cyber Law (4) + Lab (2) 3. Introduction to Computer Networks (4) + Lab(2)
Semester-4	STUGCS4/GE4X	1. Introduction to DBMS (4) + Lab (2) 2. Web & E-Commerce (5) + Tut (1) 3. Hypertext pre-processor (4) + Lab (2)

## **OVERALL CREDIT SCHEME**

S. No.	SEMESTER	Theory Total	Practical Total	Subject Total	Total Credit
1	I	400	100	500	20
2	II	400	150	550	20
3	III	500	200	700	26
4	IV	500	200	700	26
5	V	300	250	550	24
6	VI	300	350	650	24
			<b>Grand Total</b>	<b>3650</b>	<b>140</b>

**Note: Total Marks of Theory and Practical may vary semester to semester based on Generic Elective provided by other departments.**

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)	
Assessments	Weightage
Assessment -1	05%
Assessment -2	05%
Assessment -3	20%
Assessment -4	05%
Assessment -5	05%
<b>Total Internal Assessment</b>	<b>40%</b>

# **DETAILED SYLLABUS**

**B.Sc. (Hons)  
Computer science**

**Course Code: STUGCS1/C01**  
**Course Credit Hour: 4hr**

**Course Name: Programming Fundamentals using C**  
**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, multiprocessing. Element of computer file, types of files, pros and cons of file organization.

**Unit-II**

**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.

**Unit-III**

**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 statement

**Unit-IV**

**Functions:** Definition, prototypes, passing parameters, recursion.

**Data Structures:** arrays, structure, union, string.

**Pointers:** Declaration, operations on pointers, array of pointers, pointers to arrays.

**Unit-V**

**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>

**Course Code: STUGCS1/C02**  
**Course Credit Hour: 4hr**

**Course Name: Computer System Architecture**  
**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.

**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 Organisation, Register Organisation, 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 translation, Hardware support for memory management
- **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 Mano - Pearson PrenticeHall,2007.

#### **Online links for study & reference materials :**

- [http://www.cse.iitm.ac.in/~vplab/courses/comp\\_org/LEC\\_INTRO.pdf](http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf)

**Course Code: STUGCS1/AECC1**  
**Course Credit Hour: 4hr**

**Course Name: Environmental Sciences**  
**Total Contact Hour: 60hr**

**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 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 Climate Change  
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/ 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>

**Course Code: STUGCS1/GE1X**  
**Credit Hour: 4hr**

**Course Name: Computer Fundamentals**  
**Total Contact Hour: 60hr**

**Course Objective:**

- This course introduces the basic concepts of computers and fundamentals of Digital Principles.

**Course Description:**

- This course deals with fundamentals of computer. ... It also deals with the hardware and software aspects of the computer like operating system, application software and system software. It provides an overview of functions and working of central processing unit, motherboard and other peripherals.

**Course Contents:**

**UNIT-1: Introduction:** Introduction to computer system, uses, types.

**Data Representation:** Number systems and character representation, binary arithmetic

**UNIT-2: Human Computer Interface:** Types of software, Operating system as user interface, utility programs

**Devices:** Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter

**UNIT-3: Memory:** Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks

**UNIT-4: Computer Organization and Architecture:** C.P.U., registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors.

**UNIT-5: Overview of Emerging Technologies:** Bluetooth, cloud computing, big data, data mining, mobile computing and embedded systems.

**Course Learning Outcomes (CLOs):**

**CLO-1:** Bridge the fundamental concepts of computers with the present level of knowledge of the students.

**CLO-2:** Familiarize operating systems, programming languages, peripheral devices, networking, multimedia and internet

**CLO-3:** Understand binary, hexadecimal and octal number systems and their arithmetic.

**CLO-4:** Understand how logic circuits and Boolean algebra forms as the basics of digital computer.

**CLO-5:** Demonstrate the building up of Sequential and combinational logic from basic gates.

**Reference Books:**

1. A. Goel, Computer Fundamentals, Pearson Education, 2010.
2. P. Aksoy, L. DeNardis, Introduction to Information Technology, Cengage Learning, 2006
3. P. K.Sinha, P. Sinha, Fundamentals of Computers, BPB Publishers, 2007

**Course Code: STUGCS1/GE1X**  
**Course Credit Hour: 4hr**

**Course Name: C Programming**  
**Total Contact Hour: 60hr**

**Syllabus will be as our core course.**

**Course Code: STUGCS2/C03**  
**Credit Hour: 4hr**

**Course Name: Introduction to OOPs**  
**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/deallocation 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 Schildt, "The Complete Reference: Java", TMH, 7<sup>th</sup> 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, 3<sup>rd</sup> Edition.

### **Online links for study & reference materials :**

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

**Course Code: STUGCS2/CO4**  
**Course Credit Hour: 4hr**

**Course Name: Java Programming**  
**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 Content:**

**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 Schildt, "The Complete Reference: Java", TMH, 7<sup>th</sup> Edition.
3. Nino," An Introduction to Programming and Object Oriented Design using Java, w/CD", Wiley India
4. James Rumbaugh et al, "Object Oriented Modeling and Design", PHI
5. Bjarne Stroustrup, "C++ Programming Language", Addison Wesley, 3<sup>rd</sup> Edition.

**Online links for study & reference materials :**

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



**Course Code : STUGCS2/AECC2**

**Course Credit Hour : 4hr**

**Course Name: Technical communication**

**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 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 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>

**Course Code: STUGCS2/GE2X      Course Name: Introduction to Internet Technology**  
**Course Credit Hour: 4hr                      Total Contact Hour: 60hr**

**Course Objective:**

Study on internet protocols, client/server applications and webServices. 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
- Server 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: STUGCS2/GE2X**  
**Course Credit Hour: 4hr**

**Course Name: Web Technology**  
**Total Contact Hour: 60hr**

**Course 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

**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. : HTML Engineering Concepts, McGraw-Hill.
- Lewis, T.G.: Learn CSS, McGraw-Hill.

**Online links for study & reference materials :**

<https://noidatut.com/>

## **B.Sc. (H) Computer science 2<sup>nd</sup> Year**

### **SEMESTER-III**

**Course Code: STUGCS3/CO5**

**Course Credit Hour : 4hr**

**Course Name : Algorithm and Data Structure**

**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/>

**Course Code: STUGCS3/CO6**  
**Course Credit Hour: 4hr**

**Course Name: Computer Networks**  
**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. Tanenbaum : 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 Stallings : Data and Computer Communications, Pearson Education.

**Online links for study & reference materials :**

<https://noidatut.com/>

**Course Code: STUGCS2/C07**  
**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 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.

**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, avoidance 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 access 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/>

**Course Code: STUGCS3/SEEC1X**

**Course Name: HTML Programming**

**Course Credit Hour: 4hr**

**Total Contact Hour: 60hr**

**Course Objective: Students will be able to:**

- Insert a graphic within a web page.
- Create a link within a web page.
- Create a table within a web page.
- Insert heading levels within a web page.
- Insert ordered and unordered lists within a web page.

**Course outcome:**

- Be able to use the HTML programming language.
- Resolves written HTML codes.
- Runs the page he/she has designed using HTML codes.
- Be able to use the Design Programs.
- Uses Microsoft Expression Web 4 programme.

**Course Content:**

**Unit-I: Introduction**

**Unit-II: The Basics**

- o The Head, the Body
- o Colors, Attributes
- o Lists, ordered and unordered

**Unit-III: Links**

- o Introduction
- o Relative Links, Absolute Links
- o Link Attributes
- o Using the ID Attribute to Link Within a Document

**Unit-IV: Images**

- o Putting an Image on a Page
- o Using Images as Links
- o Putting an Image in the Background

• **Unit V: – Tables**

- o Creating a Table
- o Table Headers
- o Captions
- o Spanning Multiple Columns
- o Styling Table

• **Unit VI – Forms**

- o Basic Input and Attributes
- o Other Kinds of Inputs o
- Styling forms with CSS
- o Where To Go From Here

**Course Learning Outcomes (CLOs) :**

- CLO-1 : Designs site and page via Microsoft Expression Web 4 programme
- CLO-2: Uses the program Web Page Maker
- CLO-3: Designs site and page via Web Page Maker programme
- CLO-4: Publishes the site he/she designed
- CLO-5: Uses Domain Name and services.

**Book Recommended:**

1. Virginia DeBolt , Integrated HTML and CSS A Smarter, Faster Way to Learn Wiley / Sybex , 2006
2. Cassidy Williams, Camryn Williams Introduction to **HTML** and CSS, O'Reilly, 2015

**Course Code: STUGCS3/SEEC1X**

**Course Name: Linux / Unix Programming**

**Course Credit Hour: 4hr**

**Total Contact Hour: 60hr**

**Course Objective:** Introduces the UNIX/Linux operating system, including: task scheduling and management, memory management, input/output processing, internal and external commands, shell configuration, and shell customization. Explores the use of operating system utilities such as text editors, electronic mail, file management, scripting, and C/C++ compilers. Discusses trends in UNIX/Linux, including use of graphical user interfaces.

**Course outcome:** On completion of this course the student should be able to:

Identify and use UNIX/Linux utilities to create and manage simple file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks.

Effectively use the UNIX/Linux system to accomplish typical personal, office, technical, and software development tasks.

Monitor system performance and network activities.

Effectively use software development tools including libraries, preprocessors, compilers, linkers, and make files.

Comprehend technical documentation, prepare simple readable user documentation and adhere to style guidelines.

Collaborate in teams on system tasks.

## **Course Content:**

### **Introduction**

- What is linux/unix Operating systems
- Difference between linux/unix and other operating systems
- Features and Architecture
- Various Distributions available in the market
- Installation, Booting and shutdown process
- System processes (an overview)
- External and internal commands
- Creation of partitions in OS
- Processes and its creation phases – Fork, Exec, wait

### **User Management and the File System**

- Types of Users, Creating users, Granting rights
- User management commands
- File quota and various file systems available
- File System Management and Layout, File permissions
- Login process, Managing Disk Quotas
- Links (hard links, symbolic links)

### **Shell introduction and Shell Scripting**

- What is shell and various type of shell, Various editors present in linux
- Different modes of operation in vi editor
- What is shell script, Writing and executing the shell script

- Shell variable (user defined and system variables)
- System calls, Using system calls
- Pipes and Filters
- Decision making in Shell Scripts (If else, switch), Loops in shell
- Functions
- Utility programs (cut, paste, join, tr , uniq utilities)
- Pattern matching utility (grep)

#### **Course Learning Outcomes (CLOs) :**

- CLO1: Documentation will demonstrate good organization and readability.
- CLO2: File processing projects will require data organization, problem solving and research.
- CLO3: Scripts and programs will demonstrate simple effective user interfaces.
- CLO4: Scripts and programs will demonstrate effective use of structured programming.
- CLO5: Scripts and programs will be accompanied by printed output demonstrating completion of a test plan.

#### **Reference Books:**

- Sumitabha, Das, Unix Concepts And Applications, Tata McGraw-Hill Education, 2006
- Michael Jang RHCSA/ RHCE Red Hat Linux Certification: Exams (Ex200 & Ex300) (Certification Press), 2011
- Nemeth Synder & Hein, Linux Administration Handbook, Pearson Education, 2nd Edition ,2010
- W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Unix Network Programming, The sockets Networking API, Vol. 1, 3rd Edition,2014

**Course Code : STUGCS3/SEEC1X**

**Course Name : Machine Learning**

**Course Credit Hour : 4hr**

**Total Contact Hour : 60hr**

**Course Objective :** Machine learning is a field of computer science that provides computers with the capability to learn without being explicitly programmed. It is a part of artificial intelligence (AI) that allows software applications to become more precise in predicting outcomes without being explicitly programmed.

- **Course outcome :** You will get better knowledge of programming and how to implement it for actual development requirements in the industrial projects and applications.
- Enhanced knowledge on the web development framework. Using this framework, you can develop dynamic websites swiftly.

- You will learn how to design, develop, test, support and deploy desktop, custom web, and mobile applications.

### **Course Content:**

**Introduction:** Concept of Machine Learning, Applications of Machine Learning, Key elements of Machine Learning, Supervised vs. Unsupervised Learning, Statistical Learning: Bayesian Method, The Naive Bayes Classifier

**Softwares for Machine Learning and Linear Algebra Overview:** Plotting of Data, Vectorization, Matrices and Vectors: Addition, Multiplication, Transpose and Inverse using available tool such as MATLAB.

**Linear Regression:** Prediction using Linear Regression, Gradient Descent, Linear regression with one variable, Linear Regression with multiple variables, Polynomial Regression, Feature Scaling/Selection.

**Logistic Regression:** Classification using Logistic Regression, Logistic Regression vs. Linear Regression, Logistic Regression with one variable and with multiple variables.

**Regularization:** Regularization and its utility: The problem of Overfitting, Application of Regularization in Linear and Logistic Regression, Regularization and Bias/Variance.

**Neural Networks:** Introduction, Model Representation, Gradient Descent vs. Perceptron Training, Stochastic Gradient Descent, Multilayer Perceptrons, Multiclass Representation, Backpropagation Algorithm.

### **Text Books:**

1. Ethem Alpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.
2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012.

### **Course Learning Outcomes (CLOs) :**

- Enhanced knowledge on the web development framework. Using this framework, you can develop dynamic websites swiftly.
- You will learn how to design, develop, test, support and deploy desktop, custom web, and mobile applications.
- Design and improve testing and maintenance activities and procedures.
- Design, implement and develop important applications in a Machine Learning environment.
- Increased chances of working in leading software companies like Infosys, Wipro, Amazon, TCS, IBM and many more.



**Course Code: STUGCS3/SEEC1X**  
**Course Credit Hour: 4hr**

**Course Name: Mobile Computing**  
**Total Contact Hour: 60hr**

**Course Objective:**

- To give an idea of mobile applications and development phase. .
- To deal with different signal handling mechanisms.

**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.

**Reference books :**

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

**Online links for study & reference materials :**

<https://noidatut.com/>

**Course Code :** STUGCS3/SEEC1X  
**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 outcome :**

- Learn the theory and foundations of software testing
- 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 :**

- 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, Testing objectives, 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 box testing, 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 regression testing.

**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

**Online links for study & reference materials :**

<https://www.uu.se/en/admissions/master/selma/kursplan/?kKod=1DL321&lasar=>

**Course Code : STUSCS3/GE3X      Course Name : Introduction to 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, 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 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. Tanenbaum : 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 Stallings : Data and Computer Communications, Pearson Education

**Online links for study & reference materials :**

<http://www.svecw.edu.in/Docs%5CCSECNLNotes2013.pdf>

**Course Code:** STUSCS3/GE3X  
**Course Credit Hour:** 4hr

**Course Name:** Introduction to Python  
**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, 1<sup>st</sup> 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/>



**Code: STUGCS3/GE3X**  
**CONTACTS: 4L**

**INFORMATION SECURITY AND CYBER SECURITY**  
**CREDITS: 4**

**Course Objective:** To be able to secure a message over insecure channel by various means. 3. **To learn about how to maintain the Confidentiality, Integrity and Availability of a data.** ... To understand various protocols for network security to protect against the threats in the networks.

**Course Description:** Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications. Gain familiarity with prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath.

**Course Content:**

**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:**

- knowledge of cryptography and network security
- knowledge of security management and incident response
- knowledge of security in software and operating systems

- knowledge of data security and secure system development
- knowledge of privacy and data protection

**References :**

- Godbole, “Information Systems Security”, Willey
- Merkov, Breithaupt, “Information Security”, Pearson Education
- 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.

## **B.Sc. (H) Computer science 2<sup>nd</sup> Year**

### **SEMESTER-IV**

**Course Code: STUGCS4/C08**

**Course Credit Hour: 4hr**

**Course Name: Design Analysis and Algorithm**

**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, Hopcroft 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. Brassard 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>

**Course Code: STUGCS4/CO9**  
**Course Credit Hour: 4hr**

**Course Name: Software Engineering**  
**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 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 approachll, 5th Ed., McGrawHill Int. Ed., 2001.

**Online links for study & reference materials :**

[https://www.vssut.ac.in/lecture\\_notes/lecture1428551142.pdf](https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf)

**Course Code: STUGCS4/C10**  
**Course Credit Hour: 4hr**

**Course Name: Database Management system**  
**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, Codd's Rules.
- **Unit - II:** Data Base Design: Functional Dependency and Decomposition - Functional Dependency - Decomposition. Normalization - Introduction - Normalization - Normal Forms 1NF, 2NF, 3NF - BCNF - 4NF - 5NF.
- **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 NOT, 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.

**Online links for study & reference materials:**

<https://lecturenotes.in/subject/38/database-management-system-dbms>



**Course Code: STUGCS4/GE4X**  
**Course Credit Hour: 4hr**

**Course Name: Web & E-Commerce**  
**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](http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf)

**Course Code: STUGCS4/GE4X**  
**Course Credit Hour : 4hr**

**Course Name: Hypertext Preprocessor**  
**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/>**

**Course Code: STUGCS4/GE4X**  
**Course Credit Hour: 4hr**

**Course Name: Introduction to DBMS**  
**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, Codd's Rules.
- **Unit - II:** Data Base Design: Functional Dependency and Decomposition - Functional Dependency - Decomposition. Normalization - Introduction - Normalization - Normal Forms 1NF, 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 NOT, and

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:**

2. 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:**

3. Silberschatz, Korth, Database System Concepts, McGraw hill, 5th edition, 2005.
4. Rob, Coronel & Thomson, Database Systems Design: Implementation and Management, 2009.

#### **Online links for study & reference materials:**

<https://lecturenotes.in/subject/38/database-management-system-dbms>

**Course Code: STUGCS4/SEEC2X**  
**Course Credit Hour: 4hr**

**Course Name: Introduction to ORACLE**  
**Total Contact Hour: 60hr**

**Course Objectives:** An introduction to the design and creation of relational databases. Topics include storing, retrieving, Updating and displaying data using Structured Query Language (SQL) integrated into Stored Procedures, Functions, Packages and Triggers (PL/SQL Programming).

**Course Description:**

The course will have both lab and lecture. The student will be required to do assigned readings from the text and handouts as well as scheduled individual labs to reinforce the material covered in class. Scheduled tests will be used to assess the progress of the student toward achievement of the course objectives.

**Course Contents:**

**Unit-I: SQL Vs. SQL \* Plus:** SQL Commands and Data types, Operators and Expressions, Introduction to SQL \* Plus.

**UNIT 2: Managing Tables and Data:**

- Join, Built in functions
- Creating and Altering Tables (Including constraints)
- Data Manipulation Command like Insert, update, delete
- SELECT statement with WHERE, GROUP BY and HAVING, ORDER BY, DISTINCT, Special operator like IN, ANY, ALL BETWEEN, EXISTS, LIKE.

**UNIT 3: Other Database Objects**

- View
- Synonyms, Index

**UNIT 4: Transaction Control Statements**

- Commit, Rollback, Savepoint

**UNIT 5: Introduction to PL/SQL**

- SQL v/s PL/SQL
- PL/SQL Block Structure
- Language construct of PL/SQL (Variables, Basic and Composite Data type, Conditions looping etc.)
- % TYPE and % ROWTYPE
- Using Cursor (Implicit, Explicit)

**Course Learning Outcomes (CLOs) :**

1. Enhance the knowledge and understanding of Database analysis and design.
2. Enhance the knowledge of the processes of Database Development and Administration using SQL and PL/SQL.
3. Enhance Programming and Software Engineering skills and techniques using SQL and PL/SQL.
4. Preparation of background materials and documentation needed for Technical
5. Support using SQL and PL/SQL.
6. Use the Relational model and how it is supported by SQL and PL/SQL.

7. Use the PL/SQL code constructs of IF-THEN-ELSE and LOOP types as well as syntax and command functions.
8. Solve Database problems using Oracle 9i SQL and PL/SQL. This will include the use of Procedures, Functions, Packages, and Triggers.

### **Books Recommended:**

1. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle Paperback", BPB Publications, 2010.
2. Steven Feuerstein, Bill Pribyl, "Oracle PL/SQL Programming", 6th Edition, O'Reilly Media, 2014.
3. Rajeeb C. Chatterjee, "Learning Oracle SQL and PL/SQL: A simplified Guide", PHI, 2012.
4. Ron Hardman, Michael McLaughlin, "Expert Oracle PL/SQL", Oracle Press, 2005.
5. Michael McLaughlin, "Oracle Database 11g PL/SQL Programming", Oracle Press, 2008.
6. John Watson, Roopesh Ramklass, "OCA Oracle Database 11g SQL Fundamentals I Exam Guide", Oracle Press, 2008.

### **Online links for study & reference materials :**

<https://noidatut.com/>

**Course Code : STUGCS4/ SEEC2X**  
**Course Credit Hour : 4hr**

**Course Name : Intro to MICROPROCESSOR**  
**Total Contact Hour : 60hr**

**Course Objective :**

- To introduce students with the architecture and operation of typical microprocessors and microcontrollers.
- To familiarize the students with the programming and interfacing of microprocessors and microcontrollers.
- To provide strong foundation for designing real world applications using microprocessors and microcontrollers.

**Course Description :**

The Purpose of the course is to provide students with the Knowledge of Microprocessors and Microcontroller. To solve real world problems in an efficient manner, this course also emphasis on architecture, Programming and system design used in various day to day gadgets.

**Course Contents :**

**Unit 1:** Microprocessor architecture: Internal architecture, system bus architecture, memory and I/O interfaces.

**Unit 2:** Microprocessor programming: Register Organization, instruction formats, assembly language programming.

**Unit 3:** Interfacing: Memory address decoding, cache memory and cache controllers, I/O interface, keyboard, display, timer, interrupt controller, DMA controller, video controllers, communication interfaces.

**Course Learning Outcomes(CLOs) :**

CO1: recall and apply a basic concept of digital fundamentals to Microprocessor based personal computer system.

CO2: identify a detailed s/w & h/w structure of the Microprocessor.

CO3: illustrate how the different peripherals (8255, 8253 etc.) are interfaced with Microprocessor.

CO4: distinguish and analyze the properties of Microprocessors & Microcontrollers.

CO5: analyze the data transfer information through serial & parallel ports.

CO6: train their practical knowledge through laboratory experiments.

**Recommended Books:**

- Barry B. Brey : The Intel Microprocessors : Architecture, Programming and Interfacing. Pearson Education, Sixth Edition, 2009.
- Walter A Triebel, Avtar Singh; The 8088 and 8086 Microprocessors Programming, Interfacing, Software, Hardware, and Applications. PHI, Fourth Edition 2005.



**Course Code: STUGCS4/ SEEC2X**  
**Course Credit Hour: 4hr**

**Course Name: XML Programming**  
**Total Contact Hour: 60hr**

**Course Objective:**

- Expose the students to the XML family of technologies, and the latest W3C and WS-I XML standards.
- Expand the students understanding of the various applications of XML in the areas of information representation, Presentation Oriented Publishing, Message Oriented Computing, and Application Configuration. Web Services Protocols.
- Expose the students to the combined use of XML and Java technologies to support the development of modern applications targeted to the evolving spectrum of distributed and decentralized enterprise platforms.

**Course Description:**

The course provides an in-depth coverage of XML-based Java-enabled functionality. Students will learn how to specify, and manipulate XML data from Java programs using existing implementations of the current W3C specifications for the Domain Object Model (DOM) and Simple API for XML SAX).

**Course Contents:**

**Unit 1: Introduction:** Understanding Mark-up Languages,  
Introduction to XML and its Goals.

**UNIT 2: XML Basics:** XML Structure and Syntax,  
Document classes and Rules.

**UNIT 3: Other XML Concepts:** Scripting XML, XML as Data,  
Linking with XML.

**UNIT 4: XML with Style:** XSL –Style Sheet Basics,  
XSL basics, XSL style sheets.

**Course Learning Outcomes (CLOs):**

- Expose the students to the advanced XML-enabled capabilities of the Java 2 development environment for Enterprise Applications.
- Demonstrate the use of XML to support the modern approach at building comprehensive business applications using XML Markup Language technologies, XML information modeling, XML information processing, XML information rendering, XML information retrieval, XML secure messaging, XML-Based frameworks, and XML application implementation and testing methodologies and tools.
- Demonstrate the application of XML in distributed communications enabling, enterprise systems assurance, web enabling, application enabling, and enterprise data enabling.
- Expand students understanding of the current industry support for XML technologies.
- Sharpen the students practical development skills via focused assignments and projects.

**Recommended Books:**

1. XML in action web technology by William J. Pardi
2. Step by Step XML by Michael J. Young

**Course Code: STUGCS4/SEEC2X**  
**Course Credit Hour: 4hr**

**Course Name : Web Technology**  
**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

**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 : Fundamentals of HTML, PHI.
- Fairely, R.E. : HTML Engineering Concepts, McGraw-Hill.
- Lewis, T.G.: Learn CSS, McGraw-Hill.

**Online links for study & reference materials :**

<https://noidatut.com/>

**Course Code: STUGCS4/ SEEC2X**  
**Course Credit Hour: 4hr**

**Course Name: R Programming**  
**Total Contact Hour: 60hr**

**Course Objective:** The objective of this module to make students exercise the fundamentals of statistical analysis in R environment. They would be able to analysis data for the purpose of exploration using Descriptive and Inferential Statistics. Students will understand Probability and Sampling Distributions and learn the creative application of Linear Regression in multivariate context for predictive purpose.

**Course Description:** This course aims to provide a practical introduction to the R programming language. By the end of the day-long course, the user will be comfortable operating in the R environment, including importing external data, manipulating data for specific needs, and running summary statistics and visualizations.

**Course Contents:**

**UNIT 1:** Introduction: Overview and History of R, Getting Help, Data Types, Subsetting, Vectorized Operations, Reading and Writing Data.

**UNIT 2:** Control Structures, Functions, lapply, tapply, split, mapply, apply, Coding Standards.

**UNIT 3:** Scoping Rules, Debugging Tools, Simulation, R Profiler.

**Course Learning Outcomes (CLOs):** After the successful completion of this module, students will be able to:

- Install, Code and Use R Programming Language in R Studio IDE to perform basic tasks on Vectors, Matrices and Data frames.
- Describe key terminologies, concepts and techniques employed in Statistical Analysis.
- Define, Calculate, Implement Probability and Probability Distributions to solve a wide variety of problems.
- Conduct and Interpret a variety of Hypothesis Tests to aid Decision Making.
- Understand, Analyze, Interpret Correlation and Regression to analyse the underlying relationships between different variables.

**Recommended Books:**

1. William N. Venables and David M. Smith, An Introduction to R. 2<sup>nd</sup> Edition Network Theory Limited.2009.
2. Norman Matloff, The Art of R Programming - A Tour of Statistical Software Design, No Starch Press.2011.

## **B.Sc. (H) Computer science 3<sup>rd</sup> Year**

### **SEMESTER-V**

**Course Code : STUGCS5/C11**

**Course Credit Hour : 4hr**

**Course Name : VISUAL DOT NET**

**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, Stream Readers and Stream Writers, working with binary data, configuring objects for serialization, Working with and creating custom generic types.

##### **UNIT - IV**

**Processes, App Domains, 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>

**Course Code: STUGCS5/C12**  
**Course Credit: 04**

**Course Name: Management Information System**  
**Contact Hour: 60 hrs**

**Course Objective:** The aim of this course is:

1. To describe the role of information technology and decision support systems in business and record the current issues with those of the firm to solve business problems.
2. To introduce the fundamental principles of computer-based information systems analysis and design and develop an understanding of the principles and techniques used.

**Course Description:** This course is designed to enable the students to use information to assess the impact of the Internet and Internet technology on electronic commerce and electronic business and understand the specific threats and vulnerabilities of computer systems.

**Course Content:**

**Unit 1:** Foundation of Information Systems: Introduction to information system in business, fundamentals of information systems, Solving business problems with information systems, Types of information systems, Effectiveness and efficiency criteria in information system.

**Unit 2:** An overview of Management Information Systems: Definition of a management information system, MIS versus Data processing, MIS & Decision Support Systems, MIS & Information Resources Management, End user computing, Concept of an MIS, Structure of a Management information system.

**Unit 3:** Concepts of planning & control: Concept of organizational planning, The Planning Process, Computational support for planning, Characteristics of control process, The nature of control in an organization.

**Unit 4:** Business applications of information technology: Internet & electronic commerce, Intranet, Extranet & Enterprise Solutions, Information System for Business Operations, Information System for Managerial Decision Support, Information System for Strategic Advantage.

**Unit 5:** Managing Information Technology: Enterprise & global management, Security & Ethical challenges, Planning & Implementing changes. Advanced Concepts in Information Systems: Enterprise Resource Planning, Supply Chain Management, Customer Relationship Management, and Procurement Management.

**Course Outcome:**

Upon completion of this course, students will be able to:

1. Relate the basic concepts and technologies used in the field of management information systems;
2. Compare the processes of developing and implementing information systems.
3. Outline the role of the ethical, social, and security issues of information systems.
4. Translate the role of information systems in organizations, the strategic management processes, with the implications for the management.
5. Apply the understanding of how various information systems like DBMS work together to accomplish the information objectives of an organization.

**Text Books**

1. O Brian, "Management Information System", TMH
2. Gordon B. Davis & Margrethe H. Olson, "Management Information System", TMH.

**References**

- O Brian, "Introduction to Information System", MCGRAW HILL.
- Murdick, "Information System for Modern Management", PHI.
- Jawadekar, " Management Information System", TMH.
- Jain Sarika, "Information System", PPM
- Davis, "Information System", Palgrave Macmillan



**Course Code: STUGCS5/DSE1X    Course Name: Data Warehousing and Data Mining**  
**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 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 Web Pages, 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>

**Course Code : STUGCS5/DSE1X**  
**Course Credit Hour : 4hr**

**Course Name : Cloud Computing**  
**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 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/>

**Course Code: STUSCS5/DSE1X**  
**Course Credit Hour: 4hr**

**Course Name: Introduction to Python**  
**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, 1<sup>st</sup> 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/>

**Course Code : STUGCS5/DSE1X**  
**Course Credit Hour : 4hr**

**Course Name : Information Security**  
**Total Contact Hour : 60hr**

**Course Objectives:** The course is designed in a way that a candidate can identify, analyze and remediate computer security breaches by learning and implementing the real-world scenarios in Cyber Investigations Laboratory, Network Security Laboratory and in Security and Penetration Testing Laboratory.

**Course Outcomes:** Upon successful completion of the programme, candidates will be familiar with cyber security landscapes and able to

- a) Analyze and evaluate the cyber security needs of an organization.
- b) Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
- c) Measure the performance and troubleshoot cyber security systems.

**Course Content:**

**Introduction:** Computer network as a threat, hardware vulnerability, Software vulnerability, importance of data security.

**Digital Crime:** Overview of digital crime, criminology of computer crime.

**Information Gathering Techniques:** Tools of the attacker, information and cyber warfare, scanning and spoofing, password cracking, malicious software, session hijacking

**Risk Analysis and Threat:** Risk analysis, process, key principles of conventional computer security, security policies, authentication, data protection, access control, internal vs external threat, security assurance, passwords, authentication, and access control, computer forensics and incident response

**Introduction to Cryptography and Applications :** Important terms, Threat, Flaw, Vulnerability, Exploit, Attack, Ciphers, Codes, Caesar Cipher, Rail-Fence Cipher, Public key cryptography (Definitions only), Private key cryptography (Definition and Example)

**Safety Tools and Issues :** Firewalls, logging and intrusion detection systems, Windows and windows XP / NT security, Unix/Linux security, ethics of hacking and cracking

**Course Outcome:** After successful completion of the course, the learners would be able to

1. Provide security of the data over the network.
2. Do research in the emerging areas of cryptography and network security.
3. Implement various networking protocols.
4. Protect any network from the threats in the world.

**Reference Books:**

1. M. Merkow, J. Breithaupt, Information Security Principles and Practices, Pearson Education.2005
2. G.R.F. Snyder, T. Pardoe, Network Security, Cengage Learning, 2010
3. A. Basta, W.Halton, Computer Security: Concepts, Issues and Implementation, Cengage Learning India, 2008

**Course Code: STUGCS5/DSE2X**

**Course Name: OPERATION RESEARCH**

**CONTACT HR : 4**

**CREDITS: 4**

**Course Objective:** The main objectives of the course are as follows:

1. Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively.
2. Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry

**Course Description:** This course provides an in-depth insight into the concepts, theories, and techniques of Operations Research & Quantitative Techniques and their applications to planning, control, performance which could be successfully used for improving the quality of managerial decisions.

**Course Content:**

**Unit 1.** Linear Programming-Simplex Method, Graphical Method, Duality Method, Assignment Problem, Transportation Problem.

**Unit 2.** Integer Programming-Cutting Plane, Branch & Bound

**Unit 3.** Network Optimisation Models- The shortest path problem, Minimum Spanning Tree Algorithm, Maximal Flow Algorithms, PERT/ CPM.

**Unit 4.** Game Theory-Two person Zero Sum game, saddle point determination, algebraic method, graphical method etc.

**Unit 5.** Inventory Control- Determination of EOQ, Components, Deterministic Continuous & Deterministic Periodic Review Models, Stochastic Continuous & Stochastic Periodic Review Model.

**Course Outcome:**

CO1 Be able to understand the application of OR and frame a LP Problem with solution – graphical and through solver add in excel (software).

CO2 Be able to build and solve Transportation and Assignment problems using appropriate method.

CO3 Be able to design and solve simple models of CPM and queuing to improve decision making and develop critical thinking and objective analysis of decision problems.

CO4 Be able to solve simple problems of replacement and implement practical cases of decision making under different business environments.

CO5 Enables to take best course of action out of several alternative courses for the purpose of achieving objectives by applying game theory and sequencing models.

**Recommended Books:**

1. Operation Research, Kanti Swaroop
2. Operation Research, V.K. Kapoor
3. Operation Research, Paneer Selvam, PHI
4. Operations Research, Hillier & Lieberman, TMH



**Course Code: STUGCS5/DSE2X**  
**Course Credit Hour: 4hr**

**Course Name: Cyber Security**  
**Total Contact Hour: 60hr**

**Course Objectives:** The educational objectives of the program are:

1. To prepare students with the technical knowledge and skills needed to protect and defend computer systems and networks.
2. To develop graduates that can plan, implement, and monitor cyber security mechanisms to help ensure the protection of information technology assets.
3. To develop graduates that can identify, analyze, and remediate computer security breaches.

**Course Outcomes:** Upon successful completion of the programme, candidates will be familiar with cyber security landscapes and able to

1. Identify the key cyber security vendors in the marketplace.
2. Design and develop security architecture for an organization.
3. Design operational and strategic cyber security strategies and policies.

**Course Content:**

**UNIT 1: Introduction to Cyber Space:** History of Internet, Cyber Crime, Information Security, Computer Ethics and Security Policies

**Choosing the Best Browser according to the requirement and email security**

Guidelines to choose web browsers, Securing web browser, Antivirus, Email security.

**Guidelines for secure password and wi-fi security**

Guidelines for setting up a Secure password, Two-steps authentication, Password Manager, Wi-Fi Security.

**UNIT 2: Guidelines for social media and basic Windows security:** Guidelines for social media, Tips and best practices for safer Social Networking, Basic Security for Windows, User Account Password

**Smartphone security guidelines:** Introduction to mobile phones, Smartphone Security, Android Security, IOS Security.

**UNIT 3: Cyber Security Initiatives in India:** Counter Cyber Security Initiatives in India, Cyber Security Exercise, Cyber Security Incident Handling, and Cyber Security Assurance

**Online Banking, Credit Card and UPI Security:** Online Banking Security, Mobile Banking Security, Security of Debit and Credit Card, UPI Security.

**Micro ATM, e-wallet and POS Security:** Security of Micro ATMs, e-wallet Security Guidelines, Security Guidelines for Point of Sales(POS).

**UNIT 4: Social Engineering:** Social Engineering, Types of Social Engineering, How Cyber Criminal Works, Prevent for being a victim of Cyber Crime.

**Cyber Security Threat Landscape and Techniques:** Cyber Security Threat Landscape, Emerging Cyber Security Threats, Cyber Security Techniques, Firewall.

**UNIT 5: IT Security Act and Misc. Topics:** IT Act, Hackers-Attacker-Countermeasures, Web Application Security, Digital Infrastructure Security, Defensive Programming, **Information Destroying and Recovery Tools:** Recovering from Information Loss, Destroying Sensitive Information, C Cleaner for Windows.

**Course Outcome:** Upon completion of the degree program, students will be able to:

1. Analyze and evaluate the cyber security needs of an organization.
2. Conduct a cyber security risk assessment.
3. Measure the performance and troubleshoot cyber security systems.
4. Implement cyber security solutions.
5. Be able to use cyber security, information assurance, and cyber/computer forensics software/tools.

**Books and references**

1. Introduction to Cyber Security available at <http://uou.ac.in/foundation-course>
2. Fundamentals of Information Security <http://uou.ac.in/progdetail?pid=CEGCS-17>
3. Cyber Security Techniques <http://uou.ac.in/progdetail?pid=CEGCS-17>
4. Cyber Attacks and Counter Measures: User Perspective <http://uou.ac.in/progdetail?pid=CEGCS-17>
5. Information System <http://uou.ac.in/progdetail?pid=CEGCS-17>

## **B.Sc. (H) Computer science 3<sup>rd</sup> Year**

### **SEMESTER-VI**

**Course Code : STUGCS6/C11**

**Course Credit Hour : 4hr**

**Course Name : Artificial intelligence**

**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/>

**Course Code : STUGCS6/C12**  
**Course Credit Hour : 4hr**

**Course Name : Computer Graphics**  
**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/>

**Course Code STUGCS6/DSE3X**  
**Course Credit Hour: 4hr**

**Course Name: Big Data**  
**Total Contact Hour: 60hr**

**COURSE OBJECTIVES:**

- Understand the Big Data Platform and its Use cases
- Provide an overview of Apache Hadoop
- Provide HDFS Concepts and Interfacing with HDFS
- Understand Map Reduce Jobs
- Provide hands on Hadoop Eco System
- Apply analytics on Structured, Unstructured Data.
- Exposure to Data Analytics with R.

**COURSE OUTCOMES:** The students will be able to:

- Identify Big Data and its Business Implications.
- List the components of Hadoop and Hadoop Eco-System
- Access and Process Data on Distributed File System
- Manage Job Execution in Hadoop Environment
- Develop Big Data Solutions using Hadoop Eco System
- Analyze Infosphere BigInsights Big Data Recommendations.
- Apply Machine Learning Techniques using R.

**Course Contents:**

**UNIT I : INTRODUCTION TO BIG DATA AND HADOOP** Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analyzing Data with Unix tools, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Info-sphere Big-Insights and Big Sheets.

**UNIT II : HDFS(Hadoop Distributed File System)** The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

**UNIT III: Map Reduce Anatomy:** Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

**Unit IV: Hadoop Eco System Pig:** Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Meta-store, and Comparison with Traditional Databases, Hive-QL, Tables, Querying Data and User Defined Functions.

**H-base:** H-Basics, Concepts, Clients, Example, H-base Versus RDBMS.

**Big SQL:** Introduction

**UNIT V: Data Analytics with R Machine Learning:** Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with Big-R.

**Course Learning Outcomes (CLOs):**

CO1 Understand the basic concepts of artificial neural networks

CO2 Model Neuron and Neural Network, and to analyze ANN learning, and its applications.

CO3 Develop different single layer/multiple layer Perception learning algorithms.

CO4 Design of another class of layered networks using deep learning principles

**Text Books:**

- Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
- Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

**References:**

- Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
- Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
- Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.



**Course Code STUGCS6/DSE3X**  
**Course Credit Hour : 4hr**

**Course Name : Cryptography & Network Security**  
**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 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 – Elgamal 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/>

**Course Code: STUGCS6/DSE3X**  
**Course Credit Hour: 4hr**

**Course Name: Web Technology**  
**Total Contact Hour: 60hr**

**Course 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

**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. : HTML Engineering Concepts, McGraw-Hill.
- Lewis, T.G.: Learn CSS, McGraw-Hill.

**Online links for study & reference materials:**

<https://noidatut.com/>

**Course Code: STUSCS6/DSE3X**  
**Course Credit Hour: 4hr**

**Course Name: Networking Programming**  
**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.

**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, 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 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. Tanenbaum: 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 Stallings : Data and Computer Communications, Pearson Education

**Online links for study & reference materials:**

<http://www.svecw.edu.in/Docs%5CCSECNLNotes2013.pdf>

**Course Code: STUSCS6/DSE4X**  
**Course Credit Hour: 4hr**

**Course Name: Computer Based Numerical Analysis**  
**Total Contact Hour: 60hr**

**Course Objective:** The objectives of this course are:

1. To provide suitable and effective methods called Numerical Methods, for obtaining approximate representative numerical results of the problems.
2. To solve problems in the field of Applied Mathematics, Theoretical Physics and Engineering this requires computing of numerical results using certain raw data

**Course Description:**

To explore complex systems, physicists, engineers, financiers and mathematicians require computational methods since mathematical models are only rarely solvable algebraically. Numerical methods, based upon sound computational mathematics, are the basic algorithms underpinning computer predictions in modern systems science. Such methods include techniques for simple optimization, interpolation from the known to the unknown, linear algebra underlying systems of equations, ordinary differential equations to simulate systems, and stochastic simulation under random influences.

**Course Contents:**

**Module I:** 6L Approximation in numerical computation: Truncation and rounding errors, Fixed and floating point arithmetic, Propagation of errors and corresponding programming.

**Module II:** 10L Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation and corresponding programming.

**Module III:** 6L Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms and corresponding programming.

**Module IV:** 8L Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method and corresponding programming.

**Module V:** 6L Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton Raphson method and corresponding programming.

**Module VI:** 8L Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector Methods and Finite Difference method and corresponding programming.

**Course learning outcome:** On completion of the course students will be able to

1. Apply Numerical analysis which has enormous application in the field of Science and some fields of Engineering.
2. Familiar with finite precision computation.
3. Familiar with numerical solutions of nonlinear equations in a single variable.

4. Familiar with numerical integration and differentiation, numerical solution of ordinary differential equations.
5. Familiar with calculation and interpretation of errors in numerical method.
6. Familiar with programming with numerical packages like MATLAB

**Text Books:**

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

**Reference Books:**

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

**Course Code STUGCS6/DSE4X**  
**Course Credit Hour: 4hr**

**Course Name: Digital Image Processing**  
**Total Contact Hour: 60hr**

**COURSE OBJECTIVES:**

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures.

**COURSE OUTCOMES:**

- Understand the need for image transforms different types of image transforms and their properties.
- Develop any image processing application.
- Understand the rapid advances in Machine vision.

**Course Contents:**

**UNIT 1: Introduction:** Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Perspective Projection, Spatial Domain Filtering, sampling and quantization.

**Spatial Domain Filtering:** Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian.

**UNIT 2: Filtering in the Frequency domain:** Hotelling Transform, Fourier Transforms and properties, FFT (Decimation in Frequency and Decimation in Time Techniques), Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering.

**Image Restoration:** Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Estimation of Degradation functions, Restoration from projections.

**UNIT 3: Image Compression:** Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Entropy of an information source, Shannon's 1st Theorem, Huffman Coding, Arithmetic Coding, Golomb Coding, LZW coding, Transform Coding, Sub-image size selection, blocking artifacts, DCT implementation using FFT, Run length coding, FAX compression (CCITT Group-3 and Group-4), Symbol-based coding, JBIG-2, Bit-plane encoding, Bit-allocation, Zonal Coding, Threshold Coding, JPEG, Lossless predictive coding, Lossy predictive coding, Motion Compensation

**UNIT 4: Wavelet based Image Compression:** Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding, Digital Image Watermarking.



**UNIT 5: Morphological Image Processing:** Basics, SE, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.

**Image Segmentation:** Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding, Otsu's method, Moving averages, Multivariable thresholding, Region-based segmentation, Watershed algorithm, Use of motion in segmentation

**Course Learning Outcomes (CLOs):**

CO1: Review the fundamental concepts of a digital image processing system.

CO2: Analyze images in the frequency domain using various transforms.

CO3: Evaluate the techniques for image enhancement and image restoration.

CO4: Categorize various compression techniques.

CO5: Interpret Image compression standards.

CO6: Interpret image segmentation and representation techniques.

**Text Books:**

1. R. C.Gonzalez, R.E.Woods,” Digital Image processing”, Pearson edition, Inc3/e, 2008.
2. A.K.Jain,” Fundamentals of Digital Image Processing”, PHI, 1995

**References:**

1. J.C. Russ,” The Image Processing Handbook”, (5/e), CRC, 2006
2. R.C.Gonzalez & R.E. Woods; “Digital Image Processing with MATLAB”, Prentice Hall, 2003.