Noida International University

Evaluation Scheme & Syllabus

For

B. Tech

(Bio Technology)

On

AICTE MODEL CURRICULUM

(Effective from the Session: 2018-19)

Noida International University

FOR B. TECH-BIOTECHNOLOGY COURSE

(Effective from Academic session 2018-2019)

Introduction- B. Tech in Biotechnology is an academic programme of the duration of four years. Biotechnology engineering is an undergraduate degree programme in applied sciences that amalgamates the facts from both Biological sciences and technology. This study utilizes the biological processes which include the study of microorganisms or knowledge of antibiotics and further implement them in various industrial purpose.

In simple terms, Biotechnology is a study which involves the use of living organisms. The living organisms are used to make useful chemicals which can be utilized in industries. Biotechnological products are used in areas like agriculture, food sciences and medicine.

Program Educational Objectives (PEOs)

The Department of Biotechnology has developed and maintained a well-defined set of educational objectives and desired program outcomes. Educational objectives of the program cater to the requirements of the stakeholders such as students, parents, employers, alumni, faculty etc. The program educational objectives are as follows:

- **PEO**1: Provide graduates with a strong foundation in mathematics, science and engineering fundamentals to enable them to devise and deliver efficient solutions to challenging problems in Electronics, Communications and allied disciplines.
- **PEO**2: Impart analytic and thinking skills to develop initiatives and innovative ideas for R&D, Industry and societal requirements.
- **PEO**3: Provide sound theoretical and practical knowledge of both Biological sciences and technology, managerial and entrepreneurial skills to enable students to contribute to the well-being of society with a global outlook.
- **PEO**4: Inculcate qualities of teamwork as well as social, interpersonal and leadership skills and an ability to adapt to evolving professional environments in the domains of engineering and technology.
- **PEO**5: Motivate graduates to become good human beings and responsible citizens for the overall welfare of the society.

Programme specific outcome (PSO)

- Acquire knowledge on the fundamentals of biotechnology for sound and solid base which enables them to understand the emerging and advanced engineering concepts in life sciences.
- Acquire knowledge in domain of biotechnology enabling their applications in industry and research.

- Empower the students to acquire technological knowhow by connecting disciplinary and interdisciplinary aspects of biotechnology

Program outcomes (POs)

Engineering Graduates will be able to:

- **PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Credit System-Credit requirement for award of B. Tech:

- Every semester shall offer a minimum of 12 credits and a maximum of 24 credits.
- Credits for the Project or Thesis can vary from 10 to 15.
- The total number of credits for the B. Tech Degree Course could vary from a minimum of 158 credits to a maximum of 178 credits.
- All courses of study put together would engage the students for a minimum of 26 periods or hours of study a week and a maximum of 30 periods or hours a week.

Under the Choice based credit system, which is a student or learner centric system, the courses of study in the B. Tech Degree course shall be as under:

a) Professional Core (PC) Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
b) Basic Sciences and Engineering Science (BS and ES) Course: A course which informs the Professional core and should compulsorily be studied.
c) Elective Course: Generally, a course which can be chosen from a pool of courses and are of two types:
(i) Professional Elective (PE) which may be very specific or specialized or advanced or supportive to the discipline or subject of study or which provides an extended scope
(ii) Open Elective (OE) which enables an exposure to some other discipline or subject or domain or nurtures the candidate 's proficiency or skill

The Weightage in terms of Credits for each of the above in the prescribed curriculum of the institution shall be as follows:

S.no.	Credit Breakups	Credits
1	Humanities and Social Sciences including Management courses	11
2	Basic Science courses	23
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	20
4	Professional core courses	59
5	Professional Elective courses relevant to chosen specialization/branch	16
6	Open subjects – Electives from other technical and /or emerging subjects	12
7	Project work, seminar and internship in industry or elsewhere	17
8	Mandatory Courses	0
		*158

***Minor variation is allowed as per need of the respective disciplines**.

While calculating credits the following guidelines shall be adopted, namely: -

- 1 Hr. Lecture (L) per week 1 credit
- 1 Hr. Tutorial (T) per week 1 credit
- 1 Hr. Practical (P) per week 0.5
- 2 Hours Practical (Lab)/week 1 credit

Credit distribution in each semester (160 credits to 8 semesters)

Semester	**Credits**		
	Theory	Practical	Total
1st	14	6.5	20.5
2nd	13	4.5	17.5
3rd	18	4	22
4th	18	3	21
5th	17	5	22
6th	18	3	21
7th	14	7	21
8th	6	9	15
Total	**113**	**42**	**160**

Course coding system

Every course coded as follows:

BSC : Basic Science Courses

ESC : Engineering Science Course

MC : Mandatory Courses

HSMC : Humanities and Social Sciences including Management

PCC : Program core courses

PEC : Program Elective courses

OEC : Open Elective courses

SEMESTER- III											
Sl. No	**Subject Codes**	**Subjects**	**Contact Hours/Week**			**Evaluation Scheme End Semester**					
			L	**T**	**P**	**CA**	**TA**	**Total Internal**	**External**	**Total**	**Credit**
1	ESC 201	Data Structure & Algorithms	3	1	0	20	20	40	60	100	4
2	HSMC 201/ HSMC 202	Effective Technical Communication/Universal Human values	2 / 3	1 / 0	0 / 0	20	20	40	60	100	3
3	PCC-BT 301	Techniques in Biotechnology	3	1	0	20	20	40	60	100	4
4	PCC-BT-302	Microbiology & Immunology	3	1	0	20	20	40	60	100	4
5	PCC-BT-303	Biochemistry	3	0	0	20	20	40	60	100	3
6	PLC-BT-321	Techniques in Biotechnology Lab	0	0	2	20	20	40	60	100	1
7	PLC-BT-322	Microbiology & Immunology Lab	0	0	2	20	20	40	60	100	1
8	PLC-BT-323	Biochemistry Lab	0	0	2	20	20	40	60	100	1
9	PROJ- BT-01	Mini Project or Internship Assessment*	0	0	2	20	20	40	60	100	1
10		**MOOCs (Essential for Hons Degree)**									
		Total	**19**		**8**					**1000**	**22**

***The Mini Project or internship (3-4 weeks) conducted during summer break after II semester and will be assessed during III semester.**

SEMESTER- IV											
Sl. No.	**Subject Codes**	**Subjects**	**Contact Hours/Week**			**Evaluation Scheme End Semester**					
			L	**T**	**P**	**CA**	**TA**	**Total Internal**	**External**	**Total**	**Credits**
1	BSC 202	Maths V	3	1	0	20	20	40	60	100	4
2	HSMC 202/ HSMC 201	Universal Human Values/ Effective Technical Communication	3 2	0 1	0 0	20	20	40	60	100	3
3	PCC-BT 401	Bioprocess Engineering I	3	0	0	20	20	40	60	100	3
4	PCC-BT 402	Genetics & Molecular Biology	3	1	0	20	20	40	60	100	4
5	PCC-BT 403	Enzyme Engineering	3	1	0	20	20	40	60	100	4
6	PLC-BT 401	Bioprocess Engineering I Lab	0	0	2	20	20	40	60	100	1
7	PLC-BT 402	Genetics & Molecular Biology Lab	0	0	2	20	20	40	60	100	1
8	PLC-BT 403	Enzyme Engineering Lab	0	0	2	20	20	40	60	100	1
9	MC 02	Python	2	0	0	20	20	40	60	100	0
10		**MOOCs (Essential for Hons Degree)**									
		Total								**900**	**21**

B. TECH BIOTECHNOLOGY

(LIST OF PROFESSIONAL ELECTIVES & OPEN ELECTIVES SUBJECTS)

DEPARTMENTAL ELECTIVES -I
DE BT 11: Pharmaceutical Biotechnology
DE BT 12: Nano Biotechnology
DE BT 13: Biomedical Instrumentation
DE BT 14: Metabolic Engineering

DEPARTMENTAL ELECTIVES - II
DE BT 21: Biofuels and alcohol technology
DE BT 22: Descriptive Statistics & Process Control
DE BT 23: 3-D Printing
DE BT 24: Molecular modelling and drug design

DEPARTMENTAL ELECTIVES – III
DE BT 31: Animal Biotechnology
DE BT 32: Biomarker & Diagnostics
DE BT 33: Food Biotechnology
DE BT 34: Entrepreneurship in Biotechnology

DEPARTMENTAL ELECTIVES – IV
DE BT 41: Big Data Analytics
DE BT 42: Biosimilar Technology
DE BT 43: Stem Cell Technology
DE BT 44: Gene Expression & Transgenic

DEPARTMENTAL ELECTIVES – V
DE BT 51: Precision Medicine & Wellness
DE BT 52: Tissue Engineering
DE BT 53: Waste Management & Upcycling

OPEN ELECTIVES-I
1. Database Management System
2. Embedded System
3. GIS & Remote Sensing
4. Computer based Numerical Techniques

OPEN ELECTIVES-II
1. Internet of Things
2. Artificial Intelligence
3. Software Project Management System

OPEN ELECTIVES-III
1. Robotics

2. Food and Nutrition Technology
3. Cyber Security

OPEN ELECTIVES-IV

1. Bioterrorism and National Security
2. Data Sciences
3. Block chain

SEMESTER III

Course Code: ECS 201 **Course Name**: Data Structure & Algorithms

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

Course Objective:

To introduce the fundamental concept of data structures and to emphasize the importance of data structures in developing and implementing efficient algorithms.

Course Description:

This course will describe common applications for arrays, records, linked structures, stacks, queues, trees and graphs.

Course Contents:

UNIT-I:
Introduction to data structure and Algorithms: Performance analysis of Algorithm, time complexity, Big-oh notation, Elementary data organization data structure operations, Recurrences, Arrays, Operation on arrays, representation of arrays in memory, single dimensional and multidimensional arrays, spare matrices, Character storing in C, String operations.

UNIT-II:
Stacks, Quesues and Linked Lists: Stack operation, PUSH and POP, Array representation of stacks, Operation associated with stacks Application of stacks, Recursion, Polish experession, Representation quesuesopration on quesues, Priority quesuesDquesues, Singly and circularly linked list, List operations Lists implementations.

UNIT-III:
Tree: Basic terminology, Binary Trees, Binary tree representation, Algebraic/expressions, Complete Binary Trees, Extended binary tree, representing binary tress in memory, linked representation of Binary trees, Traversing binary trees & Searching in binary trees, Inserting in binary search trees, Complexity of searching algorithm, Heaps, general trees, Threaded binary tree.

UNIT-IV:
GraphS: Terminology & representations, Graphs &Multigraphs, Directed Graphs, Sequential representation of graphs, adjacency Matrices, Transversal, connected component and spanning trees, Minimum Cost spanning tree, Prims and Kruskal Algorithm, BFS, DFS, Shortest path and transitive closure, Activity networks, topological sort and critical paths.

UNIT-V:
Searching and Sorting: Linear search, binary Search, Internal and External sorting, Bubble sorting, selection sort, Insertion sort, quick sort, Two way merge sort, Heap sort, sorting on different keys, practical consideration for internal sorting, External Sorting, Storage Devices: Magnetic tapes, Disk Storage, Sorting with disks and Indexing techniques, introduction to B tree and B+ tree, File organization and storage management, Introduction to hoisting.

Course Learning Outcomes (CLOs):

CO1: Designs and analyzes simple algorithms

CO2: Understands and restates the fundamentals of basic data structures.
CO3: Develops skills in implementations and applications of data structures.

Text books:

1. Data Structures and Algorithms, A.V. Aho, J.E. Hopcroft and J. Ullman, Addison- Wesley Publishing
2. Database Design, Development and Deployment with Student CD, P. Rob and E. Semaan, McGraw-Hill/Irwin
3. Schaum‟s Outline of Data Structures with C++, J.R. Hubbard, McGraw Hill Trade.

Reference books:

1. Database system concepts, A. Silberschatz, P.B. Galvin and G. Gagne, John Wiley and Sons Inc.
2. Introduction to Data Structures and Application, J. Tremblay and P.G. Sorensen, McGraw Hill College Division

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

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

Course Code: HSMC 201 **Course Name:** Effective Technical Communication
Course Credit Hour: 3Hr **Total Contact Hour:** 30hr

Course Objective:

The course aims to provide insights related to communication skills. It aims to train the student to the basic concept of effective communication and self-development preparation.

Course Description:

This course introduces the fundamental concepts of communication skills, writing skills presentation skills and technical skills. Topic includes introduction to Grammar, speaking skills, Writing Skills, Presentation skills, Interview skills. Goal settings

Course Contents:

UNIT-I: Information Design and Development-
Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

UNIT-II: Technical Writing, Grammar and Editing-
Technical writing process, forms of discourse, writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Human factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

UNIT-III: Self Development and Assessment-
Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, taking notes; Complex problem solving; Creativity

UNIT-IV: Communication and Technical Writing-
Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

UNIT-V: Ethics-
Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, engineering ethics, managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, taking notes, Complex problem solving, Creativity.

Course Learning Outcomes (CLOs):

CLO-1: Develop the basics about organization and documents.
CLO-2: Inculcate writing skills and grammar.

CLO-3: Develop the importance of self-analysis and self-awareness.
CLO-4: Understand technical writing skills, Public speaking
CLO-5: Demonstrate ethical skills.

Text books:

(i) Raman, Singh – Business communication – Oxford Press
(ii) The sounds of English, Veena Kumar, Makaav Educational Software, New Delhi.
(iii) David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. NewYork, 2004
(iv) Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN0312406843)

Reference books:

(i) English Phonetics & Phonology, P. Roach, Cambridge University Press, London
(ii) Shiv Khera, You Can Win, Macmillan Books, New York, 2003.

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

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

Course Code: PCC BT 301 **Course Name**: Techniques in Biotechnology

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

Course Objective:

To learn different modern analytical techniques used in biotechnology and to give students a solid foundation in biology and chemistry.

Course Description:

To develop analytical and critical thinking skills in biological phenomena through scientific methods.
Student will be prepared for understanding further courses related to biochemical engineering and improvement in analytical skills.

Course Contents:

UNIT-I: Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, Electron microscopy: TEM and SEM, Atomic force microscopy and con focal scanning laser microscopy. Differential interference contrast microscopy

UNIT-II: Principle and Operations of Chromatography, Thin layer chromatography, Ion Exchange Chromatography, High Performance Liquid Chromatography (HPLC), Gas Liquid Chromatography (GLC), Gel Filtration Chromatography, Affinity Chromatography.

UNIT-III: Electromagnetic radiation and spectrum,Atomic absorption and Atomic emission spectroscopy,Principle, working and applications of UV-VIS, NMR, ESR and IR spectrometer, Principle and applications of Mass Spectroscopy, Circular Dichorism (CD) principles, Principle and applications of Positron Emission Tomography(PET), Basics of X-Ray diffraction analysis and their application in biotechnology .

UNIT-IV: Theory of Electrophoresis, Factors affecting the migration of substances Gel electrophoresis, PAGE, SDS-PAGE, Agarose Electrophoresis of Nucleic Acid, Isoelectric Focusing of Protein Pulse Gel Electrophoresis and Western Blotting. Theory of centrifugation and sedimentation. Types of centrifuges, Preparative and analytical centrifugation; Density gradient centrifugation. Application of centrifugation for preparative and analytical purpose.

UNIT-V: Principles of 3-D printing, 3-D Bioprinting of tissues, organs and bacteria.Ideal material properties for bioprinting, Biosensors: Principles and definition, characteristics of Ideal biosensors, Biochemical components of biosensors:Enzyme based biocatalyst sensors, Bioaffinity systems, Immunosensors. Principle and working of Flow Cytometry and cell sorter.

Course Learning Outcomes (CLOs):

CO1: On completion of the **courses** students will be able to understand the basic unit of the organism.

CO2: To differentiate the organisms by its cell structure.

CO3: To know Components of the Cell and their division.
CO4: To explain the arrangement of Genes and their interaction

Text books:

(i) Wilson, K, Walker, J., Principles and Techniques of Practical Biochemistry. 5th Ed. - Cambridge University Press,. Cambridge 1999.
(ii) Sabari Ghosal & Anupama Sharma Awasthi., Fundamentals of Bioanalytical Techniques and Instrumentation, PHI learning Second edition (2018)

Reference books:

(i) Bioanalytical Techniques by A. Shourie and S S Chapadgaonkar. TERI Press. 2015
(ii) Immunoassay and Other Bioanalytical Techniques. Jeanette M. van Emon. CRC press. 2006

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

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

Course Code: PCC BT 302 **Course Name**: Microbiology and Immunology

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

Course Objective:

The course provides the students with a conceptual and experimental background in the broad discipline of microbiology. The students will be introduced to the major groups of microorganisms and their diversity in structure and functions and microbial interactions

Course Description:

Emphasis has been laid on bacterial growth, nutrition, control, metabolism, and genetics. The course also introduces the students to the scope and relevance of microbes in the field of medicine, agriculture, and industry.

Course Contents:

UNIT-I:
Morphology and Ultra structure of bacterial cell, Classification of bacteria, Culture media, Isolation of microbes and its identification, culture techniques, Preservation of cultures, Methods for the control of microbes. Enumeration of bacteria. Microbial growth kinetics.

UNIT-II:
Basic features of transduction, conjugation and transformation, Viruses: Classification and structure of viruses, Viral reproduction: lytic and lysogenic cycle, Overview of biological nitrogen fixation, Bacterial photosynthesis and electron transport system.

UNIT-III:
Introduction to immune system: Innate and Adaptive immunity, Humoral and Cell mediated immune response, Cells and Molecules of the immune system, Primary and Secondary lymphoid organs, T &B cell maturation and its activation, Characteristics and types of Antigens, Haptens, adjuvants and Epitopes, Antibodies: Structure, functions and characteristics of different classes of antibodies. Monoclonal antibodies.

UNIT-IV:
Antigen and antibody interactions, precipitation reactions , Serological techniques: ELISA, RIA and western blotting, Structure and Function of MHC molecules, Exogenous and Endogenous pathways of antigen processing and presentation, Overview of Complement system and cytokines, immune tolerance.

UNIT-V:
Applications of microbiology and Immunology: Mirobiology of domestic water and waste water. Microbes in bioremediation, Microbes of industrial use, Immunity against: Bacterial disease- tuberculosis, typhoid, Protozoan disease- Malaria, Amebieosis and Viral diseases - AIDS, Dengue, Chikungunya,Vaccine's, Hypersensitivity and Immunotherapy

Course Learning Outcomes (CLOs):

CO1. Student will understand the diversified branches of microbiology
CO2. Student will know the theoretical and practical aspects of microbial growth and physiology
CO3. Students will understand the basic concept of innate and acquired immunity.
CO4. Students will gain knowledge about immunoglobulin structures and diversity of antibodies, morphology and functions of various immune cells such as dendritic cells, macrophages, neutrophils and their association with MHC molecules will be studied.

Text books:

(i) Microbiology by Pelczar (W C Brown publication)
(ii) Genral Microbiology by stainer (Mac Millan Publication)

Reference books:

(i) Microbiology by Pawar and Dagniwala (Himalaya publishing House).
(ii) Immunology and immunotechnology by Ashim K. Chakravarty (Oxford university Press)
(iii) Immunology by C. Fatima 3. Immunology by Kuby (Free man publication)

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

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

Course Code: PCC BT 303 **Course Name**: Biochemistry

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

Course Objective:

It is intended to impart basic undergraduate-level knowledge in the area of general Biochemistry

Course Description:

Students would be able to understand the biochemical basis of cellular functions and organism physiology. They would also be able to assimilate recent research findings, advancement and development in the relevant subject.

Course Contents:

UNIT-I:
Water - Structure, unusual properties, non-covalent interactions, role in biological processes. Ionization of Water, pH scale, Weak Acids, and Weak Bases. Buffers and buffering mechanism, Henderson Hasselbalch equation. Buffering against pH Changes in Biological Systems: Phosphate buffer, Bicarbonate buffer, Protein buffer, Amino acid Buffer & Hemoglobin Buffer System.

UNIT-II:
Carbohydrates – classification, structure and functions of monosaccharides, disaccharides and polysaccharides. Ring structure and mutarotation, stereo isomers and structural isomers. Metabolism – Glycolysis & oxidation of Pyruvate, TCA cycle, Gluconeogenesis, Pentose Phosphate Pathway, Oxidative phosphorylation, Disorder/ diseases of carbohydrate metabolism.

UNIT-III:
Fats and lipids – Classification, structure and function: Simple, Compound & Derived lipids, Essential fatty acids. Fatty acid synthesis, origin of acetyl-Co A for fat synthesis, Elongation & desaturation of Fatty Acids. Activation & transport of fatty acid from cytosol to mitochondria for oxidation. Oxidation of saturated & unsaturated fatty acids. β, α, ω oxidation. Formation and utilization of ketone bodies. Disorder/ diseases of lipid metabolism.

UNIT-IV:
Amino acids and proteins - Classification & structure of amino acids. Essential amino acids. Peptide bond formation, Ramachandran plot, Primary, secondary, tertiary & quaternary structure of proteins. Biosynthesis of amino acids from intermediates of Citric Acid Cycle & other major pathways. Biodegradation of amino acids: Deamination, transamination. Urea Cycle, Glucose-Alanine cycle. Disorder/ diseases of amino acids metabolism.

UNIT-V:
Purines and pyrimidines – Structure and properties. Metabolism of Nucleotides: Purines & Pyrimidines synthesis: de Novo & salvage pathway, Conversion of nucleoside monophosphates to nucleoside triphosphates, Formation of deoxyribonucleotides. Catabolism & salvage of Purine and Pyrimidine nucleotides. Disorder of purines and pyrimidines metabolism.

Course Learning Outcomes (CLOs):

CO1. Basic knowledge of structure and functions of major bio-molecules will make the students to understand and implement the acquired knowledge in future.
CO2. Understanding of metabolic pathways (catabolism as well as anabolism), their diversity and how these are specifically regulated and interrelated in different cells
CO3. Practical knowledge and hands on tools and techniques for the characterization of bio-molecules will help the students in advanced research programs
CO4. Concepts of enzyme kinetics, regulation and specificity

Text books:

(i) Principles of Biochemistry: A.L. Lehninger, Nelson and Cox, McMillan Worth Publishers.
(ii) Harper's Biochemistry-Rober K. Murray, Daryl K. Grammer, McGraw Hill, Lange. Medical Books. 25th edition.
(iii) Biochemistry: S.C. Rastogi – Third Edition ; Tata McGraw Hill Education Pvt. Ltd. New Delhi.

Reference books:

(i) Biochemistry: Stryer, W. H. Freeman
(ii) Biochemistry: Voet and Voet, John Wiley and Sons, Inc. USA
(iii) Biochemistry: Zubey, WCB.
(iv) Biochemistry: Garrett and Grisham, Harcourt.

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

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

TECHNIQUES IN BIOTECHNOLOGY LAB **P**
2

Subject Code: PLC-BT 321

1. Demonstration of basic concept of precision and accuracy using appropriate experimental data
2. Study of Beer-Lambert's law-using UV-Visible spectrophotometer.
3. To study principle and working of laboratory microscope.
4. To analyze the isolated plant pigments using paper chromatography.
5. Separation of amino acids using thin layer chromatography.
6. Separation of a mixture of polar and non polar compounds using column chromatographic technique.
7. To study and analysis of DNA sample by agarose gel electrophoresis.
8. To study and analysis of protein sample by SDS- PAGE
9. To study the separation of compounds using liquid-liquid extraction experiments.
10. To study the separation of biological compounds using various membrane separation.

Reference book:

1. Wilson and Walker, "Principles and Techniques of Practical Biochemistry" 4 Edn., Cambridge Knew pros 1997.
2. Biotechniques: Theory & Practice: Second Edition by SVS Rana, Rustogi Publications.
3. Biochemical Methods of Analysis: Saroj Dua And Neera Garg: Narosa Publishing House, New Delhi.
4. Bioanalytical Techniques : ML Srivastava; Narosa Publishing House, New Delhi.

MICROBIOLOGY& IMMUNOLOGY LAB **P 2**

Subject Code: PLC-BT 322

1. Preparation of nutrient agar slants, plates and nutrient broth and their sterilization. (Microwave Oven, Heating mantles, Fridge, Heating Oven, Tube racks)
2. Inoculation of agar slants, agar plate and nutrient broth (Incubators, Water bath, Laminar hood, dry heat sterilizer i.e. bead sterilizer)
3. Culture of microorganisms using various techniques. (Shakers i.e. Cooling and Open shaker).
4. Simple and differential staining procedures, endospore staining, flageller staining, cell wallstaining, capsular staining, negative staining. (Moist chambers, spirit lamps, slides, loops & microscopes, haemocytometer)
5. Bacterial colony counting. (Moist chambers, spirit lamps, slides, loops & microscopes, haemocytometer)
6. Isolation of microbes from soil samples and determination of the number of colony forming units. (U.V. spectrophotometer, Colony counter etc.)
7. To determine the blood group and Rh of given blood sample.
8. To perform single radial immunodiffusion anddouble immunodiffusion
9. To perform rocket immune electrophoresis
10. To perform counter current immune electrophoresis
11. To perform ELISA

Practical Books and References:

1. Lab Manual in microbiology by P Gunasekaran (New Age Int. Pub.).

BIOCHEMISTRY LAB **P**
2

Subject Code: PLC-BT 323

1. Preparation of solutions: 1) Percentage solutions, 2) Molar solutions, 3) Normal solutions
2. Spectroscopy: Determination of absorption maxima (λmax) of a given solution
3. Titration of weak acid-weak base
4. Quantitative estimation of carbohydrates
5. Distinguish reducing and non-reducing sugars
6. Quantitative estimation of proteins
7. Estimation of nucleic acids
8. Isoelectric precipitation
9. Separation of sugars, fatty acids and amino acids by paper chromatography
10. Extraction of lipids from plant material
11. Thin layer chromatography
12. Gel electrophoresis

Reference books:

1. Wilson and Walker, "Principles and Techniques of Practical Biochemistry", 4 Edn., Cambridge Knew pros 1997.

2. Plummer DT, "An Introduction to Practical Biochemistry", III Edn., Tata McGraw hill**.**

SEMESTER IV

Course Code: ECS 202 **Course Name:** Mathematics-V
Course Credit Hour: 4hr **Total Contact Hour:** 40hrs

Course Objective:

The main objective of this course is to provide students with the probabilistic and statistical analysis mostly used in varied applications in engineering and sciences and it provide the methods of organizing and simplifying data so that their significance is comprehensible.

Course Description:

This course provides an introduction to probability and statistics with applications. Topics include: random variables, continuous and bivariate probability distributions, Bayesian inference, hypothesis testing, confidence intervals, curve fitting and regression.

Course Contents:

UNIT-I: Basic Probability (12 hours)
Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

UNIT-II: Continuous Probability Distributions (4 hours)
Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

UNIT-III: Bivariate Distributions (4 hours)
Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

UNIT-IV: Basic Statistics (8 hours)
Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

UNIT-V: Applied Statistics (8 hours)
Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

UNIT-VI: Small samples (4 hours)
Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Course Learning Outcomes (CLOs):

CLO-1: Recognize basic probability theory and its application.
CLO-2: calculate Continuous Probability Distributions and their properties.

CLO-3: Calculate bivariate distributions and their properties with applications.
CLO-4: Basic concept of Statistics, Probability distribution and correlation.
CLO-5: Fitting the data and large sample testing.
CLO-6: Testing the hypothesis for Small samples

Text books:

(i) Erwin kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
(ii) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers
(iii) S. Ross, "A First Course in Probability", Pearson Education India,

Reference books:

(i) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,
(ii) W. Feller, "An Introduction to Probability Theory and its Applications", Wiley,

Online links for study & reference materials:
https://nptel.ac.in/courses/111/105/111105041/

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

Assignment -1	- 04%
Assignment -2	- 04%
Assessment-3(Mid-Exam)	- 20%
Assignment-3	- 04%
Assignment-4	- 04%
Assignment-5	- 04%
Total Internal Assessment	**- 40%**

Course Code: HSMC 201 **Course Name:** Human Values

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

Course Objective:

- Development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Course Description:

This course introduces the fundamental of human values. It includes important insights about self-exploration, right conduct, ethics and harmony.

Course Contents:

UNIT-I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I.
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration.
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4.Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
5.Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

UNIT-II: Understanding Harmony in the Human Being - Harmony in Myself!

1.Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.
2.Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.
3.Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).
4.Understanding the characteristics and activities of 'I' and harmony in 'I'.
5.Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
6. Programs to ensure Sanyam and Health.

UNIT-III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1.Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2.Understanding the meaning of Trust; Difference between intention and competence 3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship 4.Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals 5.

Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

UNIT-IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
1. Understanding the harmony in the Nature 2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. 3.Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. 4.Holistic perception of harmony at all levels of existence.

UNIT-V: Implications of the above Holistic Understanding of Harmony on Professional Ethics
1.Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. 5. Case studies of typical holistic technologies, management models and production systems

Course Learning Outcomes (CLOs):

CLO-1: Develop the basic concept of human values
CLO-2: To understand the importance of self-exploration process
CLO-3: To understand harmony at individual levels
CLO-4: To understand harmony at nature level
CLO-5: Develop professional ethics

Textbooks:

(i) Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010 Reference Books 1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
(ii) Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

Reference books:

Human Values and Professional Ethics: Values and Ethics of Profession, Jay Shree Suresh and B.S Bahgvan, S.Chand

Course Code: PCC BT 401 **Course Name:** Bioprocess Engineering I
Course Credit Hour: 3Hr **Total Contact Hour:** 30hr

Course Objective:

Course Objective is to provide basic concepts of bioprocess engineering to the students. They will learn engineering principles that can be applied to processes involving cell or enzyme catalysts with applications in the industry.

Course Description:

The students will learn the basics of bioreactor design and operation control that have been applied to a variety of bioprocess industries and also conduct related experiments for better understanding

Course Contents:

UNIT-I:
Fluid Properties: Viscosity, Newton's Law of viscosity, Kinematic Viscosity, Rheological Diagram, Euler Equation and its application, Derivation of Bernoulli Equation from Euler Equation, Applications of Bernoulli's Theorem, Pascal's Law, Hydrostatic Law. Measurement of Pressure: Definition of Gauge and & Absolute Pressure, Barometer, Various Manometers (Peizometer, U-tube manometer, Single column manometers, U-tube & Inverted U-tube differential manometers) & their industrial applications.

UNIT-II:
Flow Measuring Equipment: Head Flow Meters, Nozzel Meter, Orifice Meter, Venturi Meter, Area Flow Meters, Rotameter, Pitot Tube & Applications of these equipments. Pipe fittings, major and minor losses in pipe flow, Calculation of Pressure Drop in a Pipe, Equivalent Length & 'K' factor, Methods of finding dimensional numbers - methods of governing equations, Method of force ratios and Buckingham's π method. Reciprocating pump & its applications. Centrifugal Pumps and its applications.

UNIT-III:
Conduction and Convection Introduction. Basic concepts of conduction in solids, liquids and gases, One and two dimensional heat conduction. Critical and optimum insulation thickness. Introduction to unsteady state heat transfer. Principles of convection, Equations of forced and free convection, Heat flow due to conduction & convection. Radiation: Basic laws of heat transfer by radiation, black body and gray body concepts, solar radiations, combined heat transfer coefficients by convection and radiation. Heat Transfer Equipments: Double pipe, Shell & tube and Plate type heat exchanger, Evaporator, Condenser

UNIT-IV:
Diffusion: Fick's Law, steady state diffusion: Rectangular, cylindrical, spherical (1-D); diffusion with reaction, both at surfaces, and in the bulk medium.Transient conduction and diffusion: Basics of Fourier analysis, unsteady state conduction and diffusion (1-D), transient conduction/diffusion with generation/reaction.

UNIT-V:
Mass transfer coefficients, Mass transfer in fluidized bed reactor, flow past solids and boundary layers, Simultaneous heat and mass transfer system. Mass transport in Biomedical and Biological Engineering: Haemodialysis, Diffusion and uptake of ligands by cells, oxygen transport in tissue and capillaries.

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

Assignment -1	- 05%
Assignment -2	- 05%
Assessment-3(Mid-Exam)	- 20%Assignment-3/Quiz-1
Assignment-4	- 05%
Assignment-5	- 05%
Total Internal Assessment	**- 40%**

Course Learning Outcomes (CLOs):

C01: At the end of this course, the students will learn the basics of bioprocess engineering.

CO2: Will also learn the principle, design, and operation control of various types of bioreactors and their scale-up strategies.

CO3: Develop skills to understand Bioprrocess Engineering at Industrial level for its applications.

Text books:

(i) Holman, J.P.: "Heat Transfer" 9 th ed. McGraw Hill (1989).
(ii) Treybal, R "Mass Transfer Operations", 3rd ed. New York: McGraw-Hill, (1980).
(iii) Introduction of Fluid Mechanics by Robert W.Fox and Slan T. McDonald, John willey & sons, Ny. Fourth Ed.
(iv) Unit Operation in Chemical Engg., McCabe Smith Vth Ed.
(v) Foust A. S. et.al., "Principles of Unit Operations" John Wiley (1980)

Reference books:

(i) Holman, J.P.: "Heat Transfer" 9 th ed. McGraw Hill (1989).

Course Code: PCC BT 402 **Course Name**: Genetics and Molecular Biology
Course Credit Hour: 3Hr **Total Contact Hour**: 30hr

Course Objective:

To provide students the knowledge about gene organization, genetic materials, molecular heritance, gene transfer, and their regulations. To provide students the knowledge about cellular content, organization, structures, and functions.

Course Description:

This **course** serves as a broad introduction to the structure and function of nucleic acids, basic processes that regulate expression of **genetic information**, **biological** processes that direct inheritance of **genetic information**, and the outcome of those processes – inherited traits

Course Contents:

UNIT-I:
Fundamental principles of genetics, gene interaction, multiple alleles, complementation, linkage, recombination and linkage mapping, extra-chromosomal inheritance, chromosomes basis of heredity, Sex determination, sex linked, sex limited and sex, influenced inheritance.

UNIT-II:
Genome organization: Genome organization in prokaryotes and eukaryotes - special features of eukaryotic gene structure and organization, genome organization in mitochondria and chloroplast, DNA content and C-value paradox. Methods to measure DNA content variation - Various types of DNA sequences (simple sequences, repetitive sequences, nonsense sequences, tandem gene clusters, satellites)

UNIT-III:
Gene structure, DNA & RNA as a genetic material, packaging of DNA as chromosome, central dogma of molecular biology, DNA replication, DNA repair. Linkage and recombination, crossing over and genetic mapping, gene mapping by two point and three point test crosses, Cell cycle regulation and apoptosis.

UNIT-IV:
Genetic mutation, micro-deletion, Genetic syndrome, Techniques to detect mutation, Transcription in prokaryotes and eukaryotes, genetic code, reverse transcription, mRNA processing. Role of sigma factor in transcription, role of promoters and enhancers, mechanism and regulation of transcription in prokaryotes and eukaryotes.

UNIT-V:
DNA replication process in prokaryotes & Eukaryotes, Activity of DNA polymerases and topoisomerases, Reverse transcriptase, Translation in prokaryotes and eukaryotes Basic principles of gene cloning and r-DNA technology, genetic code, properties of genetic code, wobble hypothesis, Molecular chaperones.

Course Learning Outcomes (CLOs):

CO1. Students will know about the cell and its biology, which will help the students to understand the origins of cells and the generation of cell diversity, as well as the common features of cellular structure and function – how they obtain energy, synthesize new molecules, communicate, proliferate and survive.
CO2. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
CO3. Students will learn DNA replication, recombination and repair, transcription and translation
CO4. Students will be aware of the modern tools and techniques of genomics and isolation and identification of genes

Text books:

(i) Genetics a conceptual approach, 2nd Edition Benjamin A. Pierc WH freeman and, company, New York.
(ii) Benjamin Levin – Genes VIII, 8 th ed.

Reference books:

(i) Albert B, Bray Denis et al.: Molecular Biology of the Cell, latest ed.
(ii) Watson, Hopkins, Roberts et al.: Molecular Biology of the Gene, 4 th ed.
(iii) Genetics- Strickberger, 2nd.
(iv) Baltimore- Molecular Biology of the Cell.
(v) Advance Genetics by G.S. Miglani, Narosa Publishing House.

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

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

Course Code: PCC BT 30 **Course Name**: Enzyme Engineering
Course Credit Hour: 3Hr **Total Contact Hour**: 30hr

Course Objective:

This course provides the theory and knowledge relevant to the enzymology principles including fundamental properties of enzymes, enzyme catalytic mechanisms and enzyme kinetics. Finally this course serves to provide an awareness of the current and possible future applications of enzyme technologies.

Course Description:

This **course** covers basics and applications concerning enzymes. The knowledge of inorganic chemistry, physical chemistry, organic chemistry and biochemistry will be applied to the understand enzymes. ... It is to cultivate the human resources who can lead advanced science and **engineering** through the studies of enzymes.

Course Contents:

UNIT-I:
Introduction to enzymes: Holoenzyme, apoenzyme, prosthetic group. Interaction between enzyme and substrate-lock and key model, induced fit model. Features of active site, activation energy, enzyme specificity and types. IUB system of classification and nomenclature of enzymes. Kinetics of single substrate reactions; Derivation of Michaelis -Menten equation, turnover number; determination of Km and Vmax (LB plot, ED plot), Importance of Km & Vmax; Numerical related to enzyme kinetics, Multi-Substrate reac0tion mechanisms.

UNIT-II:
Factors affecting the velocity of enzyme catalyzed reaction- enzyme concentration, temperature, pH, substrate concentration, inhibitors and activators. Enzyme inhibition: irreversible; reversible (competitive, uncompetitive and non competitive inhibition); Substrate and Product inhibition, Allosteric regulation of enzymes, concerted & sequential model; Deactivation Kinetics.

UNIT-III:
Extraction of crude enzyme from plant, animal and microbial source; some case study. Purification of enzymes by the help of different methods. Methods of characterization of enzymes; criteria of purity. Unit of enzyme activity - definition and importance. Development of enzyme assays.

UNIT-IV:
Enzyme Immobilization: Adsorption, Matrix entrapment, Encapsulation, Cross linking, Covalent binding and their examples; Advantages and disadvantages of different immobilization techniques. Structure & stability of immobilized enzymes, kinetic properties of immobilized enzymes- partition effect, diffusion effect. Overview of applications of immobilized enzyme systems.

UNIT-V:
Enzyme Biosensors: elements of biosensors, three generations of biosensors, Types of biosensors: calorimetric, potentiometric, amperometric, optical and piezoelectric. Design of enzyme electrodes and their applications as biosensors in industry, health care and environment. Design of Immobilized Enzyme Reactors- Stirred tank reactors(STR), Continuous Flow Stirred Tank Reactors (CSTR), Packed- bed reactors (PBR), Fluidized-bed Reactors (FBR); Membrane reactors.

Course Learning Outcomes (CLOs):

CO1. Distinguish the fundamentals of enzyme properties, nomenclatures, characteristics and mechanisms
CO2. Apply biochemical calculation for enzyme kinetics
CO3. Compare methods for production, purification, characterization and immobilization of enzyme.
CO4. Discover the current and future trends of applying enzyme technology for the commercialization purpose of biotechnological products.

Text books:

(i) Fundamentals of enzymology by Nicolas C. price and Lewis stevens. Oxford University Press
(ii) Enzymes by Trevor palmer, East west Press
(iii) Enzyme Technology by Messing

Reference books:

(i) Enzymes: Dixon and Webb. (IRL Press)
(ii) Enzyme technology by Chaplin and Bucke. Cambridge Univerity Press
(iii) Biochemical engineering fundamentals, second edition. James E Bailey, David F., Ollis, McGraw Hill Intl. Edition

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

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

Course Code: MC-02 **Course Name:** Python
Course Credit Hour: 3hr **Total Contact Hour:** 34hr

Course Objective:

- Master the fundamentals of writing Python programs
- Learn basic Python coding elements such as variables, identifiers and flow control structures.
- Discover how to work with lists and sequence data.
- Write Python functions to facilitate code reuse.
- Work with the Python standard library
- Explore Python's object-oriented features

Course Description:

This is an introductory course designed for any student interested in using computation to enhance their problem solving abilities. No prior experience in programming is necessary. Students will use their problem solving abilities to implement programs in Python. This course will develop a basic understanding the Python programming language

Course Contents:

UNIT-I:

Introduction to Python: - History of python programming language, thrust areas of python, overview of programming in Python, identifiers, variables, Expressions and statements, Operators and Operands, data types, indentation, comments, reading input.

UNIT-II:

Control flow Statements:-if statement, if-else statement, if-else-elif control flow statement, nested if statement, the while loops, the for loop, Strings: Creating and storing strings, basic string operations, formatting strings and string operations.

UNIT-III:

Functions: Built in functions, function definition and calling the function, default parameters, Lists: Creating list, basic list operations, build in functions used in list, list methods, Dictionaries: Creating dictionaries, built on functions used in dictionaries, dictionary methods.

UNIT-IV:

Tuples: Creates tuples, basic tuple operations, tuple methods, Sets: set methods, Basics Object – oriented Programming: classes and objects, creating classes and objects in python, classes with multiple objects, class attributes vs. data attributes.

Course Learning Outcomes (CLOs):

At the end of the course students will demonstrate the ability to

- Understand python identifiers, variables, Expressions, statements, Operators, operand and data types.
- Implement Conditionals and Loops for Python Programs.
- Use functions and represent Compound data using Lists, Tuples, Dictionaries and strings.
- Implement basics object –oriented components.

Text books:

(i) Bill Lubanovic, Introducing Python- Modern Computing in Simple Packages, O'Reilly Publication.

(ii) Wesley J. Chun, Core Python Programming, 2nd Edition, Pearson Education.

Reference books:

(i) Guido Van Russom, Fred L. Drake, An Introduction to Python, Network Theory Limited.

(ii) Magnus Lie Hetland, Beginning Python: From Novice To Professional, Pearson Education.

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

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

Bioprocess Engineering Lab-I **P**

2

1. To find the thermal conductivity of liquid / gases

2. To determine the local velocity pressure with the help of pilot tube

3. To find out the thermal conductivities of Metal rod

4. To study the characteristics of a centrifugal pump.

5. To determine the viscosity of a given viscous liquid by capillary tube flow method.

6. To differentiate between laminar and turbulent flow using Reynolds experiment.

7. To determine velocity through orifice meter, venture meter

8. To determine the overall heat transfer coefficient in Parallel flow heat exchanger/counter flow heat exchanger

9. To determine the drying characteristics of given sample

10. To determine the minimum fluidization velocity in a fluidized bed and verify experimentally

GENETICS & MOLECULAR BIOLOGY LAB **P 2**

1. How to calculate genetics and allelic frequencies numeric problem analysis.
2. Isolation of Plasmid DNA
3. Isolation of Plant DNA
4. Estimation of DNA content in the given sample by spectrophotometer
5. Determination of Tm of DNA.
6. Isolation of bacterial genomic DNA.
7. Purification of DNA through Electrophoresis & visualization under UV transilluminator.
8. Polyacrylamide gel electrophoresis of DNA.
9. PCR amplification of DNA and visualization by gel electrophoresis.
10. Isolation and study of polytene chromosome in Drosophila.

ENZYME ENGINEERING LAB **P**
2

1. Production of commercially important enzymes from microbial sources.

2. Isolation of alpha amylase from plant source

3. Determination of enzyme activity and specific activity.

4. Partial purification of isolated enzymes.

5. Method of checking the purity of the enzyme -SDS-PAGE

6. Characterization of enzymes-effect of pH , temperature and inhibitors on enzyme activity etc.

7. Identification of Enzyme by different assay

8. Purification of enzymes by different methods

9. Immobilization of enzymes –Different Techniques such as adsorption entrapment, encapsulation and cross-linking.

10. Strain improvement techniques- physical, chemical and genetic manipulation methods.

11. Formulation of enzyme stability.

12. Enzyme inhibition