

## Department Of BIOTECHNOLOGY

### Program Outcomes (POs) & Program Specific Outcomes (PSOs)

<b>Program Outcomes (POs)</b> <b>Biotechnology graduates will be able to:</b>	
<b>PO1</b>	<b>Engineering Knowledge:</b>
	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to find the solution of complex engineering problems in the major areas of Computer Science and Engineering.
<b>PO2</b>	<b>Problem Analysis:</b>
	Identify, formulate, research literature and analyze complex Computer Science engineering problems and reaching substantiated conclusions using the first principles of mathematics, natural sciences and engineering sciences.
<b>PO3</b>	<b>Design / Development of Solution:</b>
	Design solutions for complex Computer Science and 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.
<b>PO4</b>	<b>Conduct investigations of complex problems:</b>
	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.
<b>PO5</b>	<b>Modern Tool Usage:</b>
	Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with the understanding of limitations.
<b>PO6</b>	<b>The Engineer and Society:</b>
	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Computer Science and Engineering practice.
<b>PO7</b>	<b>Environment and Sustainability:</b>
	Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and the need for sustainable development.
<b>PO8</b>	<b>Ethics:</b>
	Apply ethical principles and commit to professional ethics and responsibilities and norms of the Computer Science and Engineering practice.
<b>PO9</b>	<b>Individual and team work:</b>
	Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
<b>PO10</b>	<b>Communication:</b>

<b>Program Outcomes (POs)</b> <b>Biotechnology graduates will be able to:</b>	
	Communicate effectively on complex engineering activities with the engineering community and 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.
<b>PO11</b>	<b>Project Management and Finance:</b>
	Demonstrate the knowledge and understanding of the engineering and the management principles and apply these to one's own work, as a member and a leader in a team, to manage projects and in multidisciplinary environments.
<b>PO12</b>	<b>Life-Long Learning skill:</b>
	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.

<b>Program Specific Outcomes (PSOs)</b>	
<b>PSO 1</b>	Successful professional career and/or higher studies by gaining knowledge in fundamental mathematics and biological principles (Cognitive objective)
<b>PSO 2</b>	Provide strong foundation in the core biotechnology courses to evaluate real life problems and to propose biotechnological solutions with economical and social viability
<b>PSO 3</b>	Sensitize on environmental, health and bioethical issues, Intellectual property rights, professional ethics and life-long learning through application orientated activities (Behavioral objective).

**Department of Biotechnology**

**Course Outcomes (COs)**

**YEAR:I**

**SEMESTER:I**

**SUBJECT: Communicative English**

CO1	At the end of the course, learners will be able to: Read articles of a general kind in magazines and newspapers.
CO2	Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
CO3	Comprehend conversations and short talks delivered in English.
CO4	Write short essays of a general kind and personal letters and emails in English.
CO5	Students should become adept in their use of written word for informational, possessive and creative purposes.

**SUBJECT: Engineering Mathematics**

CO1	Use both the limit definition and rules of differentiation to differentiate functions and apply differentiation to solve maxima and minima problems
CO2	Demonstrate the tools for solving Partial differential equations and maxima, minima for functions of several variables
CO3	Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus and Evaluate integrals using techniques of integration, such as substitution, partial fraction and integration by parts
CO4	Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables
CO5	Apply various techniques in solving differential equations

**SUBJECT: Engineering Chemistry**

CO1	Interpret basics of hardness of water, boiler feed water problems and its treatment process in specific reverse osmosis process
CO2	Interpret basics of hardness of water, boiler feed water problems and its treatment process in specific reverse osmosis process
CO3	Illustrate the concepts of phase rule and the properties of alloys
CO4	Identify the types of fuels and their usage in the life span
CO5	Plan for renewable energy utilization in the twenty first century

**SUBJECT: Engineering Graphics**

CO1	Students will be able to familiarize with the fundamentals and standards of engineering graphics
CO2	Students will be able to perform freehand sketching of basic geometrical constructions and multiple views of objects
CO3	Students will be able to draw orthographic projections of lines and plane surfaces
CO4	Students will be able to draw projections of solids and development of surfaces
CO5	Students will be able to visualize and project isometric and perspective sections of simple solids

**SUBJECT: Engineering Physics**

CO1	Students will be able to acquire the knowledge of elastic materials and illustrate the applications in various fields
CO2	Describe the basics of oscillatory physics, working of laser and propagation of light in optical fibers
CO3	Describe the knowledge of quantifying the thermal properties of materials and students will be able analyze the materials based on thermal conductivity
CO4	Summarize the importance of free electrons in determining the properties of metals to understand the concept of Fermi energy and apply the knowledge of quantum mechanics
CO5	Students will be able to recognize various planes in a crystal and describe the structure determination

**SUBJECT: Problem Solving and Python Programming**

CO1	Develop algorithmic solutions to simple computational problems.
CO2	Read, write, execute by hand simple Python programs
CO3	Structure simple Python programs for solving problems.
CO4	Decompose a Python program into functions.
CO5	Represent compound data using Python lists, tuple and dictionaries.
CO6	Read and write data from/to files in Python Programs

**SUBJECT: Physics Laboratory**

CO1	Understand the quantitative chemical analysis of water quality related parameters such as alkalinity and hardness
CO2	DO content in water eco system
CO3	Permissible limit of chloride content in potable water
CO4	Apply redox reaction to analyse iron content through potentiometric titration
CO5	Make use of neutralization reaction by instrumental analysis

**SUBJECT: Chemistry Laboratory**

CO1	Understand the quantitative chemical analysis of water quality related parameters such as alkalinity and hardness
CO2	DO content in water eco system
CO3	Permissible limit of chloride content in potable water
CO4	Apply redox reaction to analyse iron content through potentiometric titration
CO5	Make use of neutralization reaction by instrumental analysis

**SUBJECT: Problem Solving and Python Programming Laboratory**

CO1	Write, test, and debug simple Python programs.
CO2	Implement Python programs with conditionals and loops.
CO3	Develop Python programs step-wise by defining functions and calling them.
CO4	Use Python lists, tuples, dictionaries for representing compound data.
CO5	Read and write data from/to files in Python.

## SEMESTER:II

### SUBJECT: Technical English

CO1	Read technical texts and write area - specific texts effortlessly.
CO2	Listen and comprehend lectures and talks in their area of specialization successfully.
CO3	Speak appropriately and effectively in varied formal and informal contexts.
CO4	Write reports and winning job applications.
CO5	Listening to commentaries of games.

### SUBJECT: Engineering Mathematics II

CO1	Matric Algebra: Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices
CO2	Vector Calculus: Gradient, divergence and curl of a vector point function and related identities. Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification
CO3	Analytic functions and conformal mappings
CO4	Complex integration, Taylor's and Laurent's series and Residue theorems
CO5	Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients

### SUBJECT: Physics of Materials

CO1	Acquire the knowledge of different kind of preparation of materials.
CO2	Gain knowledge on basics of conducting materials
CO3	Classify the semiconducting materials.
CO4	Understand the dielectric and magnetic properties of materials.
CO5	Recognize different types of New materials and its Applications

**SUBJECT: Basic Civil and Mechanical Engineering**

CO1	Explain the usage of construction material and proper selection of construction materials.
CO2	Measure distances and area by surveying
CO3	Identify the components used in power plant cycle
CO4	Demonstrate working principles of petrol and diesel engine.
CO5	Elaborate the components of refrigeration and Air conditioning cycle

**SUBJECT: Microbiology**

CO1	Gain knowledge on various classes of microorganisms, their history, microscopy basics and different staining techniques
CO2	Acquire knowledge on Structural organization and multiplication of microorganisms
CO3	Know about the Microbial growth, media, metabolism and bioenergetics of microorganism
CO4	Know about different classes of antibiotics and their mode of actions, treatment strategies and detection of resistant forms of bacteria from clinical settings.
CO5	Gain knowledge in industrial and environmental applications of microorganisms such as metabolite production, bioremediation, leaching, biopesticides

**SUBJECT: Biochemistry**

CO1	The students have a strong foundation in the structure and reactions of biomolecules- Carbohydrates
CO2	The students have a strong foundation in the structure and reactions of biomolecules – proteins, lipids, nucleic acid
CO3	The students have the knowledge about carbohydrates metabolism
CO4	The students have the knowledge about intermediary metabolisms and regulation.
CO5	The students have a strong foundation in the protein targeting and transportation

**SUBJECT: Engineering Practices Laboratory**

CO1	Fabricate carpentry components and pipe connections including plumbing works
CO2	Use welding equipments to join the structures
CO3	Carry out the basic machining operations
CO4	Make the models using sheet metal works
CO5	Illustrate on centrifugal pump and Air conditioner. Students will be able to demonstrate smithy, foundry and fittings

**SUBJECT: Biochemistry Laboratory**

CO1	The students are aware of qualitative and quantitative estimation of biomolecules
CO2	Were able to perform the experiment with body fluids
CO3	Were able to prepare buffer solution for performing the other experiments
CO4	The students can perform the estimation of protein
CO5	The students can perform the enzyme assay experiments

**YEAR:II**

**SEMESTER: III**

**SUBJECT: Transforms and Partial Differential Equations**

CO1	Understand how to solve the given standard partial differential Equations.
CO2	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
CO3	Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
CO4	Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
CO5	Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems

**SUBJECT: Stoichiometry**

CO1	To impart knowledge on the basic fundamentals of process calculation
CO2	To enable the students to understand the concepts and calculations associated with gases and calculations associated with humidification
CO3	To enable the students to perform material balances on various unit operations and processes
CO4	To enable the students to perform energy balance calculations on various unit operations and processes
CO5	To enable the students to understand the concepts and calculations associated with chemical reaction and other combustion operations in industry.

**SUBJECT: Applied Thermodynamics for Biotechnologists**

CO1	Able to describe the knowledge on thermodynamic law and properties of fluids
CO2	Able to understand the concept of solution thermodynamics
CO3	Able to understand the phase equilibria in liquid liquid and solid –solid equilibria
CO4	To understand the concept of chemical reaction equilibria
CO5	Ability to apply the thermodynamic description of microbial growth and product formation

**SUBJECT: Basic Industrial Biotechnology**

CO1	Able to learn ,define and understand the basics in industrial bioprocess and To explain the steps involved in the production of bioproducts and methods to improve modern biotechnology
CO2	Gain the knowledge the manufacturing process of the primary metabolites of commercial importance.
CO3	Gain the knowledge of manufacturing process and formulation of the secondary metabolites of commercial importance.
CO4	Understand how to isolate, identify, characterize and apply in the production of enzymes and bioproducts.
CO5	Able to estimate, evaluate and express the production of therapeutic and diagnostic products and design and deliver useful modern biotechnology products to the Society

**SUBJECT: Bioorganic Chemistry**

CO1	Recall basics of bioorganic chemistry and study the bonding and stereochemistry
CO2	Understand the mechanism of substitution and addition reaction
CO3	To gain extensive knowledge in kinetics and mechanism
CO4	To understand the basics of catalysis
CO5	To gain knowledge in bioorganic chemistry reactions

**SUBJECT: Cell Biology**

CO1	Would have deeper understanding of cell at structural and functional level.
CO2	Would have broad knowledge on the molecular interaction between cells.
CO3	Would understand the transport of ions and molecules across cell membrane
CO4	Would demonstrate a clear understanding of the signal transduction, secondary messengers.
CO5	Would develop skill on working principles of microscopy and identification of cell types

**SUBJECT: Microbiology Laboratory**

CO1	Understand the advanced technical information pertaining to laboratory bio-safety and preventive measures from pathogenic microorganism.
CO2	Know the various aseptic techniques and sterilization methods.
CO3	Develop the minimum skills to work on several important techniques for the study of microorganisms in the laboratory
CO4	Gained the knowledge in plating techniques
CO5	Observed the effect of various factor affecting the microbial growth

**SUBJECT: Cell Biology Laboratory**

CO1	To understand the basic techniques to work with cells
CO2	To demonstrate working principles of Microscopy
CO3	To understand and perform cell staining techniques
CO4	To identify the various stages of mitosis

**SUBJECT: INTERPERSONAL SKILLS/LISTENING AND SPEAKING**

CO1	Listen and respond appropriately
CO2	Participate in group discussions
CO3	Make effective presentations
CO4	Participate confidently and appropriately in conversations both formal and informal

## SEMESTER: IV

### SUBJECT: Probability and Statistics

CO1	Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
CO2	Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
CO3	Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO4	Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
CO5	Have the notion of sampling distributions and statistical techniques used in engineering and management problems

### SUBJECT: Fluid Mechanics and Heat Transfer Operations

CO1	Able to get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
CO2	Able to gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.
CO3	Are familiar to conduction of heat through solid media.
CO4	Able to interpret the phenomena of convection of heat through fluid media
CO5	Can perform calculations pertaining to processes and operations.

### SUBJECT: Molecular Biology

CO1	Describe the basic structure and biochemistry of nucleic acids and proteins and discriminate between them
CO2	Identify the principles of DNA replication, transcription and translation and explain how they relate to each other.
CO3	Discuss clearly about gene organization and mechanisms of control the gene expression in various organisms.
CO4	Discuss clearly about gene mechanisms of control the gene expression
CO5	Articulate applications of molecular biology in the modern world

**SUBJECT: Enzyme Technology and Biotransformations**

CO1	To recollect the enzyme classification and its action and the concepts helps to further proceed course Biotechnology
CO2	To demonstrate and illustrate the MM equation and type of inhibition both in theoretical and practical approach in enzyme utility.
CO3	To illustrate and explain the application of immobilized enzymes
CO4	To summarize the enzyme production and purification process to the industrial level.
CO5	To apply the enzyme application in biotransformation process

**SUBJECT: Bioprocess Principles**

CO1	Understand about the assembly and functioning of Bioreactors and its utilities
CO2	Gain knowledge on media components, perform scientific media design and optimize its concentrations
CO3	Analyze the various sterilization methods and its Kinetics and solve the problems associated with it.
CO4	Understand the concepts of metabolic stoichiometry, energetics of cell growth and product formation
CO5	Gain knowledge on kinetics of microbial growth and product formation

**SUBJECT: Environmental Science and Engineering**

CO1	Able to know the nature and facts about environment
CO2	Able to appreciate the importance of environment by assessing its impact on the human world
CO3	Able to find the interrelationship between living organism and environment
CO4	Able to analyze the importance of social issues
CO5	Able to analyze the impact of human population

**SUBJECT: Chemical Engineering Laboratory for Biotechnologists**

CO1	Have knowledge on the basic principles of chemical engineering
CO2	Be able to apply the skill of material balance and energy balance in unit operations unit process of chemical engineering and biotechnology
CO3	Be able to analyze the principles of chemical engineering and its applications in chemical, mechanical perspectives
CO4	Be able to analyze the principles of chemical engineering and its applications in biological perspectives
CO5	Understand the design and working principles of fluid moving machinery and transport phenomena

**SUBJECT: Molecular Biology Laboratory**

CO1	Demonstrate knowledge and understanding of the principles underpinning important techniques in molecular biology.
CO2	Are aware of performing the electrophoresis experiment
CO3	Demonstrate knowledge and understanding of applications of these techniques.
CO4	Demonstrate the ability to carry out laboratory experiments and interpret the results.
CO5	Students will be aware of the hazardous chemicals and safety precautions in case of emergency

**SUBJECT: ADVANCED READING AND WRITING**

CO1	Listen and respond appropriately.
CO2	Participate in group discussions
CO3	Make effective presentations
CO4	Participate confidently and appropriately in conversations both formal and informal

**YEAR: III**

**SEMESTER: V**

**SUBJECT: Mass Transfer Operations**

CO1	To demonstrate about gas -liquid, vapour- liquid and solid- liquid and liquid-liquid equilibrium
CO2	To classify and use the accurate engineering correlations of diffusion and mass transfer coefficients to model a separation process
CO3	To investigate a multi-stage equilibrium separation processes, simultaneous phase equilibrium and mass balances in continuous separation processes (absorbers, strippers, and distillation columns) and sizing continuous separation units.
CO4	To design and construction with operating principles of process economics of separating equipments
CO5	Gain the knowledge on the concept of membrane separation process and drying process

**SUBJECT: Bioprocess Engineering**

CO1	Select appropriate bioreactor configurations and operation modes based upon the nature of bioproducts and cell lines and other process criteria.
CO2	Apply modeling and simulation of bioprocesses so as to reduce costs and to enhance the quality of products and systems.
CO3	Plan a research career or to work in the biotechnology industry with strong foundation about bioreactor design and scale-up.
CO4	Integrate research lab and Industry
CO5	Identify problems and seek practical solutions for large scale implementation of biotechnology

**SUBJECT: Analytical Methods and Instrumentation**

CO1	To be familiar with different electromagnetic radiations.
CO2	To be familiar with different spectroscopic methods and their applications.
CO3	To know the role of different magnetic resonance and mass spectroscopy.
CO4	To know the role of various separation methods and their applications.
CO5	To understand the various surface analysis using different surface microscopy

**SUBJECT: Protein Engineering**

CO1	To analyze the various interactions in protein makeup
CO2	To be familiar with different levels of protein structure.
CO3	To know the role of functional proteins in various field of study.
CO4	To computer exercise in protein modelling.
CO5	To practice the latest application of protein science in their research

**SUBJECT: Principles of Food Processing (PROFESSIONAL ELECTIVE I)**

CO1	To gain fundamental knowledge about the constituents of food and organoleptic properties of food and basic idea about food chemistry and their applications.
CO2	To demonstrate the importance of additives in food technology.
CO3	To attain knowledge on food microbiology
CO4	To elaborate the effect of food spoilage and food borne diseases.
CO5	To apply their knowledge in the field of food preservation.

**SUBJECT: AIR POLLUTION AND CONTROL ENGINEERING ( OPEN ELECTIVE I)**

CO1	To understand the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management.
CO2	To identify, formulate and solve air and noise pollution.
CO3	To design stacks and particulate air pollution control devices to meet applicable standards.
CO4	To select control equipments.
CO5	To ensure quality, control and preventive measures.

**SUBJECT: Bioprocess Laboratory I**

CO1	Explain about Enzyme kinetics and characterization and how to use them for practical applications.
CO2	Evaluate the growth kinetics of microorganisms
CO3	Gained knowledge on medium optimization techniques.
CO4	Determine an experimental objective, understand the theory behind the experiment, and operate the relevant equipment safely.
CO5	Demonstrate good lab citizenry and the ability to work in team.

**SUBJECT: Analytical Methods and Instrumentation Laboratory**

CO1	Has gained practical knowledge on Absorption Spectroscopic methods
CO2	Acquired knowledge to validate and analysis using spectrometric and microscopic techniques
CO3	The students would visualize and interpret the theory of spectroscopic methods by hands on experiments.
CO4	Acquired experience in performing the experiment using nephelometry.
CO5	Acquired experience in performing the experiment using fluorimetry

**SUBJECT: Professional Communication**

CO1	Make effective presentations
CO2	Participate confidently in Group Discussions.
CO3	Attend job interviews and be successful in them
CO4	Develop adequate Soft Skills required for the workplace

## SEMESTER: VI

### SUBJECT: Bioinformatics

CO1	Understand the fundamentals of operating system, biological sequences and sequence databases.
CO2	Gain knowledge about the sequence alignment programs and its importance in Bioinformatics.
CO3	Understand the phylogenetic trees, different types of trees and protein structure and its prediction techniques.
CO4	Understand the principle behind machine learning techniques and various systems biology related advanced techniques.
CO5	Gain knowledge in programming language and to develop bioinformatics related tools with programming skills.

### SUBJECT: Genetic Engineering

CO1	Aware of how to clone commercially important genes.
CO2	To produce the commercially important recombinant proteins.
CO3	Aware of gene and genome sequencing techniques.
CO4	Aware of microarrays, Analysis of Gene expression and proteomics.
CO5	Aware of how to clone the genes from genomic library.

### SUBJECT: Applied Chemical Reaction Engineering

CO1	Write the rate equation for any type of reaction equations.
CO2	Design reactors for heterogeneous reactions and optimize operating conditions.
CO3	Relate and calculate the conversions,
CO4	Gained the knowledge on concentrations and to identify the rates in a reaction
CO5	Had a knowledge to formulate and solve chemical engineering problems

**SUBJECT: Animal Biotechnology (PROFESSIONAL ELECTIVE II)**

CO1	Recollect and remember to define, understand the fundament knowledge of animal cell culture
CO2	Understand and explain the animal diseases and its diagnosis
CO3	Understand the concepts and procedures of monoclonal antibodies and gene therapy for animal infections
CO4	Gain the knowledge on the concepts of micromanipulation technology
CO5	Understand the concepts and strategies used for the production of transgenic animals

**SUBJECT: Biopharmaceutical Technology (PROFESSIONAL ELECTIVE III)**

CO1	To define, understand and explain the Knowledge on basic pharmaceutical industry, therapeutic agents uses, regulatory issues
CO2	To understand and explain the mechanism of drug action and the principle of physico-chemical properties of drugs
CO3	To the knowledge the process involved in manufacture of drugs, analyse the special requirements, reaction process and applications
CO4	To understand and apply the knowledge on principles of manufacturing requirements, tools used, evaluate the drug properties using analytical methods and quality management of different forms of drugs
CO5	To understand the biopharmaceuticals like vitamins, hormones, contraceptives, biologics, etc. for the current and future biotechnology related products on the market

**SUBJECT: Fundamentals of Nano Science (PROFESSIONAL ELECTIVE IV)**

CO1	To recollect the science of nanomaterials
CO2	To demonstrate the preparation of nanomaterials.
CO3	To develop knowledge in characteristic nanomaterial
CO4	To develop knowledge in advanced characteristic nanomaterial
CO5	To apply the advance application

**SUBJECT: Bioprocess Laboratory II**

CO1	Graduates gain ability to investigate, design and conduct experiments, analyze and interpret data
CO2	Apply the laboratory skills to solve complex bioprocess engineering problems.
CO3	Graduates become creative, innovative and adaptable engineers as leaders or team members in their organizations and society.
CO4	Graduates perform competently in chemical and bioprocess industries and become important contributors to national development.
CO5	Graduates will demonstrate advancement in their careers through increasing professional responsibility and continued life-long learning.

**SUBJECT: Genetic Engineering Laboratory**

CO1	Describe the main principles, methods for preparation and cloning of DNA in various organisms.
CO2	Express clearly about the gene amplification and methods for analysis of DNA
CO3	Acquired practical knowledge on hybridization, restriction analysis and gene expressions
CO4	Use genetic and biotechnological techniques to manipulate genetic materials and develops new and improved living organisms.
CO5	Students will be aware of the hazardous chemicals and safety precautions in case of emergency

**YEAR: IV**

**SEMESTER: VII**

**SUBJECT: Total Quality Management**

CO1	Has gained the knowledge on concepts in quality management
CO2	Understood the principle and concepts of employers, employees and teamwork
CO3	Understood the tools to evaluate the quality maintenance
CO4	Apply the tools and techniques of quality management to manufacturing and services processes
CO5	Understood and apply the knowledge gained on ISO in the working environment

**SUBJECT: Downstream Processing**

CO1	Able to Understand the methods to obtain pure proteins, enzymes and in general about product development R & D
CO2	Define the fundamentals of downstream processing for product recovery
CO3	Understand the requirements for successful operations of downstream processing
CO4	Describe the components of downstream equipment and explain the purpose of each
CO5	Understand the process of isolation, purification, product formulations and finishing operations involved in bioproduct production

**SUBJECT: Immunology**

CO1	The students after completing the course would be aware of immune system structure and functions.
CO2	The students would be aware of immunity to various pathogens.
CO3	The students would be aware of the principles behind the production of therapeutic/diagnostic molecules.
CO4	The students would be aware of the concepts and mechanism behind tumour development, allergy and hypersensitivity reactions.
CO5	Applied immunology in clinical research.

**SUBJECT: Plant Biotechnology (PROFESSIONAL ELECTIVE V)**

CO1	Understand the nature of plant genome and its complications, also understand the usage of these genes in crop improvement program.
CO2	Ability to design organelles based gene transfer and role of different organelles in maintaining total energy balance of a plant.
CO3	Understand the role of nitrogen fixing mechanism in crop yield.
CO4	Select a suitable cloning vector for the production of genetically modified plants.
CO5	Understand the importance various transgenic plants and its role in crop improvement and green revolution.

**SUBJECT: Tissue Engineering (PROFESSIONAL ELECTIVE IV)**

CO1	Ability to understand the components of the tissue architecture
CO2	Opportunity to get familiarized with the stem cell characteristics and their relevance in medicine
CO3	Awareness about the properties and broad applications of biomaterials
CO4	Overall exposure on basics of biology of stem cell
CO5	Overall exposure to the role of tissue engineering and stem cell therapy in Organogenesis

**SUBJECT: Environmental and social Impact Assessment (Open Elective II)**

CO1	Carry out scoping and screening of developmental projects for environmental and social assessments
CO2	Explain different methodologies for environmental impact prediction and assessment
CO3	Plan environmental impact assessments and environmental management plans
CO4	Evaluate environmental impact assessment reports
CO5	Gained the knowledge on impacts created by social and environmental issues by conducting the case studies

**SUBJECT: Downstream Processing Laboratory**

CO1	Acquired knowledge for the separation of whole cells and other insoluble ingredients from the culture broth.
CO2	Learned cell disruption techniques to release intracellular products
CO3	Learned various techniques like extraction, precipitation for secondary purification process
CO4	Learned various techniques like membrane separation for concentrating biological products

CO5	Learned the basic principles and techniques of chromatography to purify the biological products and formulate the products for different end uses.
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**SUBJECT : Immunology Laboratory**

CO1	The students would be aware of immune system cells and tissues.
CO2	The students would have knowledge on immunological /clinical tests.
CO3	The students would be able to isolate lymphocytes and monocytes.
CO4	The students would be able to identify various immune system cells