



Department of Biotechnology

PROGRAMME OUTCOMES

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 & 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 & 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 multi-disciplinary 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 & life-long learning in the broadest context of technological change.



COURSE OUTCOMES – 3rd Semester

Biomolecules and Biochemistry

COURSE OUTCOMES	
On successful completion of the course, the student will be able to:	
CO1	Differentiate the structure and Function of carbohydrates and understand the various carbohydrate metabolisms
CO2	Classify amino acids and peptides
CO3	Execute enzyme kinetics by analyzing the Michaelis-Menten equation, Briggs-Halden Modification, and determination of V _{max} and K _m value
CO4	Discuss the structure and function of lipids
CO5	Assess detailed models and functions of nucleotides and nucleic acids

CO-PO Matrix for BTPC2001 (Biomolecules and Biochemistry)

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1
CO3	3	3	2	3	3	-	-	-	-	-	-	1
CO4	3	2	-	-	-	-	-	-	-	-	-	1
CO5	3	2	-	-	-	-	-	-	-	-	-	1
Average	3	2.2	0.4	0.6	0.6	-	-	-	-	-	-	1



Cell Biology & Genetics

COURSE OUTCOMES

On successful completion of the course, the student will be able to:

CO1	Cell Structure: Explain the structure and function of cell organelles and their roles in cellular processes.
CO2	Membrane Dynamics: Understand the properties and functions of biological membranes, including transport mechanisms.
CO3	Cell Cycle: Describe the phases of the cell cycle and the mechanisms of cell division (mitosis and meiosis).
CO4	Fundamental Concepts: Students will understand the fundamental principles of classical genetics, including segregation, independent assortment, dominance, and epistasis.

CO-PO Matrix for BTPC2003 (Cell Biology and Genetics)

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	-	-	2	-	-	-	-	-	-	1
CO3	3	3	-	-	-	-	-	-	-	-	-	1
CO4	2	3	-	2	-	-	-	-	-	-	-	1
Average	2.8	2	-	0.4	0.4	-	-	-	-	-	-	1



Microbiology

COURSE OUTCOMES

On successful completion of the course, the student will be able to:

CO1	Understand the Structure and Function of Genetic Material: Students will be able to describe the structure of DNA and RNA, as well as their roles in microbial cells.
CO2	Explain Gene Expression and Regulation: Students will understand how genes are expressed and regulated in prokaryotes and eukaryotes.
CO3	Conduct Basic Genetic Manipulation Techniques: Students will demonstrate proficiency in techniques such as PCR, gel electrophoresis, and cloning.
CO4	Analyze Genetic Data: Students will be able to interpret data from genetic experiments and use bioinformatics tools to analyze genetic sequences.

CO-PO Matrix for BTPC2002 (Microbiology)

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	3	-	-	-	-	-	-	-	-	-	1
CO3	3	2	3	2	3	-	-	-	-	-	-	1
CO4	3	3		3	3	-	-	-	-	-	-	1
Average	3	2	0.6	1	1.2	-	-	-	-	-	-	1



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COURSE OUTCOMES – 4th Semester

MOLECULAR BIOLOGY

Course Outcomes (COs):

1. Explain the molecular mechanisms of DNA replication, transcription, and translation in prokaryotic and eukaryotic cells.
2. Identify key molecular biology techniques, such as PCR, gel electrophoresis, and DNA sequencing, and their applications in research.
3. Develop analytical skills to evaluate biological data and interpret experimental results effectively.
4. Communicate scientific concepts clearly through written reports and oral presentations using appropriate terminology.
5. Apply critical thinking to design experiments that test hypotheses related to molecular biology.

CO-PO Matrix for BTPC2004 (Molecular Biology)

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	2	3	2	3	-	-	-	-	-	-	1
CO3	3	3	-	3	3	-	-	-	-	-	-	1
CO4	2	-	-	-	-	-	-	-	-	-	-	1
CO5	3	3	3	3	3	-	-	-	-	-	-	1
Average	2.8	2	1.2	1.6	1.8	-	-	-	-	-	-	1



BIO ANALYTICAL TOOLS AND TECHNIQUES

Course Outcomes (COs):

1. Identify and explain the principles and functions of various bioanalytical techniques and instruments.
2. Determine appropriate applications of bioanalytical methods for analyzing drugs, biopharmaceuticals, and biomolecules.
3. Perform calculations necessary for data interpretation from different bioanalytical techniques.
4. Describe the advantages and disadvantages of each bioanalytical technique covered in the course.
5. Select suitable analytical methods to solve specific problems in biological and biomedical contexts.

CO-PO Matrix for BTPC2005 (Bio-Analytical Tools and Techniques)

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	3	-	-	-	-	-	-	1
CO3	3	3	-	3	3	-	-	-	-	-	-	1
CO4	2	3	-	-	-	-	-	-	-	-	-	1
CO5	3	3	3	3	3	-	-	-	-	-	-	1
Average	2.8	3	1	1	1.8	-	-	-	-	-	-	1



BIOINFORMATICS AND BIO-STATISTICS

Course Outcomes (COs):

1. Demonstrate advanced knowledge of bioinformatics concepts, algorithms, tools, and methods for analyzing biological data.
2. Apply statistical methods to analyze and interpret biological data effectively, including measures of central tendency and dispersion.
3. Utilize bioinformatics tools for sequence alignment, database searches, and genome analysis.
4. Understand and evaluate various biological databases and their applications in research.
5. Conduct hypothesis testing using statistical methods, including t-tests and chi-square tests, to analyze experimental data.

CO-PO Matrix for BTPC2006 - Bioinformatics and Bio-Statistics

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	3	-	-	-	-	-	-	1
CO2	3	3	-	3	-	-	-	-	-	-	-	1
CO3	3	2	2	3	3	-	-	-	-	-	-	1
CO4	2	2	-	2	3	-	-	-	-	-	-	1
CO5	3	3	-	3	-	-	-	-	-	-	-	1
Average	2.8	2.4	0.4	2.2	1.8	-	-	-	-	-	-	1



DEVELOPMENTAL BIOLOGY

Course Outcomes (COs):

1. Understand the molecular and cellular processes involved in organismal development from a single cell to maturity.
2. Identify and describe the roles of various gene products and signaling pathways in developmental processes.
3. Analyze the advantages and disadvantages of different model systems used in developmental biology research.
4. Explain the events occurring during embryonic development, including germ layer formation and patterning.
5. Explore the principles of stem cell biology, regeneration, and cellular reprogramming techniques.

CO-PO Matrix for BTPC2007 - Developmental Biology

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	3	-	-	3	-	-	-	-	-	-	1
CO3	3	2	2	2	-	-	-	-	-	-	-	1
CO4	3	2	-	-	-	-	-	-	-	-	-	1
CO5	2	3	3	3	3	-	-	-	-	-	-	1
Average	2.8	2.4	1	1	1.2	-	-	-	-	-	-	1



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COURSE OUTCOMES – 5th Semester

BIOPROCESS ENGINEERING -I (UPSTREAM PROCESSING)

Course Outcomes (COs):

- CO1: Understand Fundamentals of Upstream Processing: Explain the principles of upstream bioprocessing, including media formulation, sterilization, and microbial growth kinetics.
- CO2: Analyze Microbial and Cell Culture Techniques: Apply knowledge of microbial and mammalian cell culture systems for large-scale production of bioproducts.
- CO3: Design and Operate Bioreactors: Understand the design, configuration, and operation of bioreactors used in upstream processing, including batch, fed-batch, and continuous systems.
- CO4: Optimize Growth Conditions and Process Parameters: Evaluate and optimize critical parameters like pH, temperature, aeration, and agitation to enhance productivity in upstream bioprocesses.
- CO5: Implement Monitoring and Control Strategies: Demonstrate the ability to use sensors, control systems, and data analysis to monitor and regulate upstream bioprocesses efficiently.

CO-PO Matrix for BTPC3001 BIOPROCESS ENGINEERING -I

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	-	-	-	-	1
CO2	3	3	2	2	3	-	-	-	-	-	-	1
CO3	3	3	3	2	3	-	-	-	-	-	-	1
CO4	3	3	3	3	3	-	-	-	-	-	-	1
CO5	3	3	3	3	3	-	-	-	-	-	-	1
Average	3	2.8	2.2	2	2.8	-	-	-	-	-	-	1



BTPC3002 GENETIC ENGINEERING

Course Outcomes (COs):

- CO1: Explain the fundamental concepts, tools, and techniques used in genetic engineering, including restriction enzymes, vectors, ligases, and host systems.
- CO2: Apply Molecular Cloning Techniques Demonstrate the ability to design and perform molecular cloning experiments, including DNA isolation, gene insertion, transformation.
- CO3: Analyze and Interpret Genetic Modification Results: evaluate the outcomes of genetic manipulations using molecular techniques like gel electrophoresis, PCR, and DNA sequencing.
- CO4: Design Genetic Constructs for Desired Traits: Construct and analyze recombinant DNA molecules for applications in research, medicine, and agriculture.
- CO5: Assess Ethical, Legal, and Social Issues: Critically discuss the ethical, legal, and biosafety considerations involved in genetic engineering research and applications.

CO-PO Matrix for BTPC3002 GENETIC ENGINEERING

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	3	-	-	-	-	-	-	1
CO2	3	3	2	2	3	-	-	-	-	-	-	1
CO3	3	3	2	2	3	-	-	-	-	-	-	1
CO4	3	3	2	3	3	-	-	-	-	-	-	1
CO5	3	3	3	2	3	-	-	-	-	-	-	1
Average	3	2.8	2.2	1.8	3	-	-	-	-	-	-	1



BTPC3003 IMMUNO-BIOLOGY AND IMMUNOTECHNOLOGY

Course Outcomes (COs):

- CO1: Understand the Components of the Immune System: Explain the structure and function of immune cells, organs, and molecules involved in innate and adaptive immunity.
- CO2: Differentiate Immune Mechanisms: Distinguish between various immune responses, such as humoral and cell-mediated immunity, and their roles in health and disease.
- CO3: Apply Immunological Techniques: Demonstrate knowledge and practical skills in immunological methods like ELISA, flow cytometry, Western blotting, and immunofluorescence.
- CO4: Analyze Immunological Disorders and Vaccines: Understand the basis of autoimmune diseases, hypersensitivities, immunodeficiencies, and the principles of vaccine development and immunotherapy.
- CO5: Integrate Immunotechnology in Diagnostics and Therapeutics: Apply immunological tools and biotechnological innovations in clinical diagnostics, therapeutic development, and biomedical research.

CO-PO Matrix for BTPC3003 IMMUNO-BIOLOGY AND IMMUNOTECHNOLOGY

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	-	-	-	-	1
CO2	3	3	-	-	2	-	-	-	-	-	-	1
CO3	3	3	3	3	3	-	-	-	-	-	-	1
CO4	3	3	2	3	2	2	-	-	-	-	-	1
CO5	3	3	3	3	3	2	2	-	-	-	-	1
Average	3	2.8	1.6	1.8	2.4	0.8	0.4	-	-	-	-	1



BTPE3003 FOOD PROCESS ENGINEERING

Course Outcomes (COs):

CO1: Understand principles and techniques of food processing and preservation.

CO2: Analyze various thermal and non-thermal methods for maintaining food quality.

CO3: Apply biotechnology and fermentation technologies for food product development.

CO4: Evaluate packaging and storage systems for maintaining food safety and shelf life.

CO5: Understand food quality control, regulations, and safety management practices.

CO-PO Matrix for BTPE3003 FOOD PROCESS ENGINEERING

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	-	-	-	-	1
CO2	3	3	2	2	3	-	2	-	-	-	-	1
CO3	3	3	3	2	3	-	2	-	-	-	-	1
CO4	3	3	2	2	2	-	2	-	-	-	-	1
CO5	3	3	2	2	2	2	3	-	-	-	-	1
Average	3	2.8	1.8	1.6	2.4	0.4	1.8	-	-	-	-	1



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COURSE OUTCOMES – 6th Semester

BTPC3004 BIOPROCESS ENGINEERING–II (DOWNSTREAM PROCESSING)

Course outcomes (Cos)

- 1) Understand the historical development and importance of bioprocess technologies in the biotechnology industry
- 2) Describe the general requirements of industrial fermentation, including microorganism isolation, preservation, and inoculum development.
- 3) Perform stoichiometric and elemental balances for microbial growth and product formation.
- 4) Understand and apply sterilization techniques including thermal death kinetics and the design of sterilization equipment.
- 5) Assess the effects of substrate/product inhibition and differentiate between growth-associated and non-growth-associated product formation.

CO-PO Matrix for BTPC3004 BIOPROCESS ENGINEERING–II

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	2	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	2	2	-	-	-	-	-	-	1
CO4	3	2	3	2	2	2	2	1	-	-	-	1
CO5	3	3	2	2	2	-	3	-	-	-	-	1
Average	3	2.6	1.8	1.2	1.2	0.4	1.4	0.2	-	-	-	1



BTPE3009 BIOREACTOR DESIGN AND ANALYSIS

Course outcomes (Cos)

1. Design bioreactor systems (batch, fed-batch, continuous) by applying mass/energy balance equations, Monod kinetics, and operational parameters to meet specific production goals.
2. Analyze oxygen transfer efficiency (KLa) and rheological properties of fermentation broths to optimize agitation-aeration systems for microbial and mammalian cell cultures.
3. Evaluate scale-up challenges (shear stress, oxygen gradients) using dimensionless numbers (Reynolds, power/volume) and propose solutions for industrial bioreactor configurations.
4. Operate advanced bioreactors (airlift, membrane, photobioreactors) with PID-controlled sensors (pH, DO) for applications in vaccine production, biofuels, and waste bioremediation.
5. Simulate non-ideal reactor behavior (dead zones, bypassing) using computational tools and recommend design modifications to enhance productivity.

CO-PO Matrix for BTPE3009 BIOREACTOR DESIGN AND ANALYSIS

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	-	2	-	-	-	-	1
CO2	3	3	2	3	3	-	-	-	-	-	-	1
CO3	3	3	3	2	2	2	3	-	-	-	-	1
CO4	2	2	3	3	3	2	3	1	2	2	1	1
CO5	3	3	2	3	3	-	2	-	-	-	-	1
Average	2.8	2.6	2.6	2.6	2.6	0.8	2	0.2	0.4	0.4	0.2	1



BTPC3005 OMICS TOOLS AND TECHNIQUES

Course outcomes (Cos)

- 1) Explain the principles and applications of genomics, transcriptomics, proteomics, and metabolomics.
- 2) Interpret high-throughput data from omics technologies using bioinformatics tools.
- 3) Apply omics approaches to identify genes, proteins, and metabolites involved in biological processes.
- 4) Analyze differential gene/protein expression using omics platforms for disease or trait studies.
- 5) Evaluate integrative omics approaches for systems biology and personalized medicine.

CO-PO Matrix for BTPC3005 OMICS TOOLS AND TECHNIQUES

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	2	-	-	-	-	1
CO2	3	3	2	3	3	-	-	-	-	-	-	2
CO3	3	3	3	2	2	-	-	-	2	-	-	2
CO4	3	3	2	3	3	-	-	-	-	-	-	2
CO5	3	2	2	3	3	-	2	1	-	2	-	3
Average	3	2.6	1.8	2.2	2.2	-	0.8	0.2	0.4	0.4	-	2



BTPE3005 PLANT BIOTECHNOLOGY

Course outcomes (Cos)

1. Students will be able to describe the organization and key features of plant nuclear, chloroplast, and mitochondrial genomes
2. Students will be able to explain the principles of intergenomic interactions and their impact on plant development and function.
3. Students will be able to identify and explain the function of selectable markers, reporter genes, and promoters commonly used in plant genetic engineering.
4. Students will be able to differentiate between conventional plant breeding approaches and various plant tissue culture techniques.
5. Students will be able to identify and categorize various plant secondary metabolites and their diverse applications in drug development, agriculture (biopesticides, growth regulators, biofertilizers)..

CO-PO Matrix for BTPE3005 PLANT BIOTECHNOLOGY

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	2	3	2	2	-	-	-	-	-	-	1
CO4	3	3	3	2	2	2	2	-	2	2	-	2
CO5	3	2	3	2	2	2	3	1	-	-	-	2
Average	3	2.4	2.2	1.2	1.2	0.8	1	0.2	0.4	0.4	-	1.4



MCMC3002 INDUSTRIAL SAFETY ENGINEERING

Course Outcomes:

CO1: Evaluate workplace to determine the existence of occupational safety and health hazards

CO2: Identify relevant regulatory and national consensus standards along with best practices that are applicable.

CO3: Select appropriate control methodologies based on the hierarchy of controls

CO4: Analyze injury and illness data for trends

CO-PO Matrix for MCMC3002 INDUSTRIAL SAFETY ENGINEERING

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	3	3	2	-	-	-	1
CO2	2	3	2	-	-	3	3	3	-	-	-	1
CO3	3	3	3	2	2	3	3	2	-	-	-	1
CO4	2	3	2	3	2	2	2	1	-	-	-	1
Average	2.5	3	2.2	1.7	1.5	2.7	2.7	2	-	-	-	1