

22BPC302 – INDUSTRIAL MICROBIOLOGY

COURSE OUTCOMES:		
At the end of the course, the student will be able to:		
The Course Outcome (CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain the classification, morphology, cultivation, staining techniques and microscopic examination of microorganisms relevant to industrial biotechnology.	
CO2	Apply the principles of microbial nutrition, growth, cultivation and control for the isolation, identification and safe handling of industrially important microorganisms.	PO1, PO2, PO5
CO3	Analyze microbial fermentation processes by correlating microbial physiology, fermentation strategies and process parameters for industrial production.	PO1, PO2, PO3, PO4
CO4	Evaluate microbial production systems for primary metabolites, secondary metabolites and value-added bioproducts based on process efficiency and industrial applicability.	PO1, PO2, PO3, PO4, PO5
CO5	Design suitable microbial production strategies for recombinant proteins, vaccines, monoclonal antibodies and other modern biotechnology products by integrating microbiological and bioprocess principles.	PO5, PO6, PO7, PO8

CO - PO MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	3	1	-
CO2	3	2	-	-	2	-	-	-	-	-	-	3	1	3
CO3	2	3	2	2	-	-	-	-	-	-	-	3	2	2
CO4	2	2	3	2	2	-	-	-	-	-	-	3	2	2
CO5	-	-	-	-	2	2	2	1	-	-	-	3	2	-
22BPC302	2.3	2.3	2.5	2	2	2	2	1	-	-	-	3	1.6	2.3

22BPC303 – BIOCHEMISTRY

COURSE OUTCOMES:		
At the end of the course, the student will be able to:		
The Course Outcome (CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain the concepts of carbohydrate metabolism including glycolysis, TCA cycle, pentose phosphate and glyoxalate shunt, the respiratory chain, oxidative phosphorylation and photophosphorylation, and the metabolic disorders associated with carbohydrates.	-
CO2	Describe the pathways of lipid metabolism including fatty acid synthesis and oxidative degradation, triacylglycerol and phospholipid biosynthesis and degradation, cholesterol biosynthesis, and metabolic disorders associated with lipids.	PO1, PO2
CO3	Apply the principles of nucleotide metabolism to the de novo and salvage pathways for purines and pyrimidines, their regulation and degradation, and the metabolic disorders associated with nucleic acids.	PO1, PO2
CO4	Analyze nitrogen metabolism, the biosynthesis of essential and aromatic amino acids, the urea cycle, amino acid degradation, and the metabolic disorders associated with amino acids.	PO1, PO2
CO5	Evaluate the mechanisms of protein folding and targeting including the Levinthal paradox, Anfinsen's experiment, the molten globule state, chaperones, signal sequences, secretion, protein degradation and turnover.	PO1, PO2
CO6	Seminar to be presented on recent advances in metabolism, biochemical pathways, protein folding and targeting, and content beyond the syllabus.	PO9, PO10, PO12

CO - PO MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	3	1
CO2	1	1	-	-	-	-	-	-	-	-	-	-	3	1
CO3	1	1	-	-	-	-	-	-	-	-	-	-	3	1
CO4	2	1	-	-	-	-	-	-	-	-	-	-	3	1
CO5	1	2	-	-	-	-	-	-	-	-	-	-	3	1
CO6	-	-	-	-	-	-	-	-	2	3	-	2	3	2
22BPC303	1.2	1.2	-	-	-	-	-	-	2	3	-	2	3	1.2

22BPC304 – GENETICS

COURSE OUTCOMES:		
At the end of the course, the student will be able to:		
The Course Outcome (CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain the principles of bacterial genetics, including plasmids, episomes, recombination, transformation, transduction, conjugation, and bacterial gene mapping.	-
CO2	Apply the principles of Mendelian genetics to solve problems related to inheritance patterns, multiple alleles, gene interactions, sex determination, sex linkage, and pedigree analysis.	PO1, PO2, PO3,PO4, PO5
CO3	Analyse chromosome organization, structural and numerical chromosomal variations, linkage, crossing over, chromosome mapping, and somatic cell hybridization.	PO1, PO2, PO3,PO4, PO5
CO4	Evaluate the role of Hardy–Weinberg equilibrium, evolutionary forces, genetic variation, and population genetics models in explaining population dynamics.	PO1, PO2, PO3,PO4, PO5,PO6,PO7,PO8
CO5	Interpret the genetic basis, inheritance patterns, diagnosis, and clinical significance of inherited metabolic disorders, chromosomal disorders, and multifactorial genetic diseases.	PO1, PO2, PO3,PO4, PO5,PO6,PO7,PO8

CO - PO MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	1	1
CO2	1	1	1	1	1	-	-	-	-	-	-	1	-
CO3	1	1	2	1	2	-	-	-	-	-	-	1	1
CO4	2	1	1	2	1	1	1	1	-	-	-	1	-
CO5	2	1	2	2	1	1	2	1	-	-	-	1	1

22BPC305 – MICROBIOLOGY LABORATORY

COURSE OUTCOMES:		PO's Mapped
On completion of the course, the students will be able to:		
CO1	Demonstrate appropriate laboratory safety, aseptic handling and sterilization procedures for the safe manipulation of microorganisms and microbiological materials.	
CO2	Apply microscopy and staining techniques for the observation, characterization and identification of bacterial and fungal microorganisms.	PO1, PO4, PO5
CO3	Prepare and utilize suitable culture media and microbiological cultivation techniques for the isolation and growth of microorganisms.	PO1, PO2, PO3, PO4, PO5
CO4	Perform and interpret biochemical, motility and antimicrobial susceptibility tests for the identification and characterization of bacterial isolates.	PO3, PO4
CO5	Apply appropriate techniques for microbial preservation and growth-curve analysis to evaluate the maintenance and growth characteristics of bacterial cultures.	PO6, PO7, PO8

Course Articulation Matrix

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	–	–	–	3	2	2	–	–	–	–	3
CO2	3	3	–	2	2	–	–	–	–	–	–	–	3
CO3	3	3	2	2	2	–	–	–	–	–	–	–	3
CO4	3	3	2	3	2	–	–	–	–	–	–	–	3
CO5	3	2	2	2	2	2	2	1	–	–	–	–	3

22BPC306 – BIOCHEMISTRY LABORATORY

COURSE OUTCOMES:		
At the end of the course, the student will be able to:		
The Course Outcome (CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain the fundamentals of units, volume and weight measurements, concentrations, sensitivity, specificity, precision and accuracy involved in biochemical experiments.	PO1, PO2
CO2	Apply the techniques of accurate and reproducible reagent and buffer preparation, construction of titration curves of amino acids, and operation of the pH meter, weighing balance, colorimeter and spectrophotometer.	PO1, PO4, PO5
CO3	Analyze biomolecules through qualitative and quantitative tests for carbohydrates, reducing sugars, amino acids and proteins.	PO2, PO4, PO5
CO4	Evaluate the quantity of biomolecules through estimation of nucleic acids (ribose and deoxyribose), glucose by the GOD-POD method, and cholesterol.	PO2, PO4, PO5
CO5	Design suitable protocols to determine the isoelectric point of casein and to isolate, separate and quantify various biomolecules.	PO3, PO4, PO5
CO6	Seminar to be presented on the principles, applications and recent advances in biochemical analysis and content beyond the syllabus.	PO9, PO10, PO12

MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	3	1
CO2	1	-	-	2	2	-	-	-	-	-	-	-	3	1
CO3	-	2	-	2	1	-	-	-	-	-	-	-	3	1
CO4	-	2	-	3	2	-	-	-	-	-	-	-	3	1
CO5	-	-	2	2	2	-	-	-	-	-	-	-	3	1
CO6	-	-	-	-	-	-	-	-	2	3	-	2	3	2
22BPC306	1.5	1.7	2	2.3	1.8	-	-	-	2	3	-	2	3	1.2

22BPC512 – BIOPROCESS PRINCIPLES

COURSE OUTCOMES:		
At the end of the course, the student will be able to:		
The Course Outcome (CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain the principles of fermentation processes, classifications of fermenters, process flow sheets, basic fermenter configuration, ancillaries, and the key physical and chemical parameters involved in fermentation operations.	-
CO2	Apply the principles of media formulation and optimization to design suitable fermentation media based on nutrient requirements and statistical optimization methods such as OFAT, Plackett–Burman, and Response Surface Methodology (RSM).	PO1, PO2, PO3, PO4, PO5, PO6, PO7,
CO3	Analyze sterilization methods and thermal death kinetics to select appropriate sterilization strategies and equipment for media, air, and fermentation processes.	PO1, PO2, PO3, PO4, PO5, PO7,
CO4	Analyze microbial growth, product formation, and energy relationships using stoichiometric balances, yield coefficients, maintenance coefficients, and thermodynamic principles in fermentation systems.	PO1, PO2, PO3, PO4, PO5, PO7, PO10
CO5	Evaluate microbial growth kinetics and product formation in batch, fed-batch, and continuous fermentations using Monod, Luedeking–Piret, and inhibition models to assess bioprocess performance.	PO1, PO2, PO3, PO4, PO5, PO7, PO10
CO6	Design an industrial fermentation process by integrating fermenter configuration, media design, sterilization techniques, stoichiometric analysis, and kinetic models for efficient microbial growth and product formation.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12

MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	3	1	1	-	-	-	-	-	3	2
CO3	3	3	2	2	2	-	2	-	-	-	-	-	3	1
CO4	3	3	2	2	2	-	1	-	-	1	-	-	3	2
CO5	3	3	2	3	2	-	1	-	-	1	-	-	2	2
CO6	3	3	3	3	3	2	2	1	1	1	1	2	2	2
22BPC512	3	3	2.2	2.4	2.4	1.5	1.4	1	1	1.2	1	2	2.6	1.8

22BPC513 – GENETIC ENGINEERING

COURSE OUTCOMES:		
At the end of the course, the student will be able to:		
The Course Outcome (CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain the fundamental concepts of recombinant DNA technology and demonstrate the tools, enzymes, and safety guidelines involved in creating recombinant DNA molecules.	-
CO2	Apply the principles of cloning and expression vectors to select appropriate vectors for gene cloning and expression in prokaryotic and eukaryotic systems.	PO1, PO2, PO3
CO3	Analyze the methods for constructing and screening genomic and cDNA libraries using molecular and immunological techniques for gene identification and characterization.	PO2, PO3
CO4	Apply modern molecular biology techniques such as PCR, DNA sequencing, and site-directed mutagenesis for gene amplification, analysis, and characterization.	PO1, PO2, PO3
CO5	Evaluate the applications of recombinant DNA technology in agriculture, medicine, pharmaceuticals, and biotechnology, including transgenic organisms, gene editing, and novel product development.	PO2, PO3

MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	1	2	1	2	2	2	–	2	–	2	1
CO2	3	3	2	2	2	2	1	2	2	2	2	3	2
CO3	3	3	3	3	2	2	2	2	2	2	2	3	2
CO4	3	3	3	2	3	2	1	3	2	3	2	3	3
CO5	3	3	3	3	3	3	2	3	2	3	2	3	3
CO6	-	-	-	-	-	-	-	-	2	3	-	2	3
22BPC513	3	2.8	2.4	2.4	2.2	2.2	1.6	2.4	1.6	2.4	1.6	2.8	2.2

22BPC514 – PROTEIN ENGINEERING

COURSE OUTCOMES:		
At the end of the course, the student will be able to:		
The Course Outcome (CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain the covalent, ionic, hydrogen, hydrophobic and van der Waals interactions in protein structure and the elucidation of secondary and tertiary structure using circular dichroism, X-ray diffraction and Nuclear Magnetic Resonance (NMR).	-
CO2	Apply the knowledge of molecular properties of amino acids, post translational modifications and peptide analysis techniques such as automated Edman method, mass-spectrometry and peptide mapping to characterize proteins.	PO1, PO2
CO3	Analyze the primary, secondary, super-secondary, tertiary and quaternary architecture of proteins including topology diagrams, structural motifs, domains, protein folding and the role of molecular chaperones.	PO1, PO2
CO4	Illustrate the structure-function relationship of proteins through DNA-binding proteins, transcription factors, membrane proteins and receptors, immunoglobulins and enzymes.	PO1, PO2
CO5	Design engineered proteins by applying methods to alter primary structure, improving thermal stability, enabling post translational modification, de novo protein design and protein engineering for biomaterials.	PO2, PO3, PO4, PO5
CO6	Seminar to be presented on advances in protein engineering, protein data base analysis, engineering approaches, and content beyond the syllabus.	PO9, PO10, PO12

MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	3	1
CO2	1	1	-	-	-	-	-	-	-	-	-	-	3	1
CO3	1	1	-	-	-	-	-	-	-	-	-	-	3	1
CO4	1	1	-	-	-	-	-	-	-	-	-	-	3	1
CO5	-	1	2	1	2	-	-	-	-	-	-	-	3	1
CO6	-	-	-	-	-	-	-	-	2	3	-	2	3	2
22BPC514	1.3	1	2	1	2	-	-	-	2	3	-	2	3	1.2

22BPC515 – BIOPROCESS LABORATORY -I

COURSE OUTCOMES:		
At the end of the course, the student will be able to:		
The Course Outcome (CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Understand the enzyme kinetics, media design, and microbial growth kinetics	-
CO2	Estimate the enzyme kinetic parameters and understand the effect of pH and temperature on enzyme activity	PO1,PO2, PO3,PO4,PO5, PO11
CO3	Evaluate types of enzyme inhibition kinetics and perform enzyme immobilization by gel entrapment and cross linking.	PO2,PO3,PO4, PO5,PO6, PO7,PO11
CO4	Apply statistical optimization techniques for screening and ranking of medium components for enhanced bioproduct formation	PO2,PO3,PO8,PO9, PO10
CO5	Evaluate microbial growth kinetics and to calculate the kinetic parameters for bacterial and yeast growth in batch culture.	PO2,PO3,PO8,PO9, PO10,PO11, PO12
CO6	Determine the sterilization kinetics and explain the construction, ancillaries and operation of bioreactor	PO3,PO4, PO8,PO9,PO10, PO11, PO12

MAPPING

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	3	3	-	-	-	-	-	2	-	1	-
CO3	-	2	2	2	2	1	1	-	-	-	1	-	2	2
CO4	-	1	2	-	-	-	-	1	1	1	-	-	2	2
CO5	-	1	1	-	-	-	-	1	1	1	1	1	1	1
CO6	-	-	1	1	-	-	-	1	1	1	1	1	1	1
22BPC515	2	1.5	1.8	2	2.5	1	1	1	1	1	1.25	1	1.4	1.5

22BPC516 – GENETIC ENGINEERING LABORATORY

COURSE OUTCOMES:		PO's Mapped
On completion of the course, the students will be able to:		
C01	Acquire practical knowledge and hands-on skills in fundamental genetic engineering techniques, including DNA isolation, plasmid preparation.	P01, P02, P04, P05, P09
C02	Produce DNA fragments by using enzymes such as Restriction endonuclease and ligase.	P01, P04, P05, P09
C03	Prepare the competent cells from the given culture and transform it by insertion of plasmid and selection of recombinant cells.	P01, P02, P04, P05, P09
C04	Design primers and perform PCR to amplify DNA and gene products.	P01, P03, P04, P05, P09

Course Articulation Matrix

COs\POs	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
C01	3	2	–	3	3				3	–	–	–	–
C02	2	–	–	3	2	–	–	–	3	–	–	–	–
C03	3	3	–	3	2	–	–	–	3	–	–	–	–
C04	3	–	2	3	2	–	–	–	3	–	–	–	–

22BPC722 – DOWNSTREAM PROCESSING

COURSE OUTCOMES:		
At the end of the course, the student will be able to:		
The Course Outcome (CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Understand the need for bio-separation, various unit operations to isolate and purify the bio-products	-
CO2	Analyze the various techniques for solid-liquid separation and isolation of bio-products to predict the parameters for large scale down stream processing	PO2, PO3,PO4,PO5,PO11
CO3	Apply the principles and working of different unit operations for isolation and concentration of bio-products	PO1,PO2,PO3,PO4,PO5,PO7,PO11
CO4	Demonstrate the various techniques for concentration and high-resolution purification of proteins	PO1,PO2,PO3,PO4,PO5
CO5	Classify the different methods and equipment used for the final polishing of bio-products at the industrial level	PO1,PO2,PO3,PO5,PO6,PO7,PO11

MAPPING

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	-	-	1	2	-
CO2	-	3	2	2	2	-	-	-	-	-	2	1	1	-
CO3	2	2	3	2	2	-	2	-	-	-	2	2	2	2
CO4	2	3	2	2	2	-	-	-	-	-	-	2	2	2
CO5	2	2	3	-	2	2	2	-	-	-	3	2	2	2
22BPC722	2	3	3	2	2	-	2	-	1	-	-	2	2	2

22BPC723 – DOWNSTREAM PROCESSING LABORATORY

COURSE OUTCOMES:		PO's Mapped
On completion of the course, the students will be able to:		
C01	Understand and identify different bio-separation techniques for bio-product purification	-
C02	Apply techniques for the recovery of products from fermentation broth.	P01, P07, P08,P09,P010
C03	Decide and perform experiments for isolating bio products.	P01, P02, P03, P09, P010
C04	Concentrate and purify the products through various techniques.	P01, P02,P03,P04,P05P09,P010,P011
C05	Able to formulate and finish the bio-products.	P01, P02, P04,P07,P08,P09,P010,P011

Course Articulation Matrix

COs\POs	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	PS01	PS02
C01	-	-	-	-	-	-	-	-	-	-	-	1	2
C02	1	-	-	-	-	1	2	1	2	2	-	1	3
C03	2	2	3	-	-	-	-	-	2	2	-	1	3
C04	2	2	2	1	2	-	-	-	1	1	1	1	3
C05	2	2	-	3	-	-	1	1	2	1	2	1	3