AP PGECET 2025 Biotechnology Syllabus

Engineering Mathematics Syllabus

Linear Algebra	• Matrices & determinants • Systems of linear equations • Eigenvalues and eigenvectors
Calculus	• Limit, continuity, and differentiability • Partial derivatives • Maxima & minima • Sequence and series • Test for convergence • Fourier series
Differential Equations	• Linear and non-linear first-order ODEs • Higher-order ODEs with constant coefficients • Cauchy's & Euler's equations • Laplace transforms • PDE - laplace • Heat and wave equations
Probability & Statistics	• Probability and sampling theorems • Conditional probability • Mean/median/mode/standard deviation • Random variables • Poisson/ normal/ binomial distributions • Correlation and regression analysis
Numerical Methods	• Solutions of non-linear algebraic equations • Single & multi-step methods for differential equations • Integration of trapezoidal and Simpson's rule

Biotechnology Syllabus

Microbiology	• Prokaryotic and eukaryotic cell structure • Microbial nutrition • Growth and control • Microbial metabolism (aerobic and anaerobic respiration, photosynthesis) • Nitrogen fixation • Chemical basis of mutations and mutagens • Microbial genetics (plasmids, transformation, conjugation, transduction) • Microbial diversity and characteristics features • Viruses
Biochemistry	• Biomolecules and their conformation • Weak inter-molecular interactions in biomacromolecules • Chemical and functional nature of enzymes • Kinetics of single substrate and bi-substrate enzyme-catalyzed reactions • Bioenergetics • Metabolism (glycolysis, TCA & oxidative phosphorylation) • Membrane transport and pumps • Cell cycle and cell growth control • Cell signaling and signal transduction
Molecular Biology and Genetics	• Molecular structure of genes and chromosomes • DNA replication and control • Transcription and its control • Translational processes • Regulatory controls in prokaryotes and eukaryotes • Mendelian inheritance • Gene interaction • Complementation • Linkage/ recombination/ chromosome mapping

	• External chromosomal inheritance • Chromosomal variation • Population genetics • Transposable elements • Molecular basis of genetic diseases and applications
Process Biotechnology	• Bioprocess technology for the production of cell biomass and primary/ secondary metabolites (like baker's yeast, ethanol, citric acid, amino acids, antibiotics, pigments, exopolysaccharides) • Microbial production purification and bioprocesses applications of industrial enzymes • Production and purification of recombinant proteins on a large scale • Chromatographic and membrane-based bioseparation methods • Immobilization of enzymes and cells and their applications of bioconversion processes • Aerobic and anaerobic biological processes for stabilization of solid/liquid wastes • Bioremediation
Bioprocess Engineering	• Kinetic of microbial growth • Substrate utilization and product formation • Simple structured models • Sterilization of air and media • Batch, fed-batch and continuous processes • Aeration and agitation • Mass transfer in bioreactors • Rheology of fermentation fluids • Scale-up concepts • Design of fermentation media • Various types of microbial and enzyme reactors • Instrumentation in bioreactors

Plant and Animal Biotechnology	• Special features and organization of plant cells • Totipotency • Regeneration of plants • Plant products of industrial importance • Biochemistry of major metabolic path ways and products • Autotrophic and heterotrophic growth • Plant growth regulators and elicitors • Cell suspension culture development: methodology, kinetics of growth and product formation, nutrient optimization • Production of secondary metabolites by plant suspension cultures • Hairy root cultures and their cultivation • Techniques in raising transgencies
Charcaterisitcs of Animals Cells	• Metabolism/ regulation/ nutritional requirements for mass cultivation of animal cell cultures • Kinetics of cell growth and product formation and effect of shear force • Product and substrate transport • Micro and macro carrier culture • Animal cell preservation
Immunology	• The origin of immunology • Inherent immunity • Humoral and cell mediated immunity • Primary and secondary lymphoid organ • Antigen • B and T cells and macrophages • Major histocompatibility complex • Antigen processing and presentation • Synthesis of antibody and secretion • Molecular basis of antibody

	diversity • Polyclonal and monoclonal antibody • Complement • Antigen antibody reaction • Regulation of immune response • Immune tolerance • Hyper sensitivity • Autoimmunity • Graft versus host reaction
Recombinant DNA Technology	• Restriction and modification enzymes • Vectors: Plasmid/ bacteriophage/ other viral vectors/ cosmids/ Ti plasmid/ yeast artificial chromosome • cDNA and genomic DNA library • Gene Isolation • Gene cloning • Expression of cloned gene • Transposons and gene targeting • DNA labeling • DNA sequencing • Polymerase chain reactions • DNA fingerprinting • Southern and northern blotting • In-situ hybridization • RAPD • RFLP • Site-directed mutagenesis • Gene transfer technologies • Gene therapy
Bioinformatics	• Major bioinformatics resources (NCBI, EBI, ExPASy) • Sequence and structure databases • Sequence analysis (biomolecular sequence file formats, scoring matrices, sequence alignment, phylogeny) • Genomics and proteomics (large genome sequencing strategies, comparative genomics, understanding DNA micro arrays and protein arrays)

	• Molecular and simulations (basic concepts including concept of force field)