

Department of Biotechnology
Sarguja University Ambikapur (C.G.)

Syllabus for Ph. D, Entrance Test – 2017

Cell Biology: Structural organization and functions of cell and cellular organelles: ultra structure of plasma membrane and membrane transport, nucleus, mitochondria, Golgi bodies, endoplasmic reticulum, lysosomes, Chloroplast, peroxisomes, vacuoles. Cytoskeletons structure and motility function, Cell signaling pathways, Cell cycle: mitosis, meiosis, apoptosis, cancer. Principles of genetics.

Molecular Biology: Genome Organization, Mutation, Gene structure, Gene families, Pseudogenes, Repetitive DNA, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons. DNA replication, repair and recombination, Transcription and post transcriptional processing; Translation and post translational modifications and proteins transport; Control of gene expression at transcription and translation level. Regulation of gene expression in prokaryotes and eukaryotes.

Biochemistry: Covalent and non-covalent interactions; Structure of Amino acids and proteins, Ramachandran plot, Protein sequencing; Conformation of Nucleic acids: Structural characteristics of A, B and Z-DNA, structure of t-RNA; Carbohydrates and lipids. Carbohydrate metabolism. Laws of thermodynamics and Concepts of ΔG , ΔH and ΔS . Concepts of pH, Ionic strength, Molarity, Normality, Molality, Henderson Hasselbalch equation and buffers. Enzymes and enzyme kinetics.

General Microbiology: Structure and characteristic features of bacteria, fungi, protozoa and virus; Isolation and Preservation microorganisms, aseptic techniques, microbial growth and nutrition; transformation, transduction and conjugation; Infectious disease transmission: Tuberculosis, Sexually transmitted diseases, including AIDS; Diseases transmitted by animals (rabies, plague), insects and ticks (Rickettsias, Lyme disease, malaria); Food and water borne diseases.

Immunology: Innate and adaptive immunity, Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules, antibody diversity, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immunity, complement system, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity, congenital and acquired immune-deficiencies, vaccines.

Bioinformatics: Biological Databases, Information Retrieval from Biological Databases, Unique Requirements of Database Searching, Heuristic Database Searching, Basic Local Alignment Search Tool (BLAST), FASTA Comparison of FASTA and BLAST.

Recombinant DNA Technology: Enzymes used in rDNA technology, Cloning vectors, Gene libraries, Screening strategies, DNA amplification (PCR and its types-RT-PCR, Real Time PCR, Allele

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specific.PCR, Multiplex PCR), DNA markers for genetic mapping (RAPD, RFLP, SSCP, SNPs, STS), Manipulation of Gene expression in *E.coli*, Heterologous protein production in *S. cerevisiae*; Gene Expression Regulation studies- Gel retardation assay, Reporter genes, DNA foot printing, HRT, HART; Regulatory RNAs (Interfering and antisense RNA) and gene expression

Biotechniques: Ion exchange chromatography, molecular sieve chromatography, affinity chromatography, paper chromatography, thin layer chromatography, High pressure liquid chromatography (HPLC); Centrifugation techniques, Agarose gel electrophoresis, Pulse field gel electrophoresis, SDS-PAGE, Isoelectrofocusing, 2-Dimensional electrophoresis, Immuno-electrophoresis, ELISA, flow cytometry, Hybridoma technology

Environmental Biotechnology: Types of pollutants, Detection and Measurement of Pollutants; Waste Water Treatment Technique, Bioreactors for waste water treatment, Disinfection and Disposal; Effluents Treatment for Dairy, and Sugar industries; Management of municipal, biomedical and agricultural solid waste; Concepts of bioaugmentation, biostimulation, biodegradation, biosorption, biofilms in bioremediation; Biofertilizers, biopesticides, microbially enhanced oil recovery; Integrated waste-management; production of biomass, biogas and biofuel from waste; Biodiversity and its conservation, Global environmental problems: Ozone depletion, Green house gases, Global warming

Plant Biotechnology: Plant tissue culture techniques, Callus and suspension cultures, Organogenesis, Somatic Embryogenesis, Protoplast isolation fusion, Cryopreservation, Plant Genetic Transformation, Methods for gene-transfer to plant cells, Chloroplast transformation, Generation of insects and pests resistant plants, drought tolerant plants, Disease resistant plants, Plant as bio-reactor, Plant Secondary metabolite production, Germplasm conservation.

Bioprocess Engineering: Kinetics for microbial growth, substrate utilization and product formation in batch, continuous, and fed-batch bioreactors; Design of Fermentor and types; Downstream processing: Separation of cell mass, centrifugation, ; filtration, cell disruption-solid shear and liquid shear methods; Concentration methods-evaporation, distillation, crystallization, solvent extraction, phase separation, drying; Industrial production: ethanol, acetone, citric acid, penicillin, vitamins, SCPs

Animal Biotechnology: Animal cell culture technique and applications; Cryopreservation of cells; Concept of primary and secondary culture, Cell line; Stem Cell Technology: Basics of stem cells, Embryonic, adult and amniotic fluid stem cells, Applications of stem cells; Direct and viral vectors for Gene Transfer; Animal Cloning: Principles and techniques of cloning, Applications of animal cloning.

Research Methodology: Concept of Research, characteristics of research, steps in research process, Types of research, Selection of Problem for Research: types of variables; General laboratory manual, Radiation hazards and Bio-safety rules. Data Collection, Sources of Data, Primary Data, Secondary Data, Sampling techniques, Experimental designs; Statistical analysis and applications: Mean, Median and Mode, Standard deviation, Standard error, Hypothesis tests: t-test, chi-square tests. Correlation and Regression analysis, ANOVA; Proposal/Report writing, Reference styles-Harvard and Vancouver systems; Basics of computer applications: MS office, MS PowerPoint and Excel.

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