

Pre PhD Syllabus
Department of Biotechnology, AUS

IPP – 501 (Inter School Level)

Unit – 1 (Research Methodology)

1. Research objective and statement of problem, types of research.
2. Research proposal designing and formulation.
3. Research Methodology.
4. Review of literature, meaning of concept, construct, laws, theory and hypothesis.

Unit – 2 (IPR and Ethics)

1. Intellectual Property Rights (IPR) issues and Biosafety.
2. Ethics in Science, Technology and Environment.
3. History and development of Science in India.
4. Preparation of research proposals, report and scientific paper.

Unit – 3 (Computer Applications)

1. Application of MS-office in research.
2. Introduction to databases (Pubmed) required for literature.
3. Data analysis using MS-Excel.
4. Power Point presentations and Software for Graphics.

Unit – 4 (Biostatistics)

1. Measures of Central tendency and dispersal.
2. Confidence interval: errors; levels of significance.
3. Regression and correlation.
4. T-test, chi-square test and ANOVA.
5. Use of SPSS for statistical analysis.

IPP – 502 (Inter Departmental Level)

Unit – 1 (Instrumentations)

1. Principles and applications of spectrophotometry.
2. Principles and applications of Chromatography, GC-MS.
3. Principles and applications of PCR, DNA sequencer.
4. Principles and applications of NMR.
5. Principles and applications of flow cytometer.

Unit – 2 (Techniques in Environmental Science)

1. Methods of aerobiopollutant research.
2. Methods of studying physicochemical properties of water.
3. Molecular biodiversity and phylogenetic analysis of plants and animals.
4. Estimation of trace elements in water and plant material.
5. Measurement of aquatic biodiversity and study of climate change.

6. Meteorological tools in environmental science.

Unit – 3 (Techniques in Biotechnology)

1. Gene cloning- vectors, restriction endonucleases, Genetically Modified Organisms (GMOs), Genetically Modified Microorganisms (GMMs) and their applications.
2. DNA markers and their applications. Biotechnological approaches for disease diagnosis.
3. Plant transgenesis and tissue culture, transgenesis in animals
4. Metagenomics, Bioremediation and applications of biotechnology in controlling climate change.

Unit – 4 (Microbiology)

1. Techniques to measure growth of microorganisms. Effect of carbon. Nitrogen, temperature, pH, osmotic pressure, oxygen and carbon dioxide on microbial growth.
2. Identification of bacteria on the basis of ribosomal gene sequence analysis. Assessment of microbial diversity by molecular techniques.
3. Biodegradation of recalcitrant compounds (lignin- pesticides), Bioinoculants- biopesticides and bioinsecticides.
4. Production of proteins in bacteria. Recombinant human growth hormone- insulin, Recombinant vaccines. Edible vaccines.

IPP – 503 (Departmental Level)

Unit – 1 (Use of databases, bioinformatics tools and computer-aids for data analysis and writing of research proposal)

1. Scientific databases and retrieval of data: Nucleotide databases, protein databases and literature databases.
2. Tools for alignment of nucleotide and protein sequences- local alignment and multiple alignment.
3. Applications of MS-WORD, MS-EXCEL and MS-POWERPOINT.
4. Writing of Research Proposal, Report and Research Paper: Meaning and types - Stages in preparation - Characteristics - Structure - Footnotes and Bibliography- use of Endnote. Checklist for a good proposal/report/research paper. Ethical, legal, social and scientific issues in Biological Research. IPR, patents and Biosafety.

Unit – 2 (Techniques in Biological Research)

1. Principles and applications of Spectrophotometry (UV-Visible spectrophotometry), NMR, Microscopy-phase.
2. Principles and applications of light and fluorescence microscopes, Scanning and Transmission electron microscopes.
3. Principles and applications of Autoradiography, solid and liquid scintillation, Ultracentrifugation, Chromatographic techniques.
4. Principles and applications of Atomic absorption spectrophotometry, Flow cytometry, Western blotting, ELISA, PAGE, SDS-PAGE, Agarose gel electrophoresis, 2D-gel electrophoresis, microarray analysis, mass spectrometry.

Unit – 3 (Fundamentals of Biotechnology)

1. Isolation and purification of DNA. Commonly used vectors for gene-cloning, DNA manipulating enzymes, construction of genomic and cDNA libraries.
2. Expression of genes in new hosts. DNA sequencing analysis of nucleotide sequences.
3. DNA-probes as detection methods. DNA amplification by Polymerase Chain Reaction, and its different types, biotechnological approaches for production of transgenic plants and animals.

Unit – 4 (Statistical approaches for evaluation of biological data)

1. Introduction to applications of statistics in biology.
2. Introduction to applications of Collection of data, Measures of dispersion, Simple correlation, Regression analysis.
3. Tests of significance-F-test, paired t-test and unpaired t-test, Chi-square test and its applications.
4. Analysis of variance (ANOVA), Design of experiments (CRD and RBD). Use of softwares for statistical analysis of data.

IPP – 504 (Term Paper)

Term paper to be assigned in the beginning of the semester to each Ph.D student for its submission to the department. The paper may be preparation of Protocol, Review of Literature, Methodology or any relevant topic of Research.
