Syllabus for Ph.D. Course work in Biotechnology

Paper I: Advanced Research Methodology

Bioanalytical methods: Good laboratory practices, Isolation, purification and characterization of proteins, analysis of biomolecules using TLC, gel filtration, adsorption chromatography, ion exchange chromatography, affinity chromatography, GLC, HPLC, electrophoretic techniques, one and two dimensional gel electrophoresis, UV/visible spectrophotometry, fluorescence spectrophotometry, NMR spectroscopy, X-ray diffraction; mass spectrometry.
Antibody production, ELISA, western blot, immunoprecipitation, and immunofluorescence, FISH, flow cytometry.
Properties of different types of radioisotopes, detection, measurement and uses in biological assays
Enzymes: purification and characterization

Genetic engineering methods: Isolation, purification and analysis of DNA, RNA and plasmid, restriction enzymes and their applications, properties of cloning and expression vectors (plasmid, phage), cloning and expression of DNA in bacterial, animal and plant systems; generation of genomic and cDNA libraries; DNA sequencing methods, methods for analysis of gene expression at RNA, blotting techniques, PCR techniques RFLP, RAPD and AFLP techniques and their applications, genome sequencing, micro array techniques.

Cell/ Tissue culture and bioprocess techniques:
Cell and tissue culture techniques: Plant and animal
Microscopy: Scanning and transmission microscopes, Inverted microscope, confocal microscopy, image processing methods in microscopy.
Bioreactors types, design, downstream processing- separation of cells, centrifugation- types. Biocontrol- identification, isolation, characterization, strain improvement, delivery methods, package and practices

Bioinfomatics and Statistical Methods: Computer network, on-line control using computers, Use of database, NCBI, EMBL, DDBJ, protein structural data bank, sequence analysis of proteins and nucleic acids, structure prediction, molecular modeling, data mining methods, primer designing, web-based tools for sequence searches, BLAST and FASTA.
Population and sampling, Measures of central tendency and dispersion; Binomial, Poisson and Normal distribution; confidence interval; Errors; Hypothesis testing-Z score, ‘t’ test, ‘F’ test, Chi-square test, regression analysis, correlation: LSD, multiple range test, data transformation, experimental designs.

Scientific Writing and development of Research projects: Scientific document: Maintenance of laboratory data book, Organization and writing of a research paper, short communications, review articles, monographs, technical and survey reports, authored books and edited books, dissertation and PhD Thesis. Preparing and delivering of oral and poster presentations, avoiding plagiarism, impact factor and citation index
Funding agencies: National and international funding agencies for R & D projects. Preparation of R & D projects for funding: Organization of a research project, identification of gap areas in the subject, aims and objectives of the projects, possible outcome of the project, funds requirements and justification(s). Biosafety and ethical issues, IPR, Patents and patent filing, Patent specifications and application, characteristics of the disclosure for a biotechnology invention, marketing of biotechnological invention.