



CENTRE FOR BIOTECHNOLOGY AND BIOINFORMATICS, DIBRUGARH UNIVERSITY

Pre Ph.D. - Course Work Syllabus

Course I: Research Methodology (Core) 60 + 40 = 100
Marks

40% (Internal assessment) + 60% (End semester Examination)

Course II: * Optional (Intra/Inter-Departmental) 60 + 40 = 100
Marks

40% (Internal assessment) + 60% (End semester Examination)

Unit I - Recent Trends in Biotechnology 15

Unit II - Cell and Tissue culture 20

Unit III- Enzyme and Enzyme technology 20

Unit IV- Molecular Biology of Pathogens and Diseases ✓ 20

Unit V- Microbial Biotechnology and Bioprocess Technology 20

Unit VI – Food Biotechnology 20

Unit VII- Chemical Ecology and Medicinal Plants 20

Unit VIII- Project 25

*In paper II a candidate has to take Unit I and Unit VIII and any one from the rest based on his/her area of interest.

Course III: Optional (To be offered by the prospective supervisor concerned)
40% (Internal assessment) + 60% (End semester Examination)

Course IV: Assignment (Under guidance of the prospective supervisor concerned)
80% (Assignment writing) + 20% (Viva on the assignment)

Course I: Research Methodology (Core)
Marks

60 + 40 = 100

Unit I. Introduction to research methodology: What is research? Basic and applied research; Essential steps in research, Defining the research problem, Research/Experimental design. Literature collection, Literature citation, Research report: components, Format of thesis and dissertation, Manuscript/research article, Review monographs, Bibliography and Reference. Significance of research.

Unit II. Statistical Methods: Measures of central tendency and dispersal, probability distributions (Binomial, Poisson and normal), sampling distribution, difference between parametric and non-parametric statistics, confidence interval, Standard error, levels of significance, regression and correlation, t-test, analysis of variance.

Unit III. Computational methods: Nucleic acid and protein sequence database; data mining Methods of sequence analysis, web-based tools for sequence searches motif analysis and presentation.

Unit IV. Ethical issues in biotechnology, Regulatory and social aspects of biotechnology of foods, safety assessment of nutritionally improved foods and feeds developed through the application of modern biotechnology

Bio-safety and Patent Laws: Biological risk assessment, Biosafety guidelines for Genetically Modified Micro organisms(GMM)/Plants(GMP)-Risk assessment and contained use of GMM and GMPs, guidelines for research activities-import and shipment-quality control of biologicals produced by rDNA technology-guidelines for environmental release of GMM and GMP -Mechanism of implementation of biosafety guidelines-at Institutional, national and International level-DBT guidelines-Acts and treaties related to biosafety of GMM and GMP's- Public awareness perception and acceptance of products of biotechnology Intellectual property rights-Patent laws at national and international level- Ecological risks of engineered microorganisms and remedies.

Course II: Optional (Intra/Inter-Departmental)

60 + 40 = 100

Marks

40% (Internal assessment) + 60% (End semester Examination)

Unit I - Recent Trends in Biotechnology

15

Cloning Vectors in Molecular Biology, Restriction Enzymes, PCR, DNA/Protein sequencing, Genomic/c DNA Library, Cloning Techniques in Bacteria/higher Organisms, Genetic manipulation of mammals, Gene transfer in plants. Mechanism of r-DNA transfer, Composition of genome - Molecular dissection of genome-Molecular markers for genome analysis, selectable marker and reporter genes, DNA/Protein micro arrays, DNA/ Protein Markers, DNA finger printing, Gene knock out, RNAi and Gene silencing, Protein targeting to chloroplast and Mitochondrial genome, Chloroplast transformation, antisense RNA technology, Metagenomics.

Nucleic acid sequences as diagnostic tools, New drugs/ Therapies for genetic diseases, combating infectious diseases, Protein engineering, Metabolic Engineering, Production of interferons, DNA vaccines.

Unit II- Cell and Tissue culture

20

cell and tissues culture- types of culture, techniques, culture media, their constituents and role, measuring parameters of growth, cell death, Apoptosis, Cytotoxicity assays, Transgenic plants and animals and their applications production of secondary metabolites in Bioreactors, engineering of metabolic pathways, Molecular Pharming: Genetic engineering of resistant varieties of plants., edible vaccine, expression of antibody in plants for immunotherapy.

Unit III- Enzyme and Enzyme Technology

20

Structure and functions of enzymes, Mechanism of enzyme catalyzed reactions with and without cofactors, Concepts of bioenergetics, Kinetics of enzymes, Investigation of active site structure, Metal activated enzymes and metalloenzymes.

The binding of ligands to Protein: Determination of protein ligand interaction, Use of DNA microcircles in protein-DNA binding studies, Sigmoidal kinetics and allosteric enzymes. Investigation of enzymes in biological preparations, Enzyme assays, Automation in enzymatic analysis, thermophilic enzymes

Application of enzymes in medicine and industry, Biotechnological application of enzymes. Large scale production of enzymes, Immobilized enzymes, Enzyme applications in industry medicine., enzymes as biosensors

Unit IV: Molecular Biology of Pathogens and Diseases

20

Pathogen recognition, elicitors, pathogen and host, Suppression of defense mechanisms by toxins - mode of action - role of toxins in disease development - toxin degrading enzymes. Molecular diversity of pathogens and vectors, communicable and noncommunicable diseases. Immunity and health care: Tumor immunology, Immuno diagnosis and therapy with monoclonal antibodies. Cell fusion methods, Hybridoma technology and its applications, Stem cell research; stem cells in health care. Cell culture products. Production of interferons, interleukins and vaccines

Genetic, Biochemical, hematological and immune disorders; Human genetics; tracing the inheritance of disease, tracking the genes, molecular biological techniques for rapid diagnosis of diseases, gene mapping, targeting, silencing and knockout. Human genome project, gene-based therapies. infectious and parasitic diseases. Cancer multi step carcinogenesis oncogenes anti-oncogenes

Unit V – Microbial Biotechnology and Bioprocess Technology

20

Microbial Diversity: Bergey's system of Microbial classification, construction of phylogenetic tree, G +C analysis, Preservation and maintenance of microbes. Biocontrol, Biotransformation and biofertilizer potential of Microbes. Bioassay.

Fermenter Types, immobilized cell reactors mode of operation, Optimization of conditions. Down stream processing, Microbes in pharmaceutical and food industry: Production, harvest, recovery, uses and mode of action of enzymes, antibiotics, vitamins (B12, B2) organic acids, alcohol, beverages (beer, wine, brandy), microbial supplements (Lactic acid bacteria) as medicine, biopolymer, biocides, regulation of *B. thuringiensis* protein production. Improvement in production - improved strains by protoplast fusion, recombination,

Unit VI: Food Biotechnology:

20

Food ingredient challenges, bioavailability and nutritional significances. Anti-nutritional factors, anti-vitamins, toxic factors induced by processing, Biotechnology in relation to the food industry, scope and development of food products, Case studies on biotechnology in the evaluation of food quality, contamination and spoilage of food and food products, Functional food: role in health and diseases, Probiotics, prebiotics and Nutraceuticals.

Isolation and characterization of bioactive compounds from plants - Tests for bioactivity - GC, HPLC and GC-MS methods for separation and identification of compounds. Biochemistry of plant defence mechanisms - Role of secondary metabolites - shikimic acid, acetate-mevalonate and acetate - malonate pathways. Phytoalexin - classification, structure and biosynthesis. Phytoalexin elicitors. Lytic enzymes - pre- and post-infectious compounds. Extraction of alkaloids, terpenes and phenolics - separation and identification - Estimation of gossypol, enzyme inhibitors and phenolics. Extraction methods for enzymes. Bioremediation.

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40% (Internal assessment) + 60% (End semester Examination)

Course IV: **Course IV:** Assignment (Under guidance of the prospective supervisor concerned)
80% (Assignment writing) + 20% (Viva on the assignment)

Marking

| | | | |
|------------------|---|----------|------------------------|
| Course I: In Sem | - | 40 Marks | } Research Methodology |
| End Sem | - | 60 Marks | |

Total - 100 Marks

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|-------------------|---|----------|
| Course II: In Sem | - | 40 Marks |
| End Sem | - | 60 Marks |

Total - 100 Marks

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|------------|---|------------------|
| Course III | - | 100 Marks |
| Course IV | - | 100 Marks |