Raiganj University
Department of Botany
Ph. D. Course Work Syllabus

PREAMBLE

Course-work and Course-end Examination

(1) Each Ph. D. student will have to undergo one Semester course work of six-month duration. Number of papers; breakup of marks and credits of the said course work shall be as follows:–

Paper	**Full Marks**	**Credit**
Paper – I **Research Methodology and Computer Applications**	75 marks	6
Paper – II **Subject Upgradation and Advanced Techniques**	75 marks	6
Paper – III **Review of Literature**	50 marks	4

(2) A student shall complete the coursework before submission of his/her thesis.

(3) There shall be a course-end examination conducted by the University at the end of the semester; as per the programme announced by the Controller of Examinations.

Paper-I (75 marks)
Research Methodology and Computer Applications

Unit-I

1. Research Problem – Its importance, aims and objectives, literature collection, Methodology (Experimental design / Field data collection). Data presentation and interpretation; drawing conclusions.
2. Scientific paper writing – Manuscript preparation and presentation, Plagiarism checking, automated citation techniques.
3. Research Journals, Impact Factor and paper citation index
4. Statistical methods in Biology: descriptive and inferential statistics; Measures of central tendency and measures of spread; hypothesis testing; software based statistical analysis using SPSS, XLSTAT, SigmaPlot, etc.
5. Computers in research – concept of software and hardware; operating systems; LINUX and Windows; MS-Office, Photoshop.

Unit-II

1. Culture of Micro-organisms: Media and isolation of pure cultures
2. Culture and preservation of Fungi
3. Plant tissue culture and organ culture (Pollen, Anther, Embryo) and Micropropagation
4. Herbarium techniques
5. Plant Micro technique – Fixatives and staining (single and double). Fixation for histological and histochemical study.

Unit-III

1. Principles of Microscopy (Light microscope, phase contrast, Electron Microscope (SEM & TEM) and Fluorescence microscope, Atomic Force Microscopy (AFM).
2. Principles and applications of Gel filtration Chromatography, Ion exchange Chromatography, High pressure liquid Chromatography (HPLC), Electrophoresis and ELISA, Flow cytometry.
3. Principles of Fluorescence, UV, Visible, NMR and Atomic Absorption Spectroscopy, CD, Fourier Transform-IR Spectroscopy, X-ray Diffraction
4. Use of Radio isotopes in Biology. Principles of autoradiography and applications
5. Basic concepts of Recombinant DNA technology. Expression of Recombinant proteins. DNA finger printing.

Unit-IV

Biological Databases- Accessing and data retrieval, Types of biological databases, Sequence and structure based databases, literature database. Analysis of nucleotide sequence data and protein sequence data, molecular phylogeny analysis techniques.

Paper-II (75 marks)
Subject Upgradation and Advanced Techniques

Unit-I:

1. Fungal Biotechnology
    a. Bioremediation
    b. Bio-fertilizers (Cyanobacteria, Bacteria, PGPR and PGPF)
    c. Mycotoxin and Phytoalexins
    d. Industrial Uses of Fungi
    e. Role of microbes in the degradation of pesticides and poly aromatic hydrocarbons (PAHs)
2. **Wood decay fungi**- Types and Role of Wood decay Fungi in Forest Ecosystem
3. **Mycorrhizal Fungi**- Mycorrhizal Development and Role of Mycorrhiza in Agriculture
4. **Plant Pathology**- Principal of Plant Pathology, Disease Development and Disease Control (Chemical, Biological and Integrated Disease Management). Role of Biotechnology in plant disease control.
5. **Molecular Plant Pathology**- Host pathogen interaction; Recognition; Defense Mechanisms (Structural, Chemical and Enzymatic); Plant Immunization (SAR and ISR), Elicitor and inducers, PR-Proteins, Disease diagnosis by Serological Technique- ELISA, ID, IE and FM.
6. **Some common diseases**- Diseases of crops in North Bengal, West Bengal, India.

Unit-II:

1. Heavy metal stress: Availability, physiological basis for toxicity – water relation, photosynthesis, oxidative damage, membrane perturbations, tolerance mechanism phytochelatins, phytoremediation– phytofiltration, phytoextraction, Phytostabilization, prospects and limitations.
2. Nucleic acid extraction (DNA and RNA), PCR and its application, primer designing.
3. Epigenetics – DNA methylation, Histone modification; EMSA, ChIP, Yeast 2 hybrid.
4. Expression of Recombinant Proteins, expression vectors

Unit-III

1. The origin and early evolution of angiosperms, with reference to recent findings on fossil pollen, flowers and leaf remains.
2. Concept of ICBN and salient features of Botanical nomenclature.
i. Typification ii. Rules of priority
iii. Effective and valid publication iv. Authors citations
3. Cultivation, harvest, drying, grading, packing, storage and marketing of medicinal plants.
4. Pharmacognostic study of different types of plant drugs with special reference to plants available in Raiganj University AASM garden.

Unit-IV

1. Principles of genetic engineering and production of transgenic plants
2. Plant breeding and crop improvement techniques.
3. Tissue culture of plants: Callus culture, Plantlet regeneration micro propagation.
4. Biodiversity - Types, hot spots, threats to Biodiversity and conservation

Unit-V

1. Sampling methods in microbiology.
2. Growth media, selective microbiological media use; staining methods.
3. Overview of different culture techniques employed in microbiological studies.
4. Differential tests for characterizing bacteria- techniques and principle; identification of unknown bacteria.
5. Soil and water microbiology related techniques.
6. Metagenomics; applications, concept of microbiome, global impact projects like GOS and HMP, techniques.
7. Molecular biological techniques in microbiology.
8. Overview of immune system and practical applications of immunology.
9. Overview of microorganisms in agriculture, food and industry.

Paper-III

Review of Literature 50 marks

Each student has to submit a review (within 2000 words) on a research topic before the course end examination that will be examined by both internal and external examiner.