



Department of Bioresources
School of Biological Sciences, University of Kashmir Sgr.

**Syllabus
of
Pre-Ph.D Course Work
For
Bioresources (Scholars)
Batch-2023 and onwards**

Continued for Batches 2025-2026 .

[Signature] Head
Deptt. of Bioresources
School of Biological Sciences
University of Kashmir
04/08/2026



Department of Bioresources

School of Biological Sciences, University of Kashmir Sgr.

Paper I

Title: Research Methodology

Max. Marks

100

Min. Marks

50

Time allowed

3 hours

UNIT I: PHYSICAL METHODS IN BIOLOGY

Spectroscopy: UV & Visible absorption spectrophotometry, Beer's Lambert Law, Fluorescence Spectroscopy: principles and applications, immunofluorescence Microscopy. Cell and Tissue Techniques: Cell and Tissue staining techniques, Immunoblotting, Flow cytometry. Chromatography: Partition and Absorption Chromatography, paper and thin layer chromatography, gel filtration, ion-exchange and affinity chromatography. GLC, HPLC. Electrophoresis: Behavior of bio-macromolecules in electric fields, PAGE, Agarose Gel Electrophoresis, 2D Electrophoresis. Mass spectroscopy: technology and its applications. Applied Enzymology: application of enzyme in analytical labs (clinical and industrial), enzymes as industrial catalysts, Immobilized enzymes, Abzymes.

UNIT II: BIOSTATISTICS

Hypothesis testing: Basic concept and procedure, test of difference between means—Independent and paired samples, test of proportions and test of goodness of fit. Sampling: Principles and steps in sample survey; simple random sampling, systematic, stratified and cluster sampling. Design and analysis of experiments: Principles, designs— layout, analysis of variance and comparison of treatments in completely randomised design, randomised complete block design and factorial experimental designs. Correlation and regression: Basic idea of correlation; Simple correlation— calculation of correlation coefficient; Simple linear regression— calculation of regression coefficients.

UNIT III: SCIENTIFIC WRITING

Research: Types and formulations; Meaning of Research, Objectives of Research, Motivation in Research. Research methods Vs. Methodology: Types of research- Descriptive Vs. analytical, applied Vs. Fundamental, Quantitative Vs. Qualitative, Conceptual Vs. Empirical. Research Process: Criteria of Good Research. Formulating the research problem; selecting the problem. Literature Review: Importance of literature review in research; Sources of Literature Review- Primary and secondary sources review (treatise, monographs, Patents, Journals, books and Internet resources). Identifying research gaps from literature review. Hypothesis: important considerations while making a hypothesis.

UNIT IV: RESEARCH ETHICS

Ethics in Research: Introduction to Bioethics. Ethical issues: Embryonic stem cells and cloning, gene therapy and designer babies, genetically modified animals and crops, Ethical limits of animal use and welfare. Medical research ethics: plagiarism, academic integrity. Responsibilities: Mentor and mentee responsibilities and relationships, Record keeping, authorship and publications, conflict of interest.

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1705

4/8/2016



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Paper II

Title: Recent Advances in Life Sciences

Max. Marks

Min. Marks:

Time allowed

100

50

3 hours

UNIT - I: GENETIC ENGINEERING:

Introduction, Scope and applications. Cloning vectors-Plasmids, cosmids, phages and artificial chromosomes. Expression vectors. Recombinant DNA Technology, Restriction enzymes, ligation, transformation and selection. Construction of Genomic and cDNA libraries. Gene transfer methods, Molecular markers and their applications. Bacterial genome Structure, replication of DNA and plasmids. Genetic exchange in bacteria: Transformation, Transduction, Conjugation. Recombination: Hosts, vectors and mechanism.

UNIT - II: ANIMAL CELL CULTURE:

Culture Media, procedures and techniques. Transfection: Targeted transfection, transient and stable transfections. Large scale culture of cell lines for production of biomolecules. Viral vaccines, interferons, recombinant proteins and hybrid antibodies. Somatic cell fusion. Hybridoma technology and monoclonal antibodies. Stem cell lines, their origin, types and therapeutic and other applications. Blood grouping, Rh typing. Immuno electrophoresis, ELISA. In vitro fertilization and embryo transfer.

UNIT - III: PLANTS AS BIOREACTORS.

Transgenic plants for biochemical production (edible vaccines and secondary metabolites). Modification of nutritional content (vitamins, amino acids, lipids and iron). Plant tissue culture: Cellular totipotency, cell culture, cloning. Micropropagation. Somatic embryos and synthetic seeds. Somatic hybrids and cybrids.

UNIT - IV: ISOLATION AND SCREENING OF MICROORGANISMS:

Cultivation of microorganisms. Nutritional requirements. Factors affecting growth: pH, temperature, water activity, oxygen and carbon dioxide. Microbes in beverages and food production: wine, beer, bread and cheese. Advantages of fermented foods. Commercial microbial products: Amino acids, enzymes, steroids, therapeutic agents, biopolymers. Single Cell Proteins (SCP).

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Paper III

Title: Animal Sciences	Max. Marks	Min. Marks	Time allowed
100	50	3 hours	

UNIT 1: AN INTRODUCTION TO CANCER:

Introduction to cancers, Types of cancer, causes and risk factors of cancers, properties of cancer cells. Tumor genetics: mutations, carcinogenic agents, tumor genes, defects in DNA repair, DNA damage markers. Tumor epigenetics: imprinting, DNA methylation. Oncogenes and tumor-suppressor genes. Cancer metastasis. Treatment options for cancer: Radiotherapy, chemotherapy, immunotherapy, targeted therapy and combination therapy.

UNIT II: AN INTRODUCTION TO BREAST CANCER

Introduction to breast cancer: causative factors and Risk Factors of Breast Cancer. Classification of breast cancer: types and molecular subtypes of breast cancer. Stages of breast cancer. Novel biomarkers of breast cancer. Diagnosis of breast cancer. Treatment modalities for breast cancer: Radiotherapy, chemotherapy, immunotherapy, targeted therapy and combination therapy. Breast cancer metastasis. Types of breast cancer cell lines: TNBC cell lines, ER+ cell lines, PR+ cell lines, HER2+ cell lines, normal human cell lines.

UNIT III: SIGNALING PATHWAYS IN BREAST CANCER

An introduction to the signal transduction pathways involved in the progression of cancer. Role of different signaling pathways in breast cancer. Importance of PI3K/mTOR/AKT pathway in breast cancer. NF-Kappa signaling pathway in breast cancer. TGF-beta signaling pathway. Notch signaling pathway in breast cancer. Anticancer therapies targeting the signaling pathways involved in the tumorigenesis of breast cancer.

UNIT IV: CELL CYCLE DYSREGULATION IN BREAST CANCER

An introduction to cell cycle, Phases of cell cycle, cell cycle regulators, CDKs in cell cycle. Role of CDKs in different phases of cell cycle. CDK4/CDK6-RB pathway. Cell cycle dysregulation in breast cancer. CDKs in breast cancer. Role of CDK inhibitors in breast cancer: CDK1/2 inhibitors, CDK4/6 inhibitors, and novel CDK inhibitors in breast cancer.

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4/9/2020



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Paper III

Title: Plant Sciences

Max. Marks	Min. Marks	Time allowed
100	50	3 hours

UNIT I: INTRODUCTION:

Abiotic and biotic stresses in plants. Osmo-protectants: Dehydrins, HSP. Signal transduction in plants: General features, Reactive oxygen species - Role, Types and generation. Defence mechanisms in plants: Non enzymatic, Enzymatic. Plant Immunity: Role of NO and ROS. Hypersensitivity vs pathogenicity: HR, SAR. Role of: CDPK and MAPK, Phosphoinositides (PI). Phytohormones in plant stress: Abscissic acid, Brassinosteroids, Jasmonic acid, Ethylene.

UNIT II: PLANT-MICROBE INTERACTIONS:

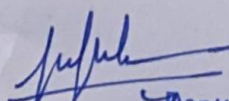
Bacterial plant pathogens and symbionts - Legume-Rhizobium symbiosis. Nitrogen fixation: Nitrogenase, components of nitrogenase, Nodulation, competition among nodulating organisms, Nodulation genes. Genetic engineering of Nitrogenase gene cluster. Host pathogen interactions: Gene-for-gene interactions in virulence and avirulence, Gene for gene interactions in plant resistance. Pathogenicity islands and protein secretion systems. Plant resistance genes: Modulation/Induction.

UNIT III: SECONDARY METABOLITES

Terpenes: Introduction, occurrence, classification based on isoprene rule. Alkaloids: Introduction, occurrence, classification based on nitrogen heterocyclic ring. Steroids: Occurrence, basic structure and biological functions of major plant and fungal steroids. Phenolics: Occurrence, basic shikimic acid pathway, phenolic types. Importance of secondary metabolites to humans.

UNIT IV: PLANT PIGMENTS:

Introduction, biological functions of naturally occurring pigments in plants. Plant-insect interactions: Theory of co-evolution, Antixenosis, Antibiosis, Tolerance. Utilization of toxic non protein aminoacids. Pollination. Plant-vertebrate interactions: mutualisms, antagonisms, Fruits, Seed Dispersal. Plant-plant interactions: Allelopathy.


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04/06/2024