



M.Sc. – Semester I Msmicrobiology and Biotechnology

PAPER: (MB/BT) **406: APPLIED BIOLOGY AND RESEARCH TECHNIQUES**

[CSIR – UGC – NET - TOPIC: 12 (A to H) &13 (A, B, E, F, G)]

Total Credits – 3

Total Hours – 45

Objectives:

- To describe bio-catalysis, pathway engineering, bioprocess control and downstream processing.
- To demonstrate their ability to reason both inductively and deductively with experimental information and data.

Unit – 1: Methods in biology

Microbial fermentation and production of small and macro molecules.

Application of immunological principles, vaccines, diagnostics. Tissue and cell culture methods for plants and animals.

Transgenic animals and plants, molecular approaches to diagnosis and strain identification.

Genomics and its application to health & agriculture, Gene therapy.

Bioresource and uses of biodiversity.

Breeding in plants and animals, including marker – assisted selection

Bioremediation and phytoremediation, Biosensors.

Unit – 2: Molecular biology and recombinant DNA methods

Isolation and purification of RNA, DNA (genomic and plasmid) and proteins, different separation methods.

Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, Isoelectric focusing gels.

Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems.

Expression of recombinant proteins using bacterial, animal and plant vectors.

Isolation of specific nucleic acid sequences

Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors.

In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms.

Protein sequencing methods, detection of post translation modification of proteins.

DNA sequencing methods, strategies for genome sequencing.

Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques

Isolation, separation and analysis of carbohydrate and lipid molecules

RFLP, RAPD and AFLP techniques.



Unit – 3: Applied bio-techniques

Histochemical and Immunotechniques: Antibody generation, Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, fluocytometry and immunofluorescence microscopy, detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.

Radiolabeling techniques: Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.

Microscopic techniques: Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze- fracture methods for EM, image processing methods in microscopy.

Electrophysiological methods: Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT.

References:

1. Life Science: Fundamentals and Practice Part 1 Pranav Kumar and Usha Mina Pathfinder Publication 7th Edition.
2. Life Science: Fundamentals and Practice Part 2 Pranav Kumar and Usha Mina Pathfinder Publication 7th Edition.
3. Principles and Techniques of Biochemistry and Molecular Biology – Wilson and Walker, Publisher Cambridge University Press, 2018, Eighth Edition.
4. Biophysical Chemistry (Principles and Techniques) – Upadhyay, Publisher Himalya Publishing House, 2016.
5. Plant Breeding Principles & Methods – 2015 – B.D. Singh, Publisher Kalyani, 2015
6. Genomes 3 – T.A. Brown, Publisher Graland science, 2007 Edition_____.
7. Introduction To Plant Tissue Culture – Razdan MK, Publisher Science Publisher, Inc., 2019, Third Edition.