

M.Phil. Biochemistry / Biotechnology Syllabus (Regular)

Paper I Research Methodology

Unit-I: Scientific Research

Importance and need for research ethics and scientific research. Formulation of hypothesis. Types and characteristic – designing a research work.

Unit-II: Scientific Writing

Scientific Writing Characteristics. Logical format for writing thesis and papers. Essential features of abstract, introduction, review of literature, materials and methods, and discussion. Effective illustration- tables and figures. Reference styles-Harvard and Vancouver systems.

Unit-III: Bioinformatics

The scope of bioinformatics. The internet. Useful search engines. The entrez system, File formats. Biological databases. Sequence and structure, NCBI, Data retrieval. Searching sequence database. Sequence similarity searches, amino acid substitution matrices. Database search-FASTA and BLAST, Protein multiple sequence alignments, CLUSTAL.

Unit-IV: Biostatistics

Collection and classification of data – diagrammatic and graphic representation of data-measurement of central tendency- standard deviation – normal distribution – Test of significance based on large samples – small samples – Student test-correlation and regression – Chi square test for independence of attributes – ANOVA.

Unit V: Bioethics And Patenting

Declaration of Bologna. Ethics in animal experimentation. CPCSEA guidelines – Animal care and technical personnel environment. Animal husbandry, feed, bedding, water, sanitation and cleanliness, waste disposal, anesthesia and euthanasia.

Composition of (Human) Institutional Ethical Committee (ICE) – General ethical issues. Specific principles for clinical evaluation of drugs, herbal remedies and human genetics research. Ethics in food and drug safety. Environmental release of microorganisms and genetically engineered organisms. Ethical issues in human gene therapy and human cloning.

Patenting – definition of patent. Product and process patents. Patenting multicellular organisms. Patenting and fundamental research.

BOOKS RECOMMENDED:

1. R.A.Day. How to write a scientific paper. Cambridge University Press.
2. Cooray P.G. Guide to scientific and technical writing.
3. Carter V Good and Douglas E seats Methods of Research.
4. Alley, Michael. The craft of scientific writing. Englewood Cliffs. N.N. prentic 1987.
5. M.C. Sharma, Desk Top Publishing on PC, BPB Publications, 1997.
6. Lesk, A.M. Introduction to Bioinformatics Oxford 2002.
7. Krane et al Fundamental concepts of bioinformatics Benjamin Cummings.
8. Sundar Rao, Jesudian Richard – An introduction to Biostatistics.
9. S.P. Gupta – Fundamentals of statistics, Sultan Chand.
10. Ethics and the use of alternatives to animals in research and education. Shirance Pereira. CPCSEA.
11. CPCSEA guidelines for laboratory animal facility (CPCSEA) – No. 13 Seaward road, Valmiki Nagar Chennai-41.
12. Ethical guidelines for biomedical research on human subjects. ICMR, New Delhi, 2000.
13. Dickson. Molecular and cell biology of human gene therapeutics. Series Chapman and Hall 1995.

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Paper II- Analytical Methods

Unit 1

Chromatography

Chromatography: Performance parameters (retention time, elution volume, capacity factor, plate height, and resolution). Low pressure liquid chromatography (LPLC)- principle, columns, matrix materials, procedure. HPLC-columns, matrix, mobile and stationary phases, sample application, pumps, detectors. HPTLC- principle, procedure, applications. Fast protein liquid chromatography. Reversed phase chromatography.

Unit 2

Microscopy and cell culture techniques

Light microscopy-components, specimen preparation. Optical contrast, specimen stains. Fluorescence microscopy, fluorophores. Optical sectioning- confocal microscopes, multiple photon microscopes. Imaging living cells and tissues. Stereomicroscope. Electron microscopy- principle, specimen preparation for TEM and SEM.

Cell culture techniques: Equipment- hoods, CO₂ incubator. Safety considerations, aseptic techniques, eradication of infections. Animal cell cultures- primary cell cultures, cell lines, media and growth requirement, subcultures, cell quantification, cryopreservation, cell viability. Elementary details of bacterial and plant cell cultures.

Unit 3

Immunochemical techniques

Antibody labeling: radiolabeling, labeling with fluorochromes and enzymes, biotinylation. Immunoassays: competitive binding, immunometric, solid-phase immunobinding, enhanced, peptide-based, fluorescence and photoluminescence-based. Immunohisto/ cytochemistry. Immunofluorescence techniques. Immunoelectron microscopy. Chromatin immunoprecipitation. Flow cytometry.

Unit 4

Electrophoretic and Spectroscopy techniques

Electrophoresis of proteins- SDS-PAGE, isoelectric focusing, 2D-PAGE. Detection, estimation and recovery of proteins in gels. Electrophoresis of nucleic acids: agarose gel electrophoresis, DNA sequencing gels, pulsed field gel electrophoresis. Electrophoretic mobility shift assay. Southern, Northern and Western blotting.

Basic principle and biological applications of IR, NMR and ESR. Mass spectrometry-principle, instrumentation, ionization, mass analyzers, MALDI-TOF, Peptide Mass Fingerprinting and tandem mass spectrometry (elementary details only).

Unit 5

Molecular Biology Techniques

Probe preparation: end labeling, random primer labeling, nick translation, molecular beacon-based probes. RFLP, DNA fingerprinting, FISH. PCR-principle and applications. RT-PCR. Real-time quantitative PCR, differential display PCR,. DNA sequencing, automated fluorescence method, pyrosequencing, cycle sequencing. DNA and protein microarrays- fabrication and applications.

Books recommended

1. Wilson and Walker. Principles and techniques of Biochemistry and Molecular biology. 6th ed. Cambridge University Press 2005.
2. Boyer, R. Modern Experimental Biochemistry. 3rd ed. Addison Wesley Longman, 2000.
3. Sambrook. Molecular Cloning. Cold Spring Harbor Laboratory, 2001.
4. Friefelder and Friefelder. Physical Biochemistry- Applications to Biochemistry and Molecular Biology. WH Freeman & Co. 1994.
5. Upadhyay, Upadhyay and Nath. Biophysical Chemistry Principles and Techniques. Himalaya publ. 1997.