Annamalai University

Faculty of Science

Department of Biochemistry & Biotechnology

M.Phil. Biochemistry

Programme Code: SBIO71

M.Phil. Biotechnology

Programme Code: SBIO72

Curriculum and Syllabi - 2019

ANNAMALAI UNIVERSITY

Department of Biochemistry and Biotechnology

SBIO71 M.Phil. Biochemistry

SBIO72 M.Phil. Biotechnology

Regulations

Duration

The M. Phil. programme is for 1 year spread over two semesters. The programme including M. Phil. dissertation shall be completed within a maximum period of 2 years. In order to be eligible for the award of the Degree of Master of Philosophy, a candidate shall have to obtain 50 percent of the maximum marks (or) equivalent grade point average.

Course Work

All M. Phil. students shall take 3 courses of 6 credits spread over two semesters

Course 1: **Research Methodology**: This will be common to all the students of the department.

Course 2: **Core Subject:** This will be common to all the students of the department.

Course 3: **Field Specialization:** Course on thesis topic

Examination for Course I and II will be held at the end of the first semester and the examination for Course III will be held at the end of the second semester.

Semester No.	Course	Total Marks
First	Course -I Course -II	100 100
Second	Course -III Dissertation Viva-voce	100 100 100
	TOTAL	**500**

M.Phil. Biochemistry / Biotechnology Syllabus (Regular)

Course – I: Research Methodology

Learning Objectives (LO): To learn in detail about the ethics in scientific research and elements in scientific writing as well as to understand the statistical and bioinformatics tools essential for biological research.

Unit-1 Scientific Research

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

Unit-2 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-3 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. Database search - FASTA and BLAST, Protein multiple sequence alignments.

Unit-4 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-5 Bioethics and Patenting

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

Text Books

1. R.A. Day. How to write a scientific paper. Cambridge University Press. 6th ed. 2006.
2. C. R. Kothari. Research Methodology: Methods and Techniques. New Age International Publishers. 2004
3. N. Gurumani. Research Methodology: For Biological Sciences. M.J.P publisher. 1st ed. 2013
4. Krane et al Fundamental Concepts of Bioinformatics. Benjamin Cummings. 1st ed. 2002.
5. S.C. Gupta – Fundamentals of Statistics. Himalaya Publishing House. 7th. 2018

Course Outcomes

At the end of the course, the student will be able to

CO1: Understand and apply the ethical principles in scientific research, formulate an hypothesis and design an experiment.
CO2: Demonstrate skill in literature analysis and compile and prepare dissertation/thesis in a logical format.
CO3: Communicate biological concepts through written and oral presentation.
CO4: Comprehend the rules of bioethics and patenting.
CO5: Understand the statistical tools and apply the appropriate tools for data analysis.

M.Phil. Biochemistry / Biotechnology Syllabus (Regular)

Course – II: Analytical Methods

Learning Objective (LO): To gain knowledge about the chromatography, microscopy, cell culture, electrophorosis, spectroscopy, immunochemical and molecular biology techniques.

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.

Unit-2 Microscopy and Cell Culture Techniques

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

Cell culture techniques: Equipment- hoods, CO_2 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 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. DNA and protein microarrays- fabrication and applications.

Text Books

1. Andreas Hofmann and Samuel Clokie. Wilson and Walker's Principles and techniques of Biochemistry and Molecular Biology. Cambridge University Press. 8th ed. 2018.
2. Freshney RI. Culture of Animal Cells. A Manual of Basic Techniques. Wiley-Hiss. 6th ed. 2010.
3. Sambrook. Molecular Cloning. Cold Spring Harbor Laboratory. 4th ed. 2012.
4. Friefelder and Friefelder. Physical Biochemistry- Applications to Biochemistry and Molecular Biology. WH Freeman & Co. 1983.
5. Upadhyay, Upadhyay and Nath. Biophysical Chemistry Principles and Techniques. Himalaya publ. 2010.

Course Outcomes

At the end of the course, the student will be able to

CO1: Understand the principle, instrumentation, methodology and troubleshooting of chromatographic techniques

CO2: Grasp the principle, instrumentation and specimen preparation of diverse types of microscopy and familiarize the salient features of cell biology techniques

CO3: Comprehend the principle, methodology and troubleshoots of immunochemical techniques

CO4: Describe the principle, instrumentation, methodology and troubleshooting of electrophoretic and spectroscopy techniques

CO5: Appreciate the principle, instrumentation, method and troubleshooting of requisite molecular biology techniques

M.Phil. Biochemistry / Biotechnology Syllabus (Regular)

Course – III: Special Paper

- Prescribed by the Respective Research Supervisor and Research Advisory Committee