



### **M. Phil. Course of Studies**

The M.Phil Programme in the Department of Biosciences and Biotechnology consists of two semesters. The course pattern in the two semesters is mentioned below. The pattern of examination will be as per the guide lines on regulation of M. Phil degree under semester system in F.M.University. The department shall follow teaching and examination based on continuous evaluation by internal as well as by external examiners.

During the second semester, a student shall deliver at least two seminars (BTM-621), which will be evaluated by the faculty members present of the department. The students will start their dissertation project in consultation with their supervisor from the beginning of the 1<sup>st</sup> semester, but the thesis will be submitted at the end of second semester. The thesis will be examined by an external examiner and the respective supervisor.

	<b>First Semester</b>	
BTM-611	Research Methodology, Statistics and Bioinformatics Applications	4 CH
BTM-612	Elective Paper: Applied Biosciences and Biotechnology	4 CH
BTM-613	Review of Literature	4 CH
	<b>Second Semester</b>	
BTM-621	Journal Paper Discussion and Seminar	2 CH
BTM-622	Project work, Viva-voce and Project Presentation	10 CH
	<b>Grand Total</b>	<b>24 CH</b>

## First Semester

### **BTM-611 Research Methodology, Statistics and Bioinformatics Applications 4CH**

#### **UNIT-I**

Research Methods: Elements of Scientific Research: Formulation of Research Problem, Framing Hypotheses, Formulation of research objectives, Review of Literature. Research Report: Components, Format of thesis and dissertation, Manuscript/research article, Review article, Bibliography and References, Significance of research, Publishing and ethical issues

#### **UNIT-II**

Concept of sample population, sampling and dispersion and randomization. Sampling: Concept and Types - Simple Random, Probability Proportionate to Size, Stratified and Purposive; Sampling and Non-sampling Errors. Data analysis and interpretation, Diagrams and graphs using Microsoft Excel, Communication and presentation skills, Statistical software-SPSS

#### **UNIT-III**

Brief description and tabulation of data and its graphical representation, Measure of central tendency and dispersion; mean, median, mode, range, standard deviation, variance. Idea of two types of errors and level of significance, tests of significance (F, Z and t-test); chi-square tests, Simple linear regression and correlation, ANOVA.

#### **UNIT-IV**

Biological Databases: Sequence and structure databases, NCBI, Specialized Databases- KEGG, OMIM. Sequence analysis – Local and Global Alignment, BLAST, Algorithms for alignment, ClustalX2, Phylogenetic Analysis, Secondary structure prediction, Molecular Visualization tool- RasMol, Finding genes in genomes

#### **UNIT-V**

Introduction to ethics and research ethics. Overview of theories and methods in ethics and research ethics. Good research practice, Criteria and principles for good research practice; research integrity and meaning of scientific misconduct and fraud. The meaning of secrecy and confidentiality. Responsibility for research and the results and consequences of research. Ethical vetting of research. Procedures and ethical principles guiding research on human beings and animals, Intellectual property rights & patenting.

#### Reference Books:

1. Statistical Methods – S.P. Gupta
2. Research Methodology, Methods & Techniques – C.R. Kothari
3. Statistics (Theory and Practice) – B.N. Gupta
4. Basic Biostatistics – G.B.N. Chainy, P.K Mohanty and G. Mishra
5. Fundamentals of Biostatistics – Veer Bala Rastogi
6. Bioinformatics: A Practical Guide to the Analysis of Genes & Proteins – Andreas D. Baxeavanis, B.F. Francis Ouellette (John Wiley and Sons)
7. Introduction to Bioinformatics – Arthur M. Lesk

**UNIT-I**

Microscopy- Light, phase-contrast, fluorescent, confocal, SEM, TEM. Centrifugation techniques. HPLC, Column chromatography techniques. Electrophoresis: Native-PAGE, SDS-PAGE, Isoelectric focusing and 2D electrophoresis, Agarose gel electrophoresis. Structure determination of Nucleic Acids and Proteins, X-Ray Crystallography, NMR and ESR Spectroscopy, Protein and Nucleic Acid Sequencing. Blotting techniques- Southern, Northern, Western.

**UNIT-II**

Immunological techniques: ELISA, FACS, Immunohistochemistry, Molecular immunodiagnostic methods, Role of Biotechnology in vaccine production, Monoclonal antibodies, Nanotechnology in Molecular Diagnosis, Drug discovery, Stem cell therapy.

**UNIT-III**

Isolation of DNA, Restriction Endonucleases, Restriction mapping, Principles and Applications of PCR, RAPD, RFLP, Nucleic Acid Labeling, Microarrays, Gene Cloning Techniques, Isolation of Plasmid, cloning vectors, properties and types (M- 13, Plasmid vectors, pBR-322, pUC-18 shuttle vector, YAC), Gene library, RNA interference, Genome editing, Expression Library construction and purification of recombinant proteins.

**UNIT-IV**

Fermentation- Types of fermenters, strain improvement, media formulation, upstream and downstream processing, production of industrially important enzymes, antibiotics, organic acids, vitamins and amino acids, Enzymatic Bioconversion; large scale animal and plant cell cultivation.

**UNIT-V**

Genetically modified organisms (GMO): Gene transfer in plant and animals (Calcium phosphate method, Microinjection, Agro bacterium inoculation etc), Selection and screening of Transgenic plants and animals, Receptor genes, Genetically modified plants and animals (pest resistant, herbicide resistant plants and transgenic animals), Role of GMO in biodegradation.

Reference Books:

Biochemistry: L. Stryer

Biochemistry: Voet and Voet

Practical Biochemistry: Wilson Walker

Analysis of genes and genomes: Reece

Gene VIII: B.Lewin

**Second Semester**

**BTM-621 Journal Paper Discussion and Seminar**

**2 CH**

**BTM-622 Dissertation, Viva-Voce and Project Presentation**

**10 CH**