Syllabus

M.Phil. Programme

Department of Microbiology , University of North Bengal

Semester	Paper code	Paper Name	Credits	Full Marks
I	MBMP 01	Research Methodology & Design	2	50
	MBMP 02	Quantitative Methods	4	100
II	MBMP 03	Computer Application	2	50
	MBMP-E1	Paper A/Paper B	4	100
III	MBMP 04	Advanced Microbiology	2	50
	MBMP-E2	Paper A/Paper B	4	100
IV	MBMP-05	Dissertation	6	150
		Total	**24**	**600**

Semester I

Paper: MBMP-01

Research Methodology and Design

Defining research Basic and applied research; Essential steps in research ; Defining the research problem; Research/Experimental design; Literature citation ; Research report : components format of thesis and dissertation , Manuscript / Research article,Review,Monographs,Bibliography and References ;Significance of research ; Bioethics in animal experiments,Safe disposal of microbial and other hazardous wastes, Project proposal.

Paper: MBMP-02

Quantitative Methods

Measures of central tendency and dispersal;Probability distributions-binomial ,poisson and normal;Sampling distribution ;Hypothesis testing-significance testing,T-test,Chi-square test,F-test;ANOVA-one way and two way analyses ; Regression and correlation analyses;Principle component analysis; Discriminant analysis using software.Biohazards,Riskanalysis,Carcinogens,Toxicagents,Biosafetycabinet,Radiation safety ,Chemical safety,Biosafety guidelines and regulation.

Semester II

Paper:MBMP-03

Computer Application

Biological databank and sequence analysis,Database searching and BLAST,FASTA,Multiple sequence alignments CLUSTALW,Computing evolution –phylogenetic analysis ,Promoters,Restrictionsites,RNA folding patterns,Proteinmotifs,Domains,Pattern recognition softwares ,Primer design,Concept of molecular cloning ,Molecular docking and Drug design.

Elective Paper (Students may choose any one of the given elective paper)

Paper: MBMP-E1

A: Instrumentation and Biotechniques

Microscopy: Theory and applications in Biological sciences, Dark-field, Phase contrast and interference, Polarisation, Confocal, Atomic force, Fluorescence and Electron (SEM and TEM) microscopy; Fluorescence activated cell sorter

Radioactivity measurement: Radioactive decay, Liquid scintillation counter- γ ray detection and its applications; Use of stable isotopes in Biological sciences; Autoradiography

Chromatography: Basic principle; Paper, Thin layer and Column chromatography; Protein purification; Liquid chromatography; Gas chromatography

Electrophoresis: Basic principle; Agarose gel electrophoresis, Polyacrylamide gel electrophoresis, Counter current electrophoresis, Immuno-electrophoresis; Isoelectric focusing

Centrifugation: Basic principle; RCF and Sedimentation Coefficient; Types of Centrifugation - High speed and Ultracentrifugation, Differential and Density-gradient centrifugation; Analytical centrifugation and applications

Spectroscopy; Theory and applications; UV-Visible, Fluorescence, IR, FTIR, NMR, Mass, Raman and Atomic absorption spectroscopy; Fluorescence polarization

B: Value Added Product from Agro - wastes

Generation of microbial biomass from wastes of cereal, oil crops, fruit wastes, vegetable waste, fermentation waste industry and whey

Baker's yeast production

Fermented edible products from wastes: vinegar, organic acid- citric acid, gluconic acid, lactic acid, Amino acid-lysine and glutamic acid, Vitamins, Enzyme production- amylase, lipase, cellulose, pectinase, Bioethanol

Microbial flavours, Microbial pigment

Microbial gums and polysaccharides

Biogas from wastes: Anaerobic digestion and Methanogenesis; Microbiota involved in anaerobic digestion; Ensilaging and methane generation; Bio-hydrogen; Techno-economics of biogas generation from fruits and vegetable wastes

Semester III

Paper:MBMP-04

Advanced Microbiology

Chemolithotropy and phototrophy,Biological nitrogen fixation,Cellsignaling in Prokaryotes ,Aerobic fermentation ,Respiration ,Bacterial genetics,Development of mutant strains and genetic analysis,Genotypeanalysis,Preservation of important strains,Properties of Phage infected bacterial culture ,Restriction ,Modification and Trangenics. Genome analysis ,Phylogenetic profiling,VNTR,SNTR,SNP,Differential Display ,Analysis of proteomes,Networking,Integrated 2D gel-MS,Purification of proteins,Microarray analysis.

Phase contrast microscopy ;Confocal microscopy;Scanning and Transmission electron microscopy ;Freeze-tech and Freeze-fracture methods for EM,ELISA,FACS,Spectroscopy (NMR,IR,MS etc).Chromatography-TLC,Gas,Column,HPLC;Electrophoresis(DNA and Protein separation techniques),PCR-Nested PCR,Real time PCR and Inverse PCR;Hybridisation ;Blotting Techniques-Western,Southern and Norhtern;Automation in diagnostics,Nanotechniques,Bioprocess,DNAsequencing,Proteinsequencing,Chemical synthesis of DNA and Protein.

Elective Paper (Students may choose any one of the given elective paper)

Paper: MBMP-E2

A: Bioethics & IPR

The importance and needs of bioethics; Bioethical business practices; Laws and bioethics; Environmental protection; Creating awareness and safeguarding health of consumers; Fair trade practices; Combating plagiarism

Concept of property, rights/protection, duties, and their correlation; History and evaluation of intellectual property rights (IPR); Distinction among various forms of IPR

Introduction to Intellectual Property and the Indian Legal System; Indian Trademark fundamentals, management, practice and procedures; Contemporary and comparative perspective in different jurisdictions; Copyright fundamentals, practice, and perspective

Introduction to patents; Key concepts; International Law of Patents; Indian Patent Act and practice**;** Patentability; Types of patents**;** WIPO treaties

International registration systems; Patent application; Documentation and search; Revocation of patent; Infringement or violation; Remedies against infringement**;** Drafting; Litigation; Commercialization and licensing

Designs law and practice; Trade secrets and confidential information; Plant varieties protection law; Biodiversity law and traditional knowledge; Legal implications and public concerns in genetic modification of foods; Computer and software IP, Semiconductor and chip law

B: Biodegradation & Bioremediation

Bioremediation: Advantages of Bioremediation, types of bioremediation.
Monitoring the efficacy of Bioremediation. Bioaugmentation, biomagnifications and Biotransformation Bioventing
Bioremediation for controlling oil spills.
Biosorption: Use of bacteria and fungi, Bioreaction for biosorption. Problems associated with disposal of xenobiotic compounds, Hazardous wastes. Biodegradation of xenobiotics: Persistent compounds, Degradation mechanisms, naphthalene, benzene, phenol, PCB's, propanil (Herbicide), urea. Biodegradation of petrochemical effluents. Global environment problems: The Green house effect, Ozone depletion, UV radiation, Acid rain.

Semester IV

Paper: MBMP-05

Dissertation

Each student will be required to undertake dissertation assigned to him related to R&D in any area of microbiology under the supervision of a faculty member. In principle, the research work is to be carried out by the student himself/herself taking advice from his/her supervisor when problem arises. The work will be allotted at the beginning of the fourth semester specifying the different aspects to be carried out by the student. At the end of the semester the student will submit a report on his work in typed and bound form.

Evaluation shall include oral presentation and a viva-voce. Defence of the viva on the project should be done in presence of an external examiner along with the faculties.