

**DEPARTMENT OF LIFESCIENCES  
UNIVERSITY OF CALICUT**

**SCHEME OF M.PHIL MICROBIOLOGY**

**2009-10**

Sem.	Course	Title	Marks			Credit
			Ext	Int	Total	
<b>I</b>	MBMP.C01	Instrumentation and research methodology	80	20	100	4
	MBMP.C02	Advanced trends in Microbiology	80	20	100	4
	MBMP.E01	Immunology and medical microbiology	80	20	100	4
	MBMP.E02	Environmental biotechnology				
<b>Total</b>			<b>240</b>	<b>60</b>	<b>300</b>	<b>12</b>
<b>II</b>	<b>Second Semester</b>					
	MBMP(Pr)	Project work	120	30	150	<b>12</b>
		Viva-voce	40	10	50	
<b>Total</b>			<b>160</b>	<b>40</b>	<b>200</b>	
<b>Grand Total</b>			<b>400</b>	<b>100</b>	<b>500</b>	<b>24</b>

**DEPARTMENT OF LIFE SCIENCES**  
**M.PHIL MICROBIOLOGY SYLLABUS**

**Core courses**

1. **MBMP. C01: Instrumentation and research methodology**
2. **MBMP. C02: Advanced trends in Microbiology**

**Elective courses (any one of the following)**

1. **MBMP. E01: Immunology and medical microbiology**
2. **MBMP. E02. Environmental biotechnology**

**MBMP. C01: INSTRUMENTATION AND RESEARCH  
METHODOLOGY**

1. Fundamental procedures used in a microbiology laboratory; Instrumentation, Colorimetry - Visible - UV Spectrometry; Separation Techniques Chromatography: TLC, Paper, Gas, Column, Ion exchange, HPLC, GC-MS, Affinity chromatography. Electrophoresis: PAGE, Agarose gel electrophoresis. Centrifugation -Principles, types, applications. Ultracentrifugation. Electroanalytical methods; Isotope techniques – Detection and measurement of radioactivity; Tracers and methods of detecting tracers.
2. Molecular tools and their applications – Restriction and Modification enzymes; Cloning vectors, DNA primers, Linkers , Adaptors and their chemical synthesis; Nucleic acid amplification methods - PCR-Types- Nested PCR, Real time PCR; RFLP; RAPD and AFLP analysis; Blotting techniques, Protein and nucleic acid sequencing; Nucleic acid microarrays .
3. Advanced diagnostic procedures in microbiology – Culture confirmation techniques ;Direct detection probes; Diagnostic sequencing; Molecular typing methods; Pulse field gel electrophoresis; PCR based typing methods; Genotyping bacteria by using VNTR. Agglutination and Precipitation –EIA, ELISA, Immunofluorescence, RIA, Chemiluminescence,, Blotting Technique (Western , Southern, Northern), Flow cytometric assays. Automation in Diagnostic Microbiology.
4. Hypotheses; theories and laws in science; Observations, evidences and proofs. Design of an experiment; experimentation; observation; data collection; interpretation and deduction. Planning of experiments: Design, selection of controls, observational requirements, instrumental requirements, Documentation of experiments. Nature and Types of data -typical examples; Data acquisition; Treatment of data; Data interpretation, Significance of statistical tools in data interpretation, errors and inaccuracies. Data presentation: graphs, tables, histograms and pi diagrams. Statistical testing of hypothesis. Ethics in biotechnology research, Biased observations, Influence of observer on observations, using and acknowledging observations by others. Publications and Patents.(Details not required) Plagiarism.

## **MBMP. C02: ADVANCED TRENDS IN MICROBIOLOGY**

1. Microbial taxonomy – Advanced molecular approaches in microbial classification. Molecular approaches. Archea - methanogens, the halophiles, the hyperthermophiles and the genus *Thermoplasma*, their importance.
2. Microbial growth and control, disinfectants and antibiotics and their chemical functions, New generation antibiotics; Evaluation of antimicrobial compounds.
3. Microbial ecology of foods, Advanced techniques of food processing and preservation; Emerging food borne diseases; Procedures to use during outbreaks of food borne diseases; Molecular and biosensor based approaches for the detection of foodborne pathogens; Genetically modified foods ; Probiotics and Prebiotics; Microorganisms as Alternative energy source ; HACCP.
4. Bioprocess Techniques; Bioreactors – instrumentation and process control; Media for fermentation; Solid State fermentation - Submerged fermentation. Strain improvement. Down stream processing; Protein engineering and metabolic engineering.
5. Cells of the immune system, specific immune responses, including B- and T-cells, macrophages, immunoglobulins, immunoglobulin genetics, and major histocompatibility proteins. Principal adverse aspects of the immune system, concentrating on the major hypersensitivities.

## **MBMP. E01: IMMUNOLOGY AND MEDICAL MICROBIOLOGY**

1. Microbial pathogenicity- sources and spread of infections in the community; Epidemiology of infectious diseases; Emergence of multidrug resistance pathogens; Mechanisms and genetics of drug resistance; Special tests for detecting resistance, Instrument based techniques.
2. Humeral and cell mediated immune response. Cells of immune system, lymphoid organs, lymphocyte traffic, T and B cells – Structure, function, maturation and development. Genetics of immune response.
3. Lymphokines and cytokines. Processing and presentation of intracellular and extracellular antigens. Immune response to T-dependant and T independent antigens. Major histocompatibility complex.
4. Immunoglobulin structure & classes. Antigen-antibody reactions and their applications in immunodiagnosis. autoimmune diseases, hypersensitivity reactions. immunodeficiency diseases. Immunotherapy for cancer. Vaccines- Types and characteristics of vaccines; Principles and effects of vaccination; Vaccine designing.
5. Symptomatology, epidemiology, preventive measures of disease – Hepatitis,-A,B,E, HIV, Tuberculosis, Enteric fever, Weil's disease, Emerging disease-s Dengue fever, Chikungunya, Swine flu, Hand, Foot and Mouth disease.

## **MBMP. E02. ENVIRONMENTAL BIOTECHNOLOGY**

1. Role of bacteria in diverse terrestrial and aquatic ecosystems, including nutrient recycling, symbiotic relationships, and adverse effects on certain ecosystems (acid mine drainage, mercury mineralization, ore leaching). Carbon, Nitrogen and Sulfur Cycling; Assorted biogeochemistry. Biotechnology in marine ecology.
2. Interactions among microbial populations; Plant-microbe interactions; Microbe-animal interactions; Development of microbial communities; Measurement of biomass and microbial activity; Microbial Diversity – phylogenetic, physiologic and metabolic; Waste treatment / Water quality, Biofuels; Microbial fuel cells. Biocontrol, Industrial microbiology.
3. Biodegradation/bioremediation; isolation and screening bioremediation's microbes, organic compound contaminants bioremediation, heavy metal and xenobiotic compounds bioremediation, hydrogen bioremediation, and engineering techniques used in bioremediation, Infectious waste management; Waste water treatment using living systems.
4. Industrial products produced by microbes, including yeast, steroid bioconversions, and large-scale productions of alcohol, foods, enzymes, vitamins, antibiotics, food additives, and chemicals. Cellulose and lignocellulose to ethanol, antibiotic production.
5. Immobilization techniques; enzyme and cell immobilization, methods for biocatalysis and biotransformations; Biopolymers- synthesis and applications; Microbial ore leaching.