M. PHIL. SYLLABUS

OF

MICROBIOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

2018

Revised as per Ministry of Human Resource Development, UGC New Delhi, Notification 5th May, 2016, (Minimum Standards and Procedure for award of M.Phil. / Ph.D. Degrees) Regulation – 2016

Re-Accredited Grade 'A' by NAAC

DEPARTMENT OF BIOSCIENCES

SAURASHTRA UNIVERSITY

RAJKOT – 360 005

M. Phil Programme in Microbiology

Duration: Minimum of 2 Semesters and maximum 4 Semesters
Components of the Progrmme: (a) M. Phil. Course Work (b) Core & Elective courses and (c) M. Phil. Dissertation

Details of M. Phil. Syllabus:

Two (one Core paper in first semester and one Elective paper in second semester).

Credit : Each Course will be of 4 credits in 4 h/week/Sem. 08 Credits
Dissertation: 16 hours/week/Sem. For 2 Sems. 16 Credits

Total 24 Credits

Marks : Each course is of 100 marks 200 Marks
Dissertation 200 marks (100 thesis & 100 Viva) 200 Marks

Total 400 Marks

M. Phil. Programme Structure

As per Ministry of Human Resource Development, UGC New Delhi, Notification 5th May, 2016, (Minimum Standards and Procedure for award of M.Phil. / Ph.D. Degrees) Regulation – 2016, (SU Ordinance Circular No. PGTR/PhD/1/254/2017, dated 25-1-2017)

CHOICE BASED CREDIT SYSTEM (CBCS)
(Total 24 Credits)

COURSE	PAPER NAME	HOURS / WEEK	CREDIT	MARKS
SEMESTER - I				
Coursework	**M.Phil. Microbiology Course Work (Research Methodology)**	8	8	
M.Phil.Micro-101	**Paper – 1.** Microbial Technology (Core)	4	4	100
M.Phil.Micro -205	Dissertation – I*	------	8	
	SEMESTER TOTAL		12	100
SEMESTER - II				
	Paper – 2 (Elective) Any ONE	4	4	100
M.Phil.Micro -202	Extremophiles and Metagenomics			
M.Phil.Micro -203	Biodegradation of Xenobiotic Compounds			
M.Phil.Micro -204	Food & Dairy Microbiology			
M.Phil.Micro -205	Dissertation – II*	15	8	200
	SEMESTER TOTAL	20	12	300
	GRAND TOTAL	**40**	**24**	**400**

*Dissertation will commence in the beginning of the first Semester but will be evaluated and grade points will be given in the Final Semester.

SEMESTER – I

M.Phil. Course Work: 8 Credits

M.Phil Paper – 1. Microbial Technology

Unit – 1. Protein Engineering

1.1 Protein architecture and structure and function relationship.
1.2 Protein modification: Chemical modification and site directed mutagenesis.
1.3 Gene shuffling and chimeric enzymes.
1.4 *In vitro* directed evolution of enzymes and other proteins.
1.5 Over expression and folding of proteins.

Unit – 2 Enzyme Technology

2.1 Biocatalysis applications in the pharmaceutical industries.
2.2 Unique industrial biocatalysis from extreme environments.
2.3 Molecular approaches in development, production and recovery of enzymes.
2.4 Biocatalytic desulfurization of fossil fuel.
2.5 Enzyme catalysis for polymer synthesis.

Unit – 3 Biosensors

3.1 Concept and development of biosensors: Historical perspective.
3.2 Market potential and limitations, new generation of biosensors, Nano-Sensors
3.3 Biosensors in medical diagnostics.
3.4 Industrial applications of biosensors.
3.5 Biosensors in agriculture and environmental monitoring.

Unit – 4 Environmental Biotechnology

4.1 Soil bioremediation.
4.2 Ground water Pollution and its bioremediation.
4.3 Surface aquatic systems.
4.4 Mycoremediation and Phytoremediation.
4.5 Legislation, regulation and policies related to bioremediation.

Semester – II
Course -2 (Elective: any ONE of the following)

Micro-102: EXTREMOPHILES AND METAGENOMICS

Unit -1 Microbial evolution and phylogeny

1.1 Molecular basis of microbial classification
1.2 Chronometers and chronological distances; Paradox in establishing Evolutionary distances
1.3 rRNA organization in the cell and its structure
1.4 Molecular phylogeny with 16S rRNA, Bioinformatics tools in the phylogenetic analysis construction

Unit – 2 : Non-cultivable microbes and Metagenomics:

2.1 Cultivable vs. non-cultivable microbes, Metagenomics approaches in relation to Non-cultivable microbes, Genetic heterogeneity among non-cultivable
2.2 Molecular methods to study the non-cultivable microbes: Isolation of nucleic acids and analyses of the microbial diversity, In-situ hybridization, molecular methods used to study non-cultivable microbesDGGE, TGGE,T-RFLP,ARDRA and other advanced methods
2.3 Metagenomic library construction; Sequence based and functional aspects of Metagenomics
2.4 The Key Projects in Metagenomics; Functional potential of the non-cultivable microbes
2.5 Biotechnological significance of the non-cultivable microbes

Unit – 3 : Archaea:

3.1 Archaea - Molecular differences between archea and other domains
3.2 Phylogenetic groups of Archaea
3.3 Ecology, Habitats and Physiology of Archaea
3.4 Genome organization in Halophilic archaea

Unit – 4 : Life at Extremities:

4.1 Hyperthermophilic Archaea and Bacteria, Life at hyper salinity and other forms of the extremities
4.2 Adaptation strategies of halophiles and hyperthermophiles at extreme conditions
4.3 Regulation of gene expression in archaea and bacteria representing extreme habitats
4.4 Protein and enzyme stability in hyper-extermophlies

Micro-103: BIODEGRADATION OF XENOBIOTIC COMPOUNDS

UNIT 1 Biodegradation
1.1 Biodegradation - Parameters Influencing Biodegradation
1.2 Biodegradation of Plant Polysaccharides - Lignin, Cellulose
1.3 Biodegradation Methodology
1.4 Kinetics

UNIT 2 Biodegradation of Xenobiotic Compounds
2.1 Biodegradation of Pesticides
2.2 Biodegradation of PAHS
2.3 Biodegradation of Nitroaromatics
2.4 Biodegradation of Chloroaromatics

UNIT 3 Microbial Transformations of Inorganic Pollutants
3.1 Acid Mine Drainage
3.2 Microbial Methylation of Mercury
3.3 Microbial Methylation of Arsenic
3.4 Bioremediation of Radioactive Wastes

UNIT 4 Biodegradation of Hydrocarbons & Bioremediation
4.1 Biodegradation of C_1 Compounds
4.2 Biodegradation of Aromatic Compounds – Aerobic & Anaerobic
4.3 Bioremediation - Various Strategies Involving Microbes: Bacteria and Fungi
4.4 GEM & Bioremediation

Micro-104 : FOOD & DAIRY MICROBIOLOGY

UNIT 1 Fermented Foods
1.1 Dairy Products
1.2 Alcoholic Beverages
1.3 Oriental Fermentations
1.4 Food Ingredients

UNIT 2 Applications of biotechnology 2.1 "Novel" Microorganisms (eg. Lactic Acid Bacteria (Probiotics), Cyanobacteria, Methylotrophs):
2.2 Enzyme Biotransformations
2.3 Genetically Modified Foods: eg. Brinjal, Tomato, Maize, Soybean, Rice
2.4 Rapid Diagnostic Methods

UNIT 3 Principles of genetic modification of food organisms
3.1 Recombinant DNA Technology
3.2 Polymerase Chain Reaction and its types
3.3 Reverse Transcription
3.4 Transgenic Animals with respect to dairy technology

UNIT 4 Ethical perspectives of food biotechnology
4.1 Environmental Impact, Safety and assessment
4.2 Intellectual Property Rights
4.3 Consumer Perceptions
4.4 Producer's Perspectives