SAURASHTRA UNIVERSITY

RAJKOT

(ACCREDITED GRADE "A" BY NAAC)

FACULTY OF SCIENCE

Syllabus for

M. Phil. (MICROBIOLOGY)

Choice Based Credit System

With Effect From: 2018-19

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*	16	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.

Programme Outcomes of M. Phil. Microbiology

PO - 1 :Critical Thinking
M. Phil Microbiology is a link between M Sc and PhD. Sstudentsare encouraged to go for M. Phil degree. It is important for critical thinking and analytical ability for future studies and jobs.
It allows for critical thinking for science and microbiology in particular with sound knowledge and theoretical skills by interaction and plausible explanations.

PO - 2 :Social Interaction
The program helps indevelopment of interest in planning and implementation of research in cooperative manner. The MPhil degree in Microbiology divinely enhances the analytical skill of the students and harbor great confidence in them.

PO – 3 :Core academic skills
Exposure in MPhil prides deeper undertaking of the subject and in fact students get more exposure and develop confidence in conceptualization of the research theme and deciding the topic, designing of the experiments, analyzing the data and deriving outcome from it.

PO-4 :Research and Development
Students develop skills to handle biochemical and molecular techniques to plan and carry out experiments. The programme will enable them to develop skills in analyzing data, testing of hypotheses using statistical software's and draw conclusions from the experimental data.

PO-5 :Communication Skills
Students gain confidence in delivering seminars, as teaching in MPhil is largely interactive that includes, class room teaching, seminar delivering by the students, writing a concept note and assignment on the recent topics and developments in the field.
They are able to communicate effectively with scientific community and with Society at large. Comprehend.

PO – 6 :Continuous Learning
Recognize and integrate life-long learning skills to become pro-active in personal and professional live. The students develop interest in persuading higher studies.

Programme Specific Outcomes of M. Phil. Microbiology

PSO-1 :
Understanding is developed the recent developments in microbiology and molecular biology in specific areas and in general context of the discipline.

PSO-2:
Formulation of hypothesis and designing experiments and conduct research using appropriate techniques
Developing ability to carry out independence research in the area of the project

PSO -4:
Developing abilities to effective writing leading to publications of the research work in standard journals

Course code	Title of the Course	Course Credits	No. of Hrs. Per Week	Weightage For Internal Examination	Weightage For Semester End Examination	Total Marks	Duration of Semester End Exam in Hrs.
M.Phil Microbiology SEMESTER I							
Coursework	M.Phil Microbiology Course Work (Research Methodology)	8	8				
M.Phil. Micro-101	Paper-1 Microbial Technology (Core)	4	4			100	2.5
M.Phil. Micro-205	Dissertation -I*	8	0				
M.Phil Microbiology SEMESTER II							
	Paper -2 (Elective) Any ONE	4	4			100	2.5
M.Phil. Micro-202	Extremophiles and Metagenomics						
M.Phil. Micro-203	Biodegradation of xenobiotic compounds						
M.Phil. Micro-204	Food and Dairy Microbiology						
M.Phil. Micro-205	Dissertation -II*	8	16			200	

SEMESTER – I

M.Phil. Course Work: 8 Credits

Objectives:

The objective is to provide broad spectrum of methodology and tools used in research and understating basics of research planning and analysis and drawing conclusions

Course Outcome:

In the first semester, according to the UGC Ordinance 2016, they have to complete a 8-Credit Course work.

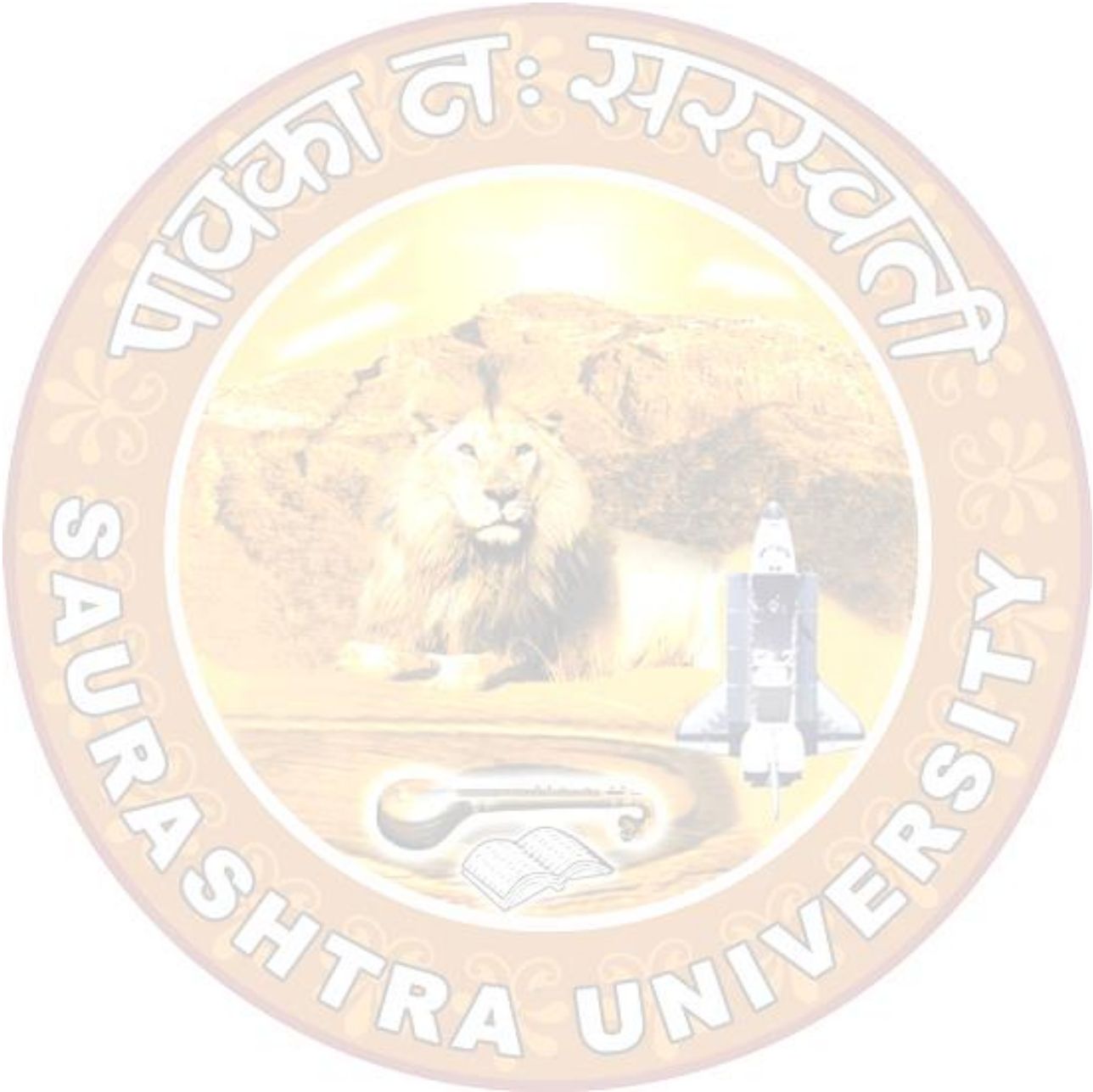
CO 1: It focuses on the research mythology, data analysis, statistical methods, literature survey, presentations and computer applications.

CO 2: By studying this paper students will be able to understand research terms, the research process and develop skills and ethics associated with the research process.

CO 3: Students will learn statistical tools and software for data analysis.

REFERENCES:

1. Research methods and Statistics A Critical Thinking by Sherri L. Jackson
2. Methods in Biostatistics for Medical Students and Research Workers by B . K. MahajanJaypee
3. Biostatistics by SundarRao
4. Statistics by D. C. Sancheti



In this semester they also study one core paper of 4 Credit. In the beginning of this semester, the students also decide the topic of their dissertation and stat working on it, which continue till second semester.

M.Phil Paper – 1. Microbial Technology

Course Outcome:

CO 1: Students will get exposure on the broader area of the applications of microorgaisms.
CO 2: Applications of microorganisms in different araes are discussed and students get broader spectrum of the usefulness of the microorganisms.
CO 3: Different aspects undertake include protein engineering, enzyme based applications and use of the microorganisms in monitoring and restoration of the environment.

Unit – 1. Protein Engineering

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

Unit – 2 Enzyme Technology

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

Unit – 3 Biosensors

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

Unit – 4 Environmental Biotechnology

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

Semester – II

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

In the second semester, the students select one elective paper out of three options. These papers are designed on the basis of three different domains of the discipline and include recent directions and development.

Micro-102: EXTREMOPHILES AND METAGENOMICS

Course Outcome:

CO 1: In this paper, the students are aquatinted with the microorganisms from highly extreme habitats.
CO 2: Various aspects of these specific organisms are dealt and students get broader spectrum of the abilities of these microorganisms.
CO 3: Another part of the syllabus relates to the microorganisms which are not cultivatable in the lab and hence they remain unknown for the world.
CO 4: Since these microorganisms account for the maximum, their study becomes very very interesting and significant.

Unit -1 Microbial evolution and phylogeny

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

Unit – 2 : Non-cultivable microbes and Metagenomics:

2.1Cultivable vs. non-cultivable microbes, Metagenomics approaches in relation to Non-cultivable microbes, Genetic heterogeneity among non-cultivable
2.2Molecular 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 noncultivablemicrobesDGGE, TGGE,T-RFLP,ARDRA and other advanced methods
2.3Metagenomic library construction; Sequence based and functional aspects of Metagenomics
2.4The Key Projects in Metagenomics; Functional potential of the non-cultivable microbes
2.5 Biotechnological significance of the non-cultivable microbes

Unit – 3 : Archaea:
3.1Archaea - Molecular differences between archea and other domains
3.2Phylogenetic groups of Archaea
3.3Ecology, Habitats and Physiology of Archaea
3.4Genome organization in Halophilic archaea

Unit – 4 : Life at Extremities:

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

Micro-103: BIODEGRADATION OF XENOBIOTIC COMPOUNDS

Course Outcome:

CO 1: In this paper, emphasis is laid on environmental aspects of the microbiology.
CO 2: The potential of microorganisms in bioremediation is an important aspect which is discussed in this paper.
CO 3: Various kinds of pollutants exist and constantly being added into the environment. The students will get enough exposure on the potential of the microbial world in reducing and removing these pollutants.

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

Course Outcome:

CO 1: In this paper, emphasis is laid on environmental aspects of the microbiology.
CO 2: The potential of microorganisms in bioremediation is an important aspect which is discussed in this paper.
CO 3: Various kinds of pollutants exist and constantly being added into the environment. The students will get enough exposure on the potential of the microbial world in reducing and removing these pollutants.

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

UNIT 2 Applications of biotechnology2.1 "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

References:
Recent research papers from the journals and review articles

DISSERTATION PROJECT WORK

Dissertation research work is offered in Semester I and II, in which students carry out experiments on the determined project frame under the supervision of the guide. Dissertation commences in the beginning of the first Semester and continues in the second semecter.