

M. PHIL. COURSE WORK
SYLLABUS
OF
MICROBIOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

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

SAURASHTRA UNIVERSITY
DEPARTMENT OF BIOSCIENCES

M. PHIL. PROGRAMME IN MICROBIOLOGY

1. The M. Phil. Programme in Microbiology and its Coursework syllabus of the Department of Biosciences, Saurashtra University is now revised as per the 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).
2. M.Phil. Programme shall be for a minimum duration of two (2) consecutive semesters / one year and a maximum of four (4) consecutive semesters / two years (Clause 3.1).
3. The M.Phil. Coursework will be of one semesters (clause 3.1) having two theory courses 100 marks each. The coursework shall be treated as prerequisite for M. Phil. preparation (clause 6.2). The M. Phil. research work for Dissertation / Thesis will be spread over all the semesters as prescribed in the Circular. Though the Dissertation will commence in the beginning, it will be evaluated and grade points, if any, will be given at the end of the programme.
4. The eligibility criteria (clause 1), admission process (clause 4.1), number of intake (clause 4.2) and all other details of this programme will be as per above Circular.
5. Coursework Pattern: The credit assigned to the M.Phil. Coursework shall be a minimum of 08 credits and a maximum of 16 credits (clause 6). All candidates admitted to the M.Phil. Programme shall be required to complete the Coursework prescribed by the Department during the initial semesters (clause 6.5).
6. An M. Phil. candidate has to obtain a minimum of 55 % of marks or its equivalent grade in the UGC 7 point scale (or an equivalent grade / CGPA in a point scale wherever the grading system is followed) in the Course work in order to be eligible to continue in the programme and submit the Dissertation / Thesis (clause 6.8).
7. Evaluation and Assessment: The overall minimum credit requirement, including credit for the Course work, for the award of M.Phil. Degree shall not be less than 24 credits (clause 8.1).
8. Upon satisfactory completion of course work, and obtaining the required marks/grade prescribed in the clause 6.8, the M. Phil Scholar shall be required to undertake research work and produce a draft dissertation/thesis within the stipulated time for M. Phil. (Clause 8.2).
9. M.Phil. Scholars shall present at least one (1) research paper in a conference / seminar before the submission of the dissertation/thesis for adjudication, and produce evidence for the same in the form of presentation certificate/reprints (clause 8.4).
10. The M.Phil. Dissertation submitted by a scholar shall be evaluated by his/her Research Supervisor and at least one external examiner who are not in the employment of the same University/College. The panel of the examiners shall consist of four Experts suggested by the research supervisor of which one shall be nominated by the Vice-Chancellor to evaluate dissertation. The Viva-voce examination, based among other things, on the critiques given in the evaluation report, shall be conducted by both of them together, and shall be open to be attended by members of the RAC, all faculty members of the Department, other research scholars and other interested experts/researchers (clause 8.7).
11. Following the successful completion of the evaluation process and before the announcement of the award of the M.Phil. Degree, the University shall submit and electronic copy of the M.Phil Dissertation to the INFLIBNET, for hosting the same so as to make it (clause 10.1).

M. Phil Programme in Microbiology : Structure & Evaluation System

The **M. Phil Programme in Microbiology** being run in the Department of Biosciences, Saurashtra University, Rajkot, will be having the following structure, Teaching and Examination Scheme.

M. Phil. Programme in Microbiology

Duration : Minimum of 2 Semesters and maximum 4 Semesters

Components of the Programme: (a) M. Phil. Course Work and (b) M. Phil. Dissertation

- (a) **M. Phil. Course work** : Coursework completion certificate will be issued by the University (PGTR) mentioning Marks secured in each course, Total Marks secured, % of marks, Grade and Credit obtained, month and year, and other details.
- (b) **M. Phil. Dissertation** : M.Phil Notification and Certificate will be issued by the University after successful Viva-Voce, containing details.

Details of M. Phil. Course work:

Courses : 2 (one Core and one Elective) in First Semester.

Credit	: Each Course will be of 4 credits in 4 h/week/Sem.	08 Credits
	: Dissertation: 20 hours/week/Sem. For 2 Sems.	20 Credits

Total 28 Credits

Marks	: Each course 100 marks (70 theory + 30 Internal)	200 Marks
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Total 200 Marks

Evaluation and Examination Scheme:

1. The Evaluation (through RAC of the Department) and Degree award notification will be done by the University (PGTR) as it is done in the case of Ph.D. Award.
2. The Semester-end evaluation of each course will be based on the evaluation on assignments and/or seminar/presentations made by the M.Phil. Scholar before the RAC of the Department. The RAC of the Department will finalize the Grades of the candidate by a combined assessment as mentioned above and the final grades shall be communicated to the University (PGTR) by the RAC of the Department (clause 6.7).
3. **A completion certificate of the M. Phil. Course Work** will be issued by the University (PGTR) at the end of the first semester (200 marks, 18 Credits (Clause 6.5 and 6.8). The passing mark is 55% (clause 6.8) without which the Dissertation cannot be submitted.
4. M. Phil. Dissertation will commence in the beginning of the year but will be evaluated by External and Internal examiners in a Viva-Voce (clause 8.7) and grade points (20 for Dissertation and 28 for the entire M. Phil Programme) will be given in the M.Phil. Award Notification.
5. No Marksheet will be issued for Dissertation as the viva-voce examination contains no marks, But regular **M. Phil. Award Notification** (as issued for Ph.D. Award Notification) will be issued by the University (PGTR) after successful Viva-Voce examination (Like Ph.D. Notification) of the M.Phil. Dissertation.
6. The **M. Phil Degree Award Notification** will contain (a) M.Phil. Coursework marks and grade with month and year of passing, (b) Year of M. Phil Awarded, Total M.Phil. Credit earned (28), Title of the Dissertation, Month, date and year of M.Phil. Degree Awarded.

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**M. Phil. Programme
in
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M.Phil. Programme Structure

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**CHOICE BASED CREDIT SYSTEM (CBCS)
(Total 28 Credits)**

Subject Code	Title of the Course	Course Credits	No. of Hrs. Per Week	Mode of Semester-end Evaluation	Total Marks
SEMESTER – I					
Micro. 101	Course-1. Research Methodology (Core)	04	04	Evaluation by the RAC of the Department based on assignments and/or seminar/presentations	100
	Course – 2 (Elective) – any One				
Micro -102	Extremophiles and Metagenomics	04	04	Evaluation by the RAC of the Department based on assignments and/or seminar/presentations	100
Micro -103	Biodegradation of Xenobiotic Compounds	04	04		
Micro -104	Food & Dairy Microbiology	04	04		
Micro -201	DISSERTATION	10	20	--	--
	Semester Total Marks	18	28	Coursework completion certificate will be issued by PGTR	200
SEMESTER – II					
Micro - 201	DISSERTATION	10	20	Evaluation by External and Internal examiners in a Viva-Voce. M.Phil. completion Notification and Certificate will be issued by PGTR	NIL
	Grand Total	28	48	60	200

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M.Phil. Course Work Syllabus

SEMESTER – I

Course – 1 : RESEARCH METHODOLOGY
(CORE COURSE)

Micro.-101: Research Methodology (Core)

Unit – 1. Research Design, Methodologies, Research Ethics

- 1.1 Basic Research Designing, Setting up Objectives of the Study and Hypotheses to be tested.
- 1.2 Setting up Experimental Design and Experimental Protocol
- 1.3 Setting up detailed methodologies, sampling methods, Strategies for execution of the protocols
- 1.4 Designing protocol for statistical validation. Research Ethics

Unit – 2. Scientific Documentation & Report Writing

- 2.1 Scientific literature collection: Types of research literature, Sources.
- 2.2 Documentation of collected literature, Reference Index, Database generation.
- 2.3 Basics of Bibliographic Citations, Different Bibliographic styles, Review of literature
- 2.4 Scientific Report Writing, Various aspects, Thesis, Report and Paper writing.

Unit – 3. Quantitative Methods in Biology: Biostatistics

- 3.1 Significance tests: Student's 't' test: Hypotheses, acceptance and rejections, significance levels.
- 3.2 Analysis of Variance: General principles, completely randomized and random-block design ANOVA.
- 3.3 Regression and correlation – bivariate analysis.
- 3.4 Non-Parametric tests, Chi-Square and its applications.

Unit – 4. Computer Applications in research

- 4.1 Data Analysis, Data sorting and validation of data.
- 4.2 Use of different software packages for data analyses. Statistical analyses using software
- 4.3 Expression of data, Tables and Graphics
- 4.4 PowerPoint Presentations

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 microbes DGGE, 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 archaea 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-extremophiles

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 C₁ 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, Methylophiles):

- 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