

MOTHER TERESA WOMEN'S UNIVERSITY
KODAIKANAL - 624 102
Tamil Nadu.

SYLLABUS FOR
M.Phil Microbiology



From 2018 – 2019 Onwards



MOTHER TERESA WOMEN'S
UNIVERSITY
KODAIKANAL

MOTHER TERESA WOMEN'S UNIVERSITY, KODAIKANAL
DEGREE OF MASTER OF PHILOSOPHY (M.Phil) MICROBIOLOGY

Choice Based Credit System

(Effective from the Academic Year 2018-2019)

M.Phil. Microbiology Examination

Mother Teresa Women's University, Kodaikanal

ALLOCATION OF PAPERS AND CREDITS (SEMESTER-WISE) FOR M.Phil

MICROBIOLOGY PROGRAMME AS PER THE TANSICHE RULES 2018-19

ONWARDS

M.Phil Microbiology Course Structure under Choice Based Credit System (CBCS)

P.No	Course code	Name of the course	Hours	Credits	Marks		
					IA	UE	Total
Semester -I							
1	AMBT11	Core I(Theory)- Research Methodology	6	4	40	60	100
2	AMBT12	Core II (Theory)- Advance in Microbiology	6	4	40	60	100
3	AMBT13	Core III (Theory)- Professional Skills	6	4	40	60	100
		Total	18	12			300
Semester -II							
4	AMBT24	Core IV (Theory)-Area Paper	6	4	40	60	100
5	AMBP21	Dissertation and Evaluation Viva-voce	6	14(12+2)	-	-	200
		Total	12	18			300
Total			30	30			600

Internal Assessment for course I & II

1. Test - 15 marks (Average of best 2 out of 3, converted to 10 points)
2. Seminar - 10
3. Attendance - 2.5
4. Assignment - 2.5
5. Model exam - 10

SEMESTER I

CORE I (THEORY)-RESEARCH METHODOLOGY-AMBT11

Credits :4

Hours :6

Objectives

- To develop understanding of the basic instruments for biological research & various research designs and techniques.
- To identify various sources of information for literature review and data collection.
- To develop an understanding of an overview to the fields of bioinformatics.
- To acquire knowledge in the application of research theory and methods, and develop skills required in writing research proposals, reports, and dissertation

Unit I

Meaning and importance, review of literature-survey/Net/Data collection-questionnaire and synopsis presentation. Research designs- experimental and non-experimental. Guidelines for preparing an article and research report. Search engines, citation index, online submission of papers. Computers in biological research. MS-Word, MS-Excel, Power point. Thesis writing, proof corrections, Reference style: Havard & Vancouver; biosafety, ethics of research and IPR. Project proposals and fund generations.

Unit II

pH meter, polarography, UV, Visible, Fluorescent, Atomic Absorption, NMR & Mass spectroscopy including ESI MS and MALDI-TOF MS and Applications, XRD. Measurement of Radioactivity: GM-Counter and Scintillation counter. Thin layer chromatography, Column Chromatography, GLC, HPLC, HPTLC, Ion exchange chromatography, GC-MS, Gel filtration, Adsorption and Affinity, Electrophoretic

techniques, SDS PAGE, PFGE, Immuno-electrophoresis, Counter immuno-electrophoresis, Agarose Gel Electrophoresis.

Unit III

Isolation and quantification of genomic DNA, Plasmid DNA & total soluble Proteins. Blotting & Hybridization. Polymerase Chain Reaction-Principles, types and applications, PCR based DNA finger printing, VNTR finger printing, RAPD & RFLP analysis. Restriction mapping. Cloning strategies, DNA sequencing- Manual and automated methods. Metagenomics.

Unit IV

Fermentors - design, types, sterilization of fermentors, production of primary and secondary metabolites with examples- Instrumentation for monitoring bioreactor and fermentation processes. Strain improvement of industrially important organisms. Development and application of immobilized cells with examples. Upstream & downstream processes. Optimization of growth condition.

Unit V

Collection, classification, sampling techniques, analysis, presentation of data-measures of central tendency-mean, median & mode, correlation coefficient, standard deviation, F-test, student 't' & Chi square test. Analysis of Variance (ANOVA) & SPSS package and its uses. Internet basics-World Wide Web (WWW), gene bank sequence data bases – NCBI, EMBL, DDBJ – protein sequence databases – PIR, SWISS PROT-retrieving database entries, sequence alignment and database searching - FASTA, BLAST, Phylogenetic analysis. Secondary and 3D structure. Prediction using DNA and Protein sequences. Data processing and publishing.

Reference

1. Bajpai S (Ed.). 2006. Biological Instrumentation and Methodology. Chand & Company Ltd., New Delhi.
2. John G. Webster (2004) Bioinstrumentation. Student Edition, John Wiley and Sons Ltd.,
2. Keith Wilson and Jon Walker. 2003. Practical Biochemistry Principles and Techniques, 5th Edition, Cambridge University Press.

3. N. Gurumani .2006. Research Methodology for Biological Sciences. 1st edition, MJP Publishers. A unit of Tamilnadu Book house, Chennai.
4. Marcello Pagano Kimberlee Gauvreau, Brooks Cole. 2000. Principles of Biostatistics (2nd Edition).
5. Bernard Rosner.1999. Fundamentals of Biostatistics. Duxbury Press.
6. David W. Mount .2001. Bioinformatics, Sequence and Genome Analysis,Cold spring Harbor Laboratory Press.
7. A.D. Baxevanis and B.F. Francis Ouellette (Eds.) .2001. Bioinformatics – A Practical Guide to the Analysis of Genes and Proteins . Wiley-Interscience.
8. B.R. Glick and J.J.Pasternack .1998. Molecular Biotechnology, Second Edition, ASM Press Washington, DC

CORE II (THEORY) - ADVANCE IN MICROBIOLOGY-AMBT12

Credits :4

Hours :6

Objectives

- To introduce basic principles and application relevance of clinical disease for students
- To understand the principles of the laboratory tests in diagnosis and identification of pathogenic microorganisms
- To learn the basic principles of environment microbiology and be able to apply these principles to understanding and solving problems in water quality and bioremediation.
- To become familiar with current research in microbiology.

Unit I

All types of microscopes including atomic force microscope, scanning tunneling microscope; cultivation & preservation methodology for microbes, development of DNA microarray for comparative and evolutionary genomics. Principles and applications of Flowcytometry, photo and video micrography & autoradiography.

Unit II

Ecological hierarchy – Ecological succession of microorganism – Homeostasis – Adaptive mechanism among microorganisms and factors affecting the growth of microorganisms- Exploration of bioactive compounds from extremophiles.

Unit III

Laboratory and hospital acquired infection, hospital waste management, MDR & XDR microbes. Automated diagnostic methods. Bio-weapons, recombinant vaccines. Environmental aspects of emerging diseases.

Unit IV

Microbes in nanotechnology, biopolymerase, biosurfactants, biofertilizers, biopesticides, bioremediation, bioaccumulation, bioluminescence, biofuel, biofilm biosensors - remote sensing microbiology- genetically modified microorganisms, microbial diversity analysis using PCR.

Unit V

Drug discovery & design including docking techniques, marine microbial antibiotics, microbial therapeutic enzymes, drug delivery, single cell proteins.

References

1. P. Asokan. 2001. Analytical Biochemistry (Biochemical Techniques), 1st Edition, 2nd Reprint, Published by CHINN Publications, Malvisharam, Vellore, Tamilnadu.
2. Bernard D. Davis, Renato Dulbecco, Herman N. Eisen, Harold S. Ginsberg, W. Barry wood, Jr. Maclyn McCarty. Microbiology, Second Edition, Harper International Edition.
3. Bernard R Glick. 2003. Molecular Biotechnology. Principles and Applications of Recombinant DNA. Third edition ASM Press. Washington DC.
4. P. Chakraborty.2003. A text book of Microbiology, 2nd Edition, Published by New Central Book Agency (P) Ltd. Kolkata.
5. E.M.T.E.L Mansi and C.F.A Bryle. 2002. Fermentation Microbiology & Biotechnology, Taylor & Francis Ltd, UK.
6. J.E Casida, JR .1995. Industrial Microbiology, New Age International Publishers.
7. E. Jawetz, J.L. Melnick, and E.A Adelberg. 1998. Review of Medical Microbiology. 19th Edition. Lange Medical Publications. ELBS. London.

8. M.M Young .2004. Comprehensive Biotechnology. The Principles, Applications and Regulations of Biotechnology in Industry, Agriculture and Medicine, Volume 1, 2, 3 & 4. Reed Elsevier India Private Ltd. India.
10. S.N Ognand. 2004. Gene Biotechnology. Himalaya Publishing house, Mumbai.
11. P. Prave, U. Faust, W. Sittig and D.A Sakatsch. 2004. Fundamentals of Biotechnology, Panima Publishing Corporation, India.
12. P.F Stanbury, A.Whitaker and S.J Hall. 1997. Principles of Fermentation Technology, Aditya Books Pvt. Ltd, India.

CORE III (THEORY)-PROFESSIONAL SKILLS-COMMON PAPER

Objectives:

After completing the course, the scholars will be able to

- Develop skills to ICT and apply them in teaching, learning contexts and research.
- Acquire the knowledge of communication skills with special reference to its elements, types, development and styles.
- Understand the terms: Communication technology, Computer Mediated Teaching and develop Multimedia/E-contents in their respective subjects.
- Develop different teaching skills for putting the content across to targeted audience.

Unit I - Computer Application Skills

Fundamentals of Computers and windows, Operating System – MS – Office Components; Word: Equation editor, Table Manipulation – Formatting Features – organizational Chart. MS – EXCEL: Statistical Functions – Number Manipulation – Chart Preparation with various types of graphs. MS PowerPoint: PowerPoint presentation with multimedia features. Internet and its applications: E-mail and attachments – working with search engines.

Unit II - Communication Skills (English/Tamil/Both)

English: Skills of Communication: Listening, Speaking, reading and Writing – Writing Synopsis, Abstract and proposals. Developing good language abilities – Public speaking – Writing Skills.

Tamil: பயிற்றுவிக்கும் திறன் - பேச்சுத்திறன் - வெளிப்பாட்டுத் திறன் - ஆய்வுத்திட்டம் - ஆய்வுச்சுருக்கம் தயாரித்தல்.

Unit III - Communication technology

Computer Mediated Teaching: Multimedia, E – Content, Satellite Based Communication – EDUSAT and ETV channels. Web: Internet I Education.

Unit IV - Pedagogical Skills

Micro teaching Skills: Skill of Induction, Skill of Stimulus Variation. Skill of Explaining, Skill of Probing Questions, Skill of Blackboard, Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills – Research Extension and Consultancy.

Unit V - Industrial Technology

Lecture Techniques: Steps, Planning of a lecture, Lecture Notes, Updating, Delivery of Lecture. Teaching – Learning Techniques: Team teaching, Group Discussion. Seminar, Workshops, Symposium and Panel Discussion – Games and Simulations – Web Based Instructions.

References

- Micael D. and William (2000). Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New York.
- Information and Communication Technology in Education: A Curriculum for Schools and Programme of Teacher development. Jonathan Anderson
- Pandey S.K.(2005). Teaching communication. Commonwealth publisher, Delhi
- Sharma. R.A.(2006), Fundamentals of education technology, Surya publication, Meerut
- Kum Babu A. and Dandapani S. (2006), Microteaching, Neelkamal Publications, Hyderabad
- Vanaja M and Rajasekhar S. (2006), Computer Education, Neelkamal Publications, Hyderabad

CORE IV(THEORY)- AREA PAPER AMBT24

BIOENERGY & BIOFUELS

Credits :4

Hours :6

Unit I – General Characteristics of Bacteria

Bacterial Systematics - Aim and principles of classification, systematics and taxonomy, concept of species, taxa, strain; conventional, molecular and recent approaches to polyphasic bacterial taxonomy, evolutionary chronometers, Bergey's Manual of classification. Cell organization - Cell size, shape and arrangement, glycocalyx, capsule, flagella, endoflagella, fimbriae and pili. Cell-wall - Composition and detailed structure of Gram-positive and Gram-negative cell walls. Application of Bacteria in Industry, Agricultural and Environmental.

Unit II – General Characteristics of Algae

Algae - History of phycology with emphasis on contributions of Indian scientists; General characteristics and Classification of algae including occurrence, thallus organization, algae cell ultrastructure, pigments, flagella, eyespot food reserves and vegetative, asexual and sexual reproduction – lifecycle : Haplobiontic, Haplontic, Diplontic, Diplobiontic and Diplohaplontic life cycles. Applications of algae in agriculture, industry, environment and food.

Unit III – General Characteristics of Fungi

Fungi - Historical developments in the field of Mycology including significant contributions of eminent mycologists. General characteristics and classification of fungi including habitat, distribution, nutritional requirements, fungal cell ultra- structure, thallus organization and aggregation, fungal wall structure and synthesis, asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexual mechanism. Economic importance of fungi with examples in agriculture, environment, Industry, medicine, food, biodeterioration and mycotoxins.

Unit IV – Production of Bioenergies

Production of biofuels and its application: Biogas production – Steps involved, factors affecting, substrates used, advantages. Biodiesel production – steps involved, factors affecting, and substrates used, applications. Bioethanol production - steps

involved, factors affecting, and substrates used, applications. Biohydrogen production - steps involved, factors affecting, and substrates used, applications.

Unit V – Pollution and Biosafety

Air, land, water pollution- effects of pollution - Control measures of air pollution through biofuels

Reference Books

- **Microalgae as a Feedstock for Biofuels** – Luisa Gouveia, Springer Science & Business Media, 2011.
- **Biofuels from algae** – Ashok Pandey, Duu – Jong Lee, Yusuf Chisti, Carlos R.Soccol, 2013
- **The Science of Algal Fuels** – Richard Gordon, Joseph Seckbach, 2013
- **CRC Handbook of Microalgal mass culture** – Amos Richard, 2013
- **Microalgae: Biotechnology & Microbiology** – E.W.Becker, 1996, Cambridge University Press.
- **Microbial Fuel Cells** – Bruce E.Logan, John Wiley & Sons, 2008

PAPER-IV INDUSTRIAL MICROBIOLOGY - AMBT24

Unit I

Introduction to bioprocess technology – Isolation, cultivation, preservation and improvement of industrially important organisms.

Unit II

Fermentation – Types, Fermentors – Basic unit, design, components, asepsis, containment requirement, body construction, temperature control, aeration, agitation and function, types. Sterilization of fermentors – aseptic inoculation method – sampling method – air & media supply, monitoring and control devices.

Unit III

Downstream processing – foam separation, precipitation methods, filter devices and filter aids. Industrial scale configuration – cell disruption methods. Chromatography – two face aqueous extraction – super critical fluid extraction – ultra filtration – drying devices – crystallization and whole broth processing.

Unit IV

Industrially important microbial products: Vitamins – Vitamin B₁₂; organic acids – citric acid; alcohol production – ethanol; amino acid – L-glutamate; Growth regulators – IAA; antibiotics – penicillin.

Unit V

Production of biofuels and its application: Biogas production – Steps involved, factors affecting, substrates used, advantages. Biodiesel production – steps involved, factors affecting, and substrates used, applications. Bioethanol production - steps involved, factors affecting, and substrates used, applications. Biohydrogen production - steps involved, factors affecting, and substrates used, applications.

Reference

1. Stanbury PF., Whittakar A., and Hall SJ. 1995. Principles of Fermentation Technology.

2. Casida L.E 1989. Industrial Microbiology.
3. Wulf Cruger, Biotechnology: A textbook of Industrial Microbiology.
4. McNeil and Harvey. 1990. Fermentation – A practical approach.
5. Arnold L. Dermain and Nadine A .Solomon. 1986. Industrial Microbiology and Biotechnology.

PAPER IV - AMBT24
AGRICULTURAL & ENVIRONMENTAL MICROBIOLOGY

Unit I

Ecology and Microbial Diversity: Various environments and its components – Extreme environments – Microbial communities and its interaction – Interaction between microbes and environment – commensalism, parasitism, mutualism, colonization, succession – Interaction of microbes with plants – Rhizosphere, Phyllosphere – Interaction of microbes with animals – rumen microbiology.

Unit II

Environmental Microbiology: Biogeochemical cycle – Carbon, Nitrogen, Phosphorus, Sulfur and other cycles – Microbes in fresh water and marine water.

Unit III

Biotransformation and Biodegradation: Evolutionary role of microorganisms in biosphere. Biodegradation, Bioremediation of xenobiotic components, Principles of measuring Biodegradability – Design and implementation of Biodegradation assays – management of organic contaminants in field site – verification of Bioremediation in the field site. Biopolymer and its application.

Unit IV

Soil Microbiology: Significant development in Soil microbiology – Soil microorganisms – methods used in soil microbiological studies. Isolation of bacteria (*Rhizobium*, *Azotobacter*, *Azospirillum*) - Fungi (VAM) – Algae (Cyanobacteria, Nostoc, Oscillatoria) – Actinomycetes (Frankia).

Unit V

Biofertilizers and Biocontrol agents: *Rhizobium* and legume root nodulation – free living N₂ fixing bacteria (*Azotobacter* and *Azospirillum*) – Nitrogen fixation (Blue green algae) – Phosphorous solubilizing bacteria – Phosphorus mobilization. Biofertilizer production, Mass cultivation, Quality Control Analysis – Packaging.

Reference:

1. Ronald M. Atlas & Richard Bartha. 1991. Microbial Ecology, Fundamentals and application.
2. Thomas D. Brock and M.T Madigan. 1991. Biology of Microorganisms.

3. Alexander 1977. Introduction to soil microorganisms and plant growth.
4. N.S. Subba Rao – Soil Microorganisms and Plant growth.
5. N.S. Subba Rao – Biofertilizers.
6. Dasgupta R.S – Plant Pathology.
7. George N. Agrios – Plant diseases.

PAPER IV- AMBT24
CLINICAL MICROBIOLOGY

Unit I

Microbes and their host interaction – normal flora of human – host pathogen interactions – viral, bacterial, fungal and parasites – protozoans & nematodes. Various associations – pathogenic, opportunistic, symbiotic, commensalism, mutualism etc.

Unit II

Virulence factors, pathogenicity & toxigenicity

Virulence factors – various types with reference to viral, bacterial, fungal, protozoans & nematode pathogens. Toxins – types – mode of action. Epidemiology and control measures. Community infection and nosocomial infection.

Unit III

Bacterial, Fungal, Viral and Protozoan diseases – Pathogenesis, Laboratory Diagnosis, Epidemiology and Control of Bacterial diseases. Bacteriology – Morphology, Pathogenesis and laboratory diagnosis of *Staphylococcus*, *Bacillus anthrax*, *Cornebacterium*, *Clostridium*, *Streptococci*, *Mycobacterium*, *E. Coli*, *Salmonella*, *Shigella*, *Pseudomonas* and *Vibrio cholera*. Parasitology – *Ascaris*, *Giardia*, *Plasmodium*, *Taenia solium*, *E.histolytica*. Zoonotic disease – Rabies, Filariasis. Fungal disease – Candidiasis, Aspergilloosis, Superficial Mycoses. Viral disease – Hepatitis, Influenza, Pox, HIV, Polio.

Unit IV

Diagnosis, treatment and prevention of diseases

Diagnosis – micro, macro, biochemical, serological & molecular. Treatment – chemical, chemotherapy and alternative therapy – Siddha, Ayurvedha, Unnani and Naturopathy. Prevention – Natural & artificial vaccine, Active & Passive

Unit V

Chemotherapy – Antimicrobics – Antibacterial, Antifungal, Antiviral –m Drugs and Mode of action – Selection – Kirby Bauer Test, MIC – Drug resistance

Reference:

1. David Greenwood, Richard CD, Slack, John Forrest Peutherer, (1992) Medical Microbiology.
2. Charttejee K.D. 1980. Parasitology & Helminthology
3. Jawetz and Melnich. 1986. Review of medical microbiology
4. Chaechter M. Medof G. Eisenstein BC (1993). Mechanism of Microbial diseases.
5. Joans Stokes E, Ridgway GL and Wren MWD (1993). Clinical Microbiology
6. Principles of Bacteriology, Virology and Immunity – Topley & Wilsons (1990)

DISSERTATION AND EVALUATION VIVA-VOCE – AMBP21

