

PhD Course Work syllabus
2021-22



DEPARTMENT OF MICROBIOLOGY

TRIPURA UNIVERSITY (A Central University)

SURYAMANINAGAR, AGARTALA – 799 022

TRIPURA, INDIA

DATE OF SYLLABUS REVISION

26th September 2016

16th April 2018

31st July 2021

Program specific Outcomes

- The programme will enable the student to
- Train as an independent as well as a team worker with adequate knowledge in the field of microbiology.
- Groom as an independent researcher with critical writing and reading skills.
- Train as a productive manpower for industry as well as academics.

Paper I: Research Methodology I

Research Methodology is common for all enrolled Scholars (Written Examination)

PaperII: Research Methodology II

Course Outcomes:

- Student will be able to carry out an extensive Literature search relevant to students' area of interest. This readies the student to design and rationalize the Objectives for the PhD proposal.
- Student will enhance the critical and analytical abilities in student's area of research by reading and analyzing already published research work in the field.
- Student will improve critical scientific writing skills
- Unit III and IV being elective give student a flexibility to learn about his/her area of research interest directly from particular research investigator in the department. It further establishes the PI-Student rapport allowing a long term ease to work and learn for a student.

SECTION: A (Evaluating Report and Assignment)

Unit 1: Literature review of the proposed area of work. (Report to be submitted at the end of the coursework).

Unit 2: Writing a critic on 5 selected papers emphasizing how these are relevant to their proposal. (Report to be submitted at the end of the coursework)

SECTION: B (Written examination)

UNIT3: (written examination)

UNIT 4: (written examination)

For unit 3 and unit 4 students have to select any two unit from the following eight units:

(A) Microbial Technology

Selective isolation of microbes from environment: selection of medium and growth condition. Characterization of isolates: conventional and in-silico techniques, Tailor-made consortium development for biotechnology

(B) Microbial Bioreactors

Bioreactor used in biotechnology: suspended growth reactors; continuous- Flow stirred Tank Reactor; membrane reactor; rotating drum reactors; packed bed biofilm reactors; moving bed biofilm reactors, trickling filters.

(C) Microbial productions of therapeutic compounds

Microbial production of therapeutic compounds (β lactam, aminoglycosides, Annamycin's, Rifamycin, peptide antibiotics, Quinolones), biotransformation of steroids, vitamin B12 and riboflavin fermentation

(D) Modern trends in microbial production

Modern trends in microbial production of bioplastics (PHB, PHA), bioinsecticides, biopolymer (dextran, alginate, xanthan, pullulan), Biofertilizers (nitrogen fixer Azotobacter, Phosphate solubilizing microorganisms), Single Cell Protein and production of biological weapons with reference to anthrax.

(E) Basic Bioinformatics:

Database indexing and specification of search terms, the archives: nucleic acid sequence database, genome database and genomic browsers, protein sequence database, databases of structures, Submission and retrieval of Data in GenBank, Pairwise and multiple sequence analysis. Database searching using BLAST

(F) Structure-based drug discovery and ligand screening

Protein stability and folding, Sasisekharan-Ramakrishnan-Ramchandran plot, protein structure prediction and modelling, prediction of protein function, structure-based drug discovery, Molecular Docking, Virtual Screening, refinement and filtering techniques, Lipinski's Rule of Five, ADMET Property Analysis, molecular dynamics simulations, Structure-function Relationship Paradigm, Receptor-ligand Interaction Studies

(G) Staying together:

Bacterial societies Properties of Biofilms and Chronic Infections: Bacteria and Biofilms; Biofilm properties (Extracellular Matrix, nutrients, Oxygen, pH, Antibiotic tolerance and persistence); Medicalbiofilms and host interactions; Diagnosis of chronic biofilm-associated infections; Treatment of chronic biofilm-associated infections; Evolution of biofilms; Models of biofilms: in vitro, ex vivo and animal models Elective

(H) Communities of Priority pathogens: ESAKAPE

Molecular mechanisms of biofilms of ESAKAPE bacteria: *Enterococcus faecium* ; *S. epidermidis* and *S. aureus* (MRSA and MSSA); *P. aeruginosa*; *Enterobacter* sp.: with special emphasis on *E. coli*; *K. pneumoniae*; *Acinetobacter baumannii*

Paper III: Advance Area of Research

Course Outcomes:

- Student will learn about the recent trends in microbiology.
- Student will learn about microbial behavior in different ecological niche.
- Student will get versed with difficult to culture microbes and their importance in microbiology research.
- Student will get acquainted with adaptation methods in microbes.
- Student will learn about the importance of microbes in the treating waste water and different waste water treatment settings.

Unit1: Microbial Ecology

Introduction to microbial ecology an overview (motivation, history and applications); Ecology of macro- and microorganisms (definitions, terminology and concepts); Interactions with the biotic environment (symbiosis, competition, parasitism, predation); Microbes as an Individuals and in populations (growth, distribution, activity); Interactions within microbial communities (Biofilms, quorum sensing, antibiotics etc.); Microbial functions in ecosystems and global cycles.

Unit 2: Metagenomics and Protein Purification

Non-culturable bacteria, new approaches for exploring non-culturable bacteria from environmental samples, culture independent molecular methods, Methods of enzyme purification and characterization using available biophysical and biochemical methods.

Unit3: Microbial Stress adaptations

Two component systems; Osmotic stress and osmoregulation, aerobic-anaerobic shifts, FNR regulon, Nitrate response, ArcAB system, phosphate supply- Pho regulon; response to nutritional stress, Growth regulation by microbes, Toxin-Antitoxin systems

Unit 4: Microbial Bioreactors for Waste Water Treatment

Water Chemistry and Microbiology; Water and Waste Water treatment; Advanced Microbial Treatment Techniques, Regulations for discharge of water.

Paper IV: Presentation of Ph. D. work plan

Course Outcomes:

- Student will be able enhance his/her presentation skills.
- Student will be ready for presenting and discussing the research work at conferences and seminars.

The Ph.D. synopsis and related research work done by the scholar in the duration of the course work. a report would be submitted with a presentation given in front of the respective RAC.