



Program: Ph.D. in Microbiology
Course: Course work

**DEPARTMENT OF STUDIES IN MICROBIOLOGY
MANASAGANGOTRI
MYSURU – 570 006
2020 -21**

Paper1: Advanced Research Methodology

Ph.D. outcomes:

At the end of their PhD course, Research Scholars should:

- Be able to get into research and teaching lines in various institutions and universities.
- Have a thorough knowledge of the literature and a comprehensive understanding of scientific methods and techniques applicable to research;
- Be able to demonstrate originality in the application of knowledge, together with a practical understanding of how research and enquiry are used to create and interpret knowledge in their field;
- Have developed the ability to critically evaluate current research, techniques and methodologies;
- Have self-direction and originality in tackling and solving problems;
- Be able to act autonomously in the planning and implementation of research; and have gained oral presentation and scientific writing.
- Students get an adequate knowledge on patent and copyright for their innovative research works.
- During their research career, information in patent documents provide useful insight on novelty of their idea from state of the art search. This provides further way for innovations

PhD Pedagogy:

The structure of the PhD course is designed to produce graduates with rigorous research and analytical skills, who are exceptionally well-equipped to go onto Postdoctoral research, or employment in industry, teaching and public service. While pursuing course work research student will study about various analytical, molecular, bioinformatic and statistical, which can be applied in the research field. They will be trained about scientific writing and development of research projects. They will be assigned with seminars and assignments which help them to improve their presentation and writing skill.

The PhD course provides:

- A period of sustained in-depth study of a specific topic;
- An environment that encourages the student's originality and creativity in their research;
- Skills to enable the student to critically examine the background literature relevant to their specific research area;

The opportunity to develop skills in making and testing hypotheses, in developing new theories, and in planning and conducting experiments; developing practical research skills and learn new state of the art techniques used in biomedical research. The opportunity to expand the student's knowledge of their research area, including its theoretical foundations and the specific techniques used to study it; the opportunity to gain knowledge of the broader field of biomedical research.

- An environment in which to develop skills in written work, oral presentation and publishing the results of their research in high-profile scientific journals, through constructive feedback of written work and oral presentations.

Paper1: Advanced Research Methodology

Unit:1

Microbiology: Good laboratory practices. Safety measures: Laminar airflow. Fume hood. Biosafety cabinets level I –IV, containment and clean labs. Isolation, Identification and preservation of microorganism, safe disposal of Microorganisms. Microscopy. Scanning and transmission microscopes, Inverted microscope, confocal microscopy, image processing methods in microscopy. Antimicrobial, Antioxidant Immunomodulatory, Anti diabetic assays. **Biocontrol:** identification, isolation, characterization. Strain improvement. delivery methods, package and practices.

Unit: 2

Biomolecules and Analytical Methods: isolation, purification and characterization of biomolecules, gel filtration, adsorption chromatography, ion exchange chromatography, affinity chromatography. GLC, HPLC. Electrophoretic techniques, two dimensional gel electrophoresis. UV/ visible spectrophotometry, fluorescence spectrophotometry, NMR spectroscopy, X-ray diffraction, mass spectrometry. Centrifugation. ELISA, immunoprecipitation and immunofluorescence. FISH, flow cytometry. MALDI-TOF, MS, 2D electrophoresis, ICP-MS, Biosensors, surface plasma resonance.

Unit: 3

Molecular Methods: Properties of cloning and expression vectors (plasmid, phage) cloning and expression of DNA in bacteria and fungi, methods for analysis of gene expression at RNA. QRT PCR blotting techniques. PCR techniques RFLP, RAPD and AFLP techniques and their applications genome sequencing micro array techniques.

Unit: 4

Bioinformatics and Statistical Methods: Use of database NCBI, EMBL, DDBJ, protein structural data bank sequence analysis of proteins and nucleic acids, structure prediction molecular modelling data mining methods, primer designing, web-based tools for sequence searches, BLAST and FASTA Population and sampling, Measures of central tendency and dispersion, Binomial, Poisson and Normal distribution, confidence interval: Errors: Annova (one and two way) Hypothesis testing Z score, “t” test, ‘F’ test. Chi-square test, regression analysis correlation: LSD, multiple range test data transformation, experimental designs.

Unit: 5

Scientific Writing and development of Research projects: Scientific document maintenance of laboratory data book. Organization and writing of a research paper, short communications, review articles, monographs, technical and survey reports authored books and edited books, dissertation and PhD Thesis, Preparing and delivering of oral and poster presentations, avoiding plagiarism, impact factor and citation index.

Funding agencies: National and international funding agencies for R & D projects. Preparation of R & D projects for funding: Organization of research project, identification of gap areas in the subject aims and objectives of the projects, possible outcome of the project, funds requirement and justifications. Biosafety and ethical issues. Bioethics, animal ethics and institutional ethical committee.

Introduction to IPR: Kinds of IPR: Patents, copyright, design, trademark, geographical indicators, industrial design and trade secrets. Patent Office and appellate board. India’s new National IP policy- Govt. of India steps to promote IPR, career opportunities in IP.