

**Ph.D. PRELIMINARY QUALIFYING EXAMINATION**  
**Syllabus for Paper I Research Methodology (Microbiology)**

1. Fundamental procedures used in a Microbiology Laboratory; Instrumentation, Colorimetry, Visible – UV spectrometry; Separation techniques – Chromatography; TLC, Paper, Gas, Column, Ion exchange, HPLC, GC-MS, Affinity chromatography, Electrophoresis; PAGE, Agarose gel electrophoresis; Centrifugation – Principles, types, applications; Ultracentrifugation
2. Molecular tools and their applications – Restriction and Modification enzymes; Cloning vectors, DNA primers, Linkers, Adaptors and their chemical synthesis; Nucleic acid amplification methods – PCR; Types – Nested PCR, Real time PCR; RFLP; RAPD and AFLP analysis; Protein and Nucleic acid sequencing; Nucleic acid microarrays
3. Advanced diagnostic procedures in Microbiology – Culture confirmation techniques; Direct detection probes; Diagnostic sequencing; Molecular typing methods; Pulse Field Gel Electrophoresis; PCR based typing methods; Genotyping of bacteria by using VNTR. Agglutination and Precipitation – EIA, ELISA, Immunofluorescence, RIA, Chemiluminescence, Blotting techniques (Western, Southern, Northern), Flowcytometric assays. Automation in diagnostic microbiology.
4. Philosophy of science. Ethics and scientific conduct. Ethics inhuman and animal studies. Publications and Patents. Research methodology : Strategies, Planning and Analysis; Literature search and Personal Reference Databases. Research theory – inductive and deductive reasoning, Hypothetico-deductive reasoning. Research problem, Research design, Sampling design, Measurement and Scaling Techniques, Nature and Types of data, methods of data collection, Processing and analysis of data, Data presentation : Graphs, Tables, Histograms and Pi diagrams; Testing of hypotheses, Interpretation and scientific report writing.

References

1. Vasantha Pattabhi and N. Gautham - Biophysics – Kluwer Academic Publishers – 2002
2. Bengt Nolting – Methods in Modern Biophysics – 2<sup>nd</sup> edition Springer-Verlag Berlin Heidelberg – 2006
3. David Sheehan – Physical Biochemistry : Principles and Applications – 2<sup>nd</sup> edition – John Wiley & Sons Ltd. - 2009
4. Thomas Jue – Biomedical Applications of Biophysics – Vol. 3 – Humana Press – 2010
5. Rodney F. Boyer – Modern Experimental Biochemistry – 3<sup>rd</sup> Edition – 2000
6. Keith Wilson and John Walker – Principles and techniques of biochemistry and molecular biology – 7<sup>th</sup> Edition – Cambridge University Press – 2010

**Ph.D. PRELIMINARY QUALIFYING EXAMINATION**  
**Model Question Paper for Research Methodology (Microbiology)**

Time : Three hours

Maximum: 70 Marks

- I. Answer any one of the following (1x20=20 Marks)
1. Write an essay on chromatography techniques
  2. Processing and analysis of Data
- II. Write on any two of the following (2x10=20 Marks)
3. Pulse field gel electrophoresis
  4. Nucleic acid microarrays
  5. Theories of research
- III. Write notes on any five of the following (5x6=30 Marks)
6. ELISA
  7. Realtime PCR
  8. Blotting Techniques
  9. Design of experiments in science
  10. AFLP
  11. Immunofluorescence