

DEPARTMENT OF MICROBIOLOGY
Jawaharlal Nehru Medical College
AMU, Aligarh

Syllabus for Admission to Ph.D. Programme 2022-23 onwards
Section-B

Course Title: Doctor of Philosophy (Microbiology)

Course Code: Ph.D. MICROBhOLOGY

Course Objective: Plan, execute and evaluate teaching assignments in the fields of bacteriology, virology, parasitology, immunology and mycology and Plan, execute, analyses and present the research work in medical microbiology.

Course Outcomes:

- 1- Knowledge of basic research methodology so that they can conduct fundamental and applied research.
- 2- Demonstrate practical skills in the use of tools, technologies and methods common to microbiology, and apply the scientific method and hypothesis testing in the design and execution of experiments
- 3- Training in teaching methods in the subject which may enable them to take up teaching assignments in Institutes.

Course Contents:

Biostatistics

Biostatistics and its application in research and microbiology, mean, mode, median, student's t test, standard error, standard deviation, chi-square test, difference between parametric and non-parametric statistics, Data presentation, Measures of central tendency; Measure of disparity: Mean deviation, Coefficient of variation; Correlation and regression. Probability theory and distributions: Binomial, Poisson, and Normal distributions. Statistical inference- Hypothesis testing (t test, Z test, Chi square test), ANOVA for one way and two way classified data. Bioinformatics basics; Databases: Sequence databases, Structural databases (e.g. PDB, MMDB, FSSP, SCOP, BRENDA); Data mining tools; Data submission tools; Data analysis tools (BLAST & FASTA); Gene prediction tools; Tools for Phylogenetic prediction. Sequence Analysis, Structure alignment, Primer Designing, Mass Spectrometry based proteomics tools, Protein structure & functions prediction tools; Modeling: 2D and 3D protein modeling. System Biology approach to understand microbial enzyme machinery.

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Introduction to Scientific Research

Meaning of Scientific Research Purpose, Characteristics, Type of research; Motivation of research; Process of research: Identification of the problem, formulation of objectives, research plan and its components. Documentation and Scientific writing: Writing of Research proposal, Preparation of Research paper and Review articles, Thesis writing and Bibliography compilation.

Plagiarism: Anti-plagiarism tools like iThenticate, PlagScan etc

Intellectual Property Rights: Patentable subject matter and patent types, Deposit of microorganisms for the purposes of Patent; Biosafety issues, Ethical, legal and social issues in Scientific research.

General Microbiology

Historical introduction, morphology of bacteria, Prokaryotic and eukaryotic cells, Gram's stain, Gram-positive and Gram-negative bacteria, Koch's postulates, sterilization and disinfection, Hospital waste management, culture media, culture methods, antimicrobial susceptibility testing, drug resistance.

Microbiological Techniques

Basic techniques for isolation cultivation and enumeration of Microorganisms; Staining of microorganisms; Microscopy: bright field microscopy, dark field microscopy, fluorescence microscopy, phase contrast and electron (transmission and scanning) microscopy; Growth limitation and sterilization techniques.

Molecular Biology Techniques: PCR and its types, applications of PCR, Real Time PCR, RT-PCR. Gel electrophoresis: Agarose and PAGE, formaldehyde-agarose for RNA, Denaturing gels, native PAGE, SDS-PAGE, Southern, Northern and Western blotting. Library preparation: Genomic DNA, cDNA, EST and reduced representation libraries. DNA microarray, DNA sequencing techniques.

Biophysical techniques: Principle & application of gel filtration, Ion exchange & hydrophobic interaction chromatography, GC, HPLC, FPLC, Isoelectric-focussing (IEF), 2-D gels, Centrifugation and its types, Spectrophotometry, GC-MS, LCMS, NMR, MALDITOF, X-ray crystallography, Circular Dichroism.

Immunological techniques: ELISA, RIA, immunofluorescence, RAST, RIST, MLR, flow cytometry and fluorescence, FACS and immunoelectron microscopy; Hybridoma technology, monoclonal antibodies and enzymes; Antibody engineering. Centrifugation, electrophoresis. principle and application of immunological techniques (immunodiffusion, ELISA), principle and application of spectrophotometer, principle of PCR, different types of PCR. Hypersensitivity reaction, vaccination.