ADIKAVI SRI MAHARSHI VALMIKI UNIVERSITY
RAICHUR

Ph. D. Entrance Examination Syllabus

(2025-26)

(Approved in BoS on 29th Sep, 2025)

DEPATRTMENT OF MICROBIOLOGY
Krishna Tunga Campus, Yerigera, Raichur, 584 133

ADIKAVI SRI MAHARSHI VALMIKI UNIVERSITY RAICHUR

Syllabus for Entrance examination of Ph.D. degree

Note: The entrance examination is of 3 hours duration and consists of 80 marks. Out of 80 marks **60 marks are from the Chemistry core subject syllabus and 20 marks from the Research Methodology syllabus.** Out of 80, 40 marks questions are of multiple-choice type and 40 marks are essay type questions. 20 marks for interview (Viva-voce)

Research Methodology (4 Units)

Unit 1

Scientific Research: Essential steps in research; Objectives, motivation and significance of research, approaches to scientific research; scientific Hypothesis; basic and applied research; components of research; general laboratory organization; laboratory setup and equipment's; organized functional laboratory; laboratory note books-types, format and content; intellectual property rights; ethics of scientific research; plagiarism.

Unit 2

Information Retrieval: Literature survey through Libraries, Internet —PubMed, Medline, Science Direct, Inflibnet, Scirus etc.; Types of source materials — Reviews, Research Articles, Proceedings; Text Books; Reference Books etc.; review process and analysis of information and literature citation –in Text, in references, sequence system, number system, alphabetical and chronological Systems. Citation Index, Impact Factors, H-index. **Experimental Design and Scientific Data Presentation:** Design of experiments; units of measurements, variable in biology, collection, classification, and tabulations of research Data; preparation of Tables, Figures, Statistical Diagrams, Research report writing, preparation of scientific publication, presentation of research data; photography; legends.

Unit 3

Biostatistics: Mean, Median, Mode, Measure of dispersion, Range, Standard deviation, Mean Deviation, Standard errors, Confidence limits, Simple significance tests based on the normal distribution; Use of t-tests, Correlation of measurements, regression Analysis, ANOVA, Random Samples, Partial Correlation; Multiple Regression, LSD, Chi-square Test, Use of Statistical Packages-SPSS; Use of Calculators and Computer Programs for Statistical analysis.

Unit 4

Microbiological Techniques: Safety standards in microbiology laboratories; good laboratory practices, cleanliness of laboratories; principle and applications of different types of microscopes; sterilization, media preparation, microbial culturing and preservation techniques; isolation of microorganisms from different sources; automated microbial Identification Systems. **Biochemical Techniques:** Chromatography, Colorimeter, UV-Visible and IR Spectroscopy; Centrifugation techniques, Immunological Techniques-Production of Antibodies; in vitro antigen- antibody based techniques, Recombinant DNA Technology-Isolation of nucleic acids; restriction digestion; cloning and expression Vectros, gene cloning, PCR, RFLP, RAPD, DNA Finger printing, nucleic acid hybridization, Autoradiography, Protein engineering and analysis of recombinants.

Core subject (8 Units)

Unit 1

Microbial Diversity and Taxonomy: Identification, nomenclature and classification concepts; major characteristics used in taxonomy of microorganisms: morphological, physiological, genetical and molecular characteristics; numerical taxonomy and chemotaxonomy. **Acellular Microbiology:** Viruses: General characteristics, viral classification based on host, structure and nucleic Acids; modes of replication; Viroids and Prions: general description and significance. **Bacteriology:** General characteristics, structural, ultrastructural and chemical organization of bacterial cell, classification and reproduction. **Mycology:** General characteristics, structural, ultrastructural and chemical organization in unicellular and multicellular fungi; classification; methods of reproduction.

Unit 2

Environmental Microbiology: Role of microorganisms in environment, microorganisms in soil, water and air. Extremophiles. **Microbial Physiology:** Properties of water, buffers, carbohydrates, proteins, lipids and nucleic acids; Bioenergetics – laws of thermodynamics,

oxidative and substrate level phosphorylation; glycolysis, gluconeogenesis, glyoxalate Cycle, TCA, PPP, HMP, EDP, aerobic and anaerobic respiration; fermentation; photosynthesis in bacteria. Synthesis of purine, Pyrimidines, nucleotides and porphyrins; secondary metabolism in fungi and bacteria.

Unit 3

Microbial Genetics and Molecular Biology:

a. Principles of heredity, Mendelian laws of inheritance; genome organization in prokaryotes and eukaryotes, chromosomal and extra-chromosomal genes.
b. Structure and replication of DNA, denaturation and renaturation kinetics, types of DNA.
c. Structure and types of RNA, mechanisms of transcription and translation in prokaryotes and eukaryotes; genetic code; regulation of gene expression, post-translational modification of proteins; mutation and mutagenesis.
d. Genetic recombination in bacteria, fungi and viruses: transformation, transduction, conjugation, heterothallism, parasexuality, phage genetics.

Unit 4

Agricultural Microbiology and Phytopathology: Importance of microorganisms in agriculture, bacterial and fungal bioinoculants: commercial production and applications., Parasitism and pathogenicity in plant disease development; etiology, diagnosis, epidemiology and management of plant diseases.

Immunology and Medical Microbiology: Cells and organs of immune system, types of immunity, immunresponse, physicochemical properties of antigen and antibody; antibody based diagnostic methods; immunotherapies and vaccines. Pathogenesis, clinical conditions, laboratory diagnosis, epidemiology, chemotherapy and prevention of important viral, bacterial and fungal infections.

Microbial Biotechnology: Concepts, biotechnological applications of microorganisms in agriculture, industry and environment. Gene therapy, genetically modified microorganisms; microbial products of commercial importance; patenting, bioethics and IPR issues.

Unit 5

Historical Preview of Genetics, Development of microbial genetics, contributions of various scientists, early concepts of genes; discovery of the chemical basis of heredity - experimental evidences, use of microorganisms in genetic studies. Genomic structure and organization, Organization of genetic material – Genome organization in viruses, bacteria and eukaryotes. Interrupted genes, gene clusters. Structure of nucleosome, chromatin and chromosome. Genetic

recombination in bacteria, in viruses, Transposable elements, Regulation of transposition, Chromosomal rearrangements, Transposons and evolution.

Unit 6

Mutation and types. Mutagenic agents, Mutants – isolation, selections, screening and enrichments, Uses of mutants. Reversion and suppression. Genes and Proteins, Polymorphisms – types of polymorphism, commercializing the Genome - Revenue opportunities, Sequencing & genome projects: Early sequencing efforts. Methods of preparing genomic DNA for sequencing, DNA sequence analysis methods, Next generation sequencing. Genomics: Gene variation and Single Nucleotide Polymorphisms (SNPs), Expressed sequenced tags (ESTs), genotyping tools -DNA Chips, comparative genomics. Functional genomic studies with model systems.

Unit 7

Genome management in eukaryotes: Cell differentiation and gene regulation. Inheritance pattern in eukaryotes, Mutations, organization of eukaryotic genome within the nucleus, translation and post-translational modification in eukaryotes. Interference RNA, RNA silencing, SiRNA: Applications in Functional genomics, medicine and Gene Knockdown. Metagenomics- definition & concept. Functional genomics: C-Value and paradox of genomes, Repetitive and coding sequences, Genetic and physical maps, chromosome walking. Molecular markers –Microsatellites and telomerase as a molecular marker. Methods of molecular mapping, Marker assisted selection, T-DNA tagging, Transposon tagging. Bioinformatics analysis- clustering methods. Approaches to physical mapping, FISH – DNA amplification markers.

Unit 8

Proteomics: Introduction to proteins, Methods of protein isolation, purification, quantification, large scale preparation of proteins, use of peptides in biology, Proteomics databases and proteins as drugs. Proteome analysis Mass-spec based analysis of protein expression and post-translational modifications. "Protein Chip" interactions and detection techniques. Methods of measurement of mRNA expression, DNA array hybridization non-DNA array hybridization, two-dimensional PAGE for proteome analysis, Applications of proteome analysis to drug development and toxicology. Crisper-cas