ಆದಿಕವಿ ಶ್ರೀ ಮಹರ್ಷಿ ವಾಲ್ಮೀಕಿ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ, ರಾಯಚೂರು
ADIKAVI SRI MAHARSHI VALMIKI UNIVERSITY, RAICHUR
Krishna Tunga Campus, Mantralay Road (N.H. 167), Yergera-584133, Raichur, Karnataka

DEPARTMENT OF MICROBIOLOGY

DOCTOR OF PHILOSOPHY (Ph. D.) COURSE WORK SYLLABUS
(Effective from the academic year 2025-26 and onwards)

Subject / Paper Code	Title of the Paper	Teaching Hours / week	Semester End Exam Marks	IA	Credits
Ph. D. Paper-1	Research Methodology	04	80	20	04
Ph. D. Paper-2	Coagnant Subject – General Microbiology	04	80	20	04
Ph. D. Paper-3	Research Specialization – Genetics and Genomics	03	80	20	03
Ph. D. Paper-4	Research and Publication Ethics	02	40	10	02

Ph. D. Paper-1 - Research Methodology		
Course Code :		Credit :4
Total Contact Hours : 60 T	Internal Assessment: 20 M	Examination: 80 M
UNIT-I		
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.		**15 hours**
UNIT-II		
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.		**15 hours**
UNIT-III		
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		**15 hours**
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,		

Ph. D. Paper-2 - MICROBIOLOGY		
Course Code :		Credit :4
Total Contact Hours : 60 T	Internal Assessment: 20 M	Examination: 80 M
UNIT-I		
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.		**15 hours**
UNIT-II		
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.		**15 hours**
UNIT-III		
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. e. Genomics and proteomics: Microbial genome mapping and protein analysis; Bioinformatics – protein and nucleic data bases, construction of phylogenetic trees.		**15 hours**
UNIT-IV		
Agricultural Microbiology and Phytopathology: a. Importance of microorganisms in agriculture, bacterial and fungal bioinoculants: commercial production and applications.		**15 hours**

nucleic acid hybridization, Autoradiography, Protein engineering and analysis of recombinants.	

REFERENCES

1. Handbook of Mixed Methods in Social & Behavioral Research - Abbas Tashakkori and Charles Teddlie, Sage Publications, 2010 (2nd Edition)
2. Qualitative Research Methods for the Social Sciences - Bruce L. Berg and Howard Lune, Pearson, 2017 (9th Edition)
3. Research and Applications: Design and Methods - Robert K. Yin, Publisher: Sage Publications, 2018 (6th Edition)
4. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches - John W. Creswell and J. David Creswell, Sage Publications, 2017 (5th Edition)
5. Statistics for Research: With a Guide to SPSS - George Argyrous, Publisher: Sage Publications, 2018 (3rd Edition)
6. The Craft of Research - Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams, University of Chicago Press, 2016 (4th Edition)

b. Parasitism and pathogenicity in plant disease development; etiology, diagnosis, epidemiology and management of plant diseases. **Immunology and Medical Microbiology:** a. Cells and organs of immune system, types of immunity, immunresponse, physicochemical properties of antigen and antibody; antibody based diagnostic methods; immunotherapies and vaccines. b. 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.	

REFERENCES

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and Walter, P. (2007). *Molecular Biology of the Cell* (5th ed.). W.W. Norton and Company.1446 pp.
2. De Robertis, E. D. P., and De Robertis, E. M. F. (1987). *Cell and Molecular Biology* (8th ed.). Lea and Febiger.576 pp.
3. Gottschalk. G. (1985). Bacterial metabolism. 2nd Ed. Springer, New York, United States of America.376 pp.
4. Karp, G. (2020). *Cell and Molecular Biology: Concepts and Experiments* (8th ed.). John Wiley and Sons.944 pp.
5. Lodish, H., Berk, A., Kaiser, C. A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A., and Scott, M. P. (2020). *Molecular Cell Biology* (9th ed.). W.H. Freeman.1184 pp.
6. Lundblad, R. L. and Macdonald, F. (Eds.). (2018). Handbook of Biochemistry and Molecular Biology 5 th Ed. CRC Press, Boca Raton, United States of America.1001 pp.
7. Moat, A. G., Foster, J. W., and Spector, M. P. (2002). *Microbial Physiology* (4th ed.). Wiley-Liss.736 pp.
8. Nelson, D. L., and Cox, M. M. (2024). *Lehninger Principles of Biochemistry* (8th ed.). W.H. Freeman 1096 pp.
9. Stryer, L. (2022). *Biochemistry* (9th ed.). Macmillan Higher Education. 560 pp.
10. Voet, D., Voet, J. G. and Pratt, C. W. (2016). Fundamentals of biochemistry. 5 th Ed. ISBN: 978- 1-118- 91840-1. John Wiley and Sons, Germany. 1264 pp

Ph. D. Paper-3 - GENETICS AND GENOMICS		
Course Code :		Credit :3
Total Contact Hours : 45 T	Internal Assessment: 20 M	Examination: 80 M
UNIT-I		
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. Mutation and types. Mutagenic agents, Mutants – isolation, selections, screening and enrichments, Uses of mutants. Reversion and suppression.		**15 hours**
UNIT-II		
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. 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.		**15 hours**
UNIT-III		
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. 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,		**15 hours**

Applications of proteome analysis to drug development and toxicology. Crisper-cas	

1. Introduction to Genomics – Arthur M Lesk, Oxford University Press, 2007.
2. Plant Genome Analysis – Peter M Gresshoff, CRC Press.
3. Genetic Analysis – Principles, Scope and Objectives by JRS Finchman, Blackwell Science,1994.
4. Discovering Genomics, Proteomics & Bioinformatics – A M Campbell & L J Heyer, Pearson Education, 2007
5. Protein Arrays, Biochips and Proteomics – J S Albala & I Humprey-Smith, CRC Press, 2003
6. Genomics & Proteomics – Sabesan, Ane Books, 2007.
7. Proteomics – S. R. Pennington and M J Dunn, 2004.
8. Purifying Proteins for Proteomics – Richard J Simpson, IK International, 2004
9. Proteins and Proteomics – Richard J Simpson, IK International, 2003
10. DNA sequencing – Luhe Alphey, 2004
11. Biocomputing Informatics and the Genome Projects – Smith D.W., Academic Press, 1993.
12. Genes VIII – Benjamin Lewis. Oxford University & Cell Press.
13. Bioinformatics –methods and applications: genomics, proteomics and drug discovery, S C RASTOGI, N MENDIRATTA & P RASTOGI, PHI, 2006
14. Genomics and evolution of Eukaryotes – Laura Katz and D Bhattacharya, 2007.

Ph. D. Paper-4 - RESEARCH AND PUBLICATION ETHICS		
Course Code :.		Credit :2
Total Contact Hours : 30 T	Internal Assessment: 10 M	Examination: 40 M
UNIT-I		
Philosophy and Ethics- Introduction to philosophy: definition, nature and scope, concept, branches. Ethics-definition, moral philosophy, nature of moral judgments and reactions. Scientific contents ethics with respect to science and research. Intellectual honesty and research integrity. Scientific misconduct-falsification, fabrication and plagiarism (FFP). Redundant publications-duplicate and overlapping publication (salami slicing). **Best Publication ethics-** definition, introduction and importance. practices/standards setting initiatives and guidelines-COPE, WAME etc. Conflicts of interest. Publication misconduct-definition, concept, Violation of publication ethics, Authorship and contrubutrship. Identification of publication misconduct, complaints and appeals. Predatory publishers and journals. Open access publishing and initiatives. SHERP/ROMEO online resources to check publisher copyright and self-archiving policies.		**15 hours**
UNIT-II		
Publication misconduct Group discussion-subject specific ethical issues, FFP, authorship. Conflict of interest. Complaints and appeals; examples and fraud from India and abroad. **Software tools**-use of plagiarism software like TURNITIN, ORKUND and other open-source software tools. **Date base and research metrics-** data base: indexing databases. Citation databases; web of science, Scopus, etc., Research Matres-impact factor of journal as per journal citation report, SNIP/SJR, IPP, cite score. Matrics-h index, G index, i10 index. Alt matrics.		**15 hours**

REFERENCES

1. Beal J. Predatory publishers are corrupting open access. Nature 489 (7415), 179.
2. Bird A. Philosophy of science, Routledge.
3. Chaddah P. Ethics in competitive Research: Do not get scoped; do not get plagiarized. ISBN 978-9387480865
4. MacIntyre, Alasdair (1967). A short History of ethics. London.
5. National Academy (INSA) Ethics in Science education and research Governance (2019).