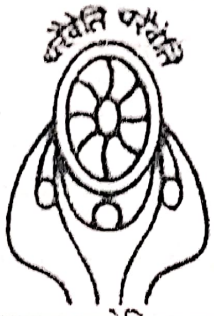
# SCHEME AND CURRICULUM

# Ph.D. Microbiology

## Effective from the session 2023



महात्मा ज्योतिबा फुले
रुहेलखण्ड विश्वविद्यालय, बरेली

**Department of Microbiology**

**Mahatma Jyotiba Phule Rohilkhand, University**

**Bareilly - 243006**

**Course: Advanced Analytical Techniques**
**Course Code:**

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| **Course objective:**<br>To provide an advanced understanding of the core principles of various techniques used in biological experiments. | | |
| **Learning outcomes:**<br>• Demonstrate principles of various basic and advanced techniques used in biological experiments<br>• Critically analyze and interpret the results obtained from biological experiments | | |
| **Credits:** 4 | | **Core Compulsory** |
| Max. Marks: 100 | | Min. Pass Marks:55 |
| **Total No. of Lectures-Tutorial (in hours per week): L-T: 4-0-0** | | |
| **UNIT** | **TOPICS** | **No. of lectures 60** |
| I | **Recombinant DNA techniques**<br>Use of Restriction and modification enzymes in cloning; Plasmid vector; Transformation and Plasmid isolation; PCR; Southern Blotting, Northern Blotting, RFLP, RAPD, Western Blotting, DNA finger printing, DNA sequencing methods (Sanger's chain termination method, and automated DNA sequencing); Real time PCR and Microarrays and their applications, RNAi and Genome editing. | 12 |
| II | **Biostatics**<br>Types and sources of data, data collection methods, primary data, secondary data, analysis for specific type of data, tabulation and graphical representation, central tendency, dispersion, skewness, correlation, regression, chi-square test, t- and F- tests, ANOVA- One way and two-way, important non-parametric tests like Sign, Run, Kendall's coefficient. | 12 |
| III | **Genomics and Proteomics**<br>Next generation sequencing (NGS); Genome annotation, Phylogenetic Analysis-Methods and Tools, gene prediction, ORF finding. Homology: Ortholog& paralog Global expression profiling; RNA-seq. and protein expression, Microbial genomic resources.UV and fluorescence spectroscopy; Circular Dichroism; Mass spectrometry - Principles and their applications; Protein separation techniques and instrumentation (Gel filtration, Ion exchange and Affinity chromatography, 1D and 2D Polyacrylamide gel electrophoresis); Immunochemical detection of proteins.; Introduction and overview of Metabolomics; Nanotechnology and its Applications in Microbiology. | 12 |
| IV | **Microbial and Cellular Techniques**<br>Microbial techniques; Microbial growth and kinetics (synchronous culture, continuous and batch and fed-batch cultures, chemostat and turbidostat); Methods for identifying microbes (polyphasic approach); Cell disruption and fractionation of organelles; Isolation and purification of membrane proteins; | 12 |

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| | Various methods to study cell-cell and cell-virus fusion. Flow cytometry techniques; Confocal and Atomic Force Microscopy. Biosafety &Types of Biosafety cabinets. | |
| V | **Experimental Models and instrumentation in Biology**<br>Rodent and non-rodent models, worms as models for studying human-microbe interactions, Handling and maintenance of animals, Ventilated cages, Different routes of injections and collection of various biological components, Formulation of feed and design of experiments. Principle instrumentation and environmental applications of Neutron Activation Analysis, X- Ray Fluorescence, X-Ray Diffraction, AAS, Hyphenated techniques-LC-MS/MS, GC-MS/MS, HPTLC-MS, ICP-MS. | 12 |

**Suggested readings:**


1. Ausubel FW. Current Protocols in Molecular Biology. Wiley-Blackwell. 2011. Print
2. Burgess R. and Deutcher MP. Guide to Protein Purification. Academic Press, San Diego, USA. 2009. Print
3. Butler, M. Animal Cell Culture & Technology. 1st edition. Tailor & Francis Publishers (UK). 2004. Print
4. Freshney, R.I. Culture of Animal cells: A Manual of Basic Technique and specialized applications. 7th edition. Wiley-Blackwell. 2016. Print
5. Green M.R. and Sambrook J. Molecular Cloning: A Laboratory Manual. Vol. I, II, III. 4th edition. Cold spring harbor laboratory press. 2013. Print
6. Principles and Techniques of Biochemistry and Molecular Biology (2018) 8th ed. Wilson K and Walker J, Cambridge University Press, ISBN No. 131661476X.
7. Physical Biochemistry: Principles and Applications (2010) 2nd ed., Sheehan, D., Wiley Blackwell (West Sussex), ISBN: 978-0-470-85602-4 / ISBN: 978-0-470-85603-1.
8. Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2nd ed., Freifelder D, W.H. Freeman and Company (New York), ISBN:0-7167-1315-2 / ISBN:0-7167-1444-2.
9. Instrumental methods of analysis (1988) 7th ed. H. H. Willard, L. L. Merritt, J. A. Dean and F. A. Settle (United States).
10. D.S. Goodsell 2013 Bio-nanotechnology: Lessons from Nature, John Wiley
11. C. N. Banwell and E. M. McCash; Fundamentals of Molecular Spectroscopy, 4th Edition. Tata McGraw Hill, 1994.
12. D. L. Pavia, G. M. Lampman, G. S. Kriz and J. R. Vyvyan, Introduction to Spectroscopy. 5th Edition. Cengage India, 2011