

# Savitribai Phule Pune University

(Formerly University of Pune)

## Syllabus for Ph.D. (PET) Entrance Exam : Microbiology

### Research Methodology

- 1) **Foundation of Research:** Meaning, Objectives, Motivation, Utility, Characteristics and Types. Characteristics of scientific methods - understanding the language of research - Concept, Construct, definition, Variable. Scientific Research Process. Steps of research, methods of research, research ethics.
- 2) **Problem Identification & Formulation:** definition and formulating the research problem, Necessity of defining the problem, Importance of literature review in defining a problem. Literature survey: primary and secondary; web sources; critical literature review. Research Question - Investigation Question - Hypothesis testing - Qualities of a good hypothesis - Null hypothesis & Alternative Hypothesis
- 3) **Research Design:** Concept and Importance in Research - Features of a good research design - Exploratory Research Design - Concept, Types and uses, Descriptive Research Design - concept, types and uses. Experimental Design - Concept of Independent & Dependent variables. Biased and unbiased research design
- 4) **Qualitative and Quantitative Research:** Qualitative - Quantitative Research - Concept of measurement, causality, generalization, replication. Merging the two approaches. **Biological data:** Types of data - Qualitative data, Quantitative data
- 5) **Data Collection and analysis:** Execution of the research - Observation and Collection of data - Methods of data collection, hypothesis-testing - Generalization and Interpretation.
- 6) **Measurement:** Concept of measurement - what is measured? Problem in measurement in research - Validity and Reliability. Levels of measurement - Nominal, Ordinal, Interval, Ratio.
- 7) **Sampling, data collection and analysis:** Concept of Statistical population, Sample, Sampling Frame, Sampling Error, Sample size, Non Response. Characteristics of a good sample, sample distribution, Probability and Probability distributions. Determining size of the sample - Practical considerations in sampling and sample size. Data analysis - Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis - Cross tabulations and Chi-square test including testing hypothesis of association including Chi test, correlation and regression analysis.
- 8) **Interpretation of Data and Paper Writing:** Graphical interpretation of data, Layout of a Research Paper, Journals, Ethical issues related to publishing, Plagiarism and Self-Plagiarism.  
Use of Encyclopedias, Research Guides, Handbook etc., Academic databases for concerned discipline

- 9) **Use of tools / techniques for referencing and writing:** methods to search required information effectively, PubMed, effective literature search using Entrez, Google Scholar. Software for paper formatting like MSOffice, software for detection of Plagiarism. Basics of internet and e-mailing. Reporting and Thesis writing - Structure and components of scientific reports - Types of report - Technical reports and thesis - Significance - Different steps in the preparation - Layout, Structure and Language of typical reports - Illustrations and tables - Bibliography, referencing and footnotes - Reproduction of published material - citation and acknowledgement - Oral presentation - Planning - Preparation - Practice - Making presentation - Use of visual aids - Importance of effective communication.
- 10) **Application of results and ethics:** Environmental impacts - Ethical issues - ethical committees - Commercialization - Copy right - royalty - Intellectual property rights and patent law - Falsification and verification.
- 11) **Reasoning and Mental ability:** Analogy, Logical reasoning and aptitude, Classification, Series, Coding-Decoding, Direction Sense, Representation Through Venn Diagrams, Mathematical Operations, Arithmetical Reasoning, Inserting the Missing Character, Number, Ranking and Time Sequence Test, Eligibility Test, Representation through Venn-diagrams, Number & symbols ordering, Comprehension questions, Statement & assumptions, Statement & conclusions, Statement & actions.

#### **Books recommended**

1. Research Methodology-C R Kothari
2. Research Methodology: An Introduction-Stuart Melville and Wayne
3. Practical Research Methodology-Catherine Dawson
4. Research Methods for Science Michael P Marder
5. Research Methodology: Principle, Methods and Practices-Joshua O.Miluwi and Hina Rashid
6. Research Methodology: A Step By Step Guide for beginners- Ranjeet Kumar
7. How to Write and publish a Research Paper- Seventh Edition-Robert Day And Barbara Gastle
8. Introduction to Biostatistics and Research Methods- P S S Sunder Rao
9. Research Methodology and Scientific Writings- C George Thomas

#### **References:**

- 1) Garg, B. L.Karadia R. Agrawal, F. and Agrawal U. K., 2002. An Introduction to Research Methodology, RBSA Publishers
- 2) Kothati C. R.,1990. Research Methodology: Methods And Techniques New Age International 418p.
- 3) Sinha S. C. and Dhiman A. K., 2002. Research Methodology Ess Ess Publications 2 Columes.
- 4) Trochim W. M. K., 2005. Research Methods: The Concise Knowledge Base Atomic Dog Publishing. 270P
- 5) Wadehra B. L., 2000. Law Relating to Patents, Trade Marks, Copyright Design and Geographical Indications, Universal Law Publishing

## Additional reading

- 1) Anthony M. Graziano A. M. And Raulin M. L., 2009. Research Methods: A Process Of Inquiry Allyn And Bacon
- 2) Carlos C. M., 2000. Intellectual Property Rights The WTO and Developing Countries: The Trips Agreement and Policy Options, Zed Books New Yorks
- 3) Coley S. M., and Scheinberg C.A., 1990, "Proposal Writing", Sage Publications
- 4) Fink A., 2009. Conduction Research Literature Reviews: From the Internet to Paper. Sage Publications
- 5) Leedy, P. D. and Ormrod J. E., 2004 Practical Research: Planning and Design, Prentice Hall
- 6) Satarkar S. V., 2000. Intellectual Property Rights and Copy Rights Ess Ess Publications
- 7) Website for guidelines on experimentation animals (Institutional Animal Ethics Committee as per CPCSEA) : <http://cpcsea.nic.in>
- 8) Website for guidelines on Indian Biosafety Safety Rules & Regulations : <http://dbtbiosafety.nic.in/>
- 9) Website for guidelines on research using human subjects (Institutional Human Ethics Committee as per ICMR) : [http://www.icmr.nic.in/ethical\\_guidelines.pdf](http://www.icmr.nic.in/ethical_guidelines.pdf)

## Subject Concerned Syllabus Microbiology

- 1) **General Microbiology:** Bacterial cytology, Systematics of Bacteria, Molecular Taxonomy, Yeast and Fungi Microbial Growth, Bacteriophages: T, lambda and M13, Viruses: General features; HIV, Polio, Plant viruses: tobacco mosaic virus, cauliflower mosaic virus.
- 2) **Basic Biochemistry:** Biomolecules as compounds of carbon with a variety of functional groups, polar, nonpolar compounds, pH and buffers, Biochemistry of proteins, nucleic acids, lipids and carbohydrates.
- 3) **Microbial Metabolism and Physiology:** Enzymes , Enzyme kinetics , Regulatory enzymes, Biological membranes and transport, Principles of bioenergetics, Oxidative phosphorylation, Glycolysis, gluconeogenesis, and the pentose phosphate pathway, Citric acid cycle and its role in metabolism, Principles of metabolic regulation.
- 4) **Molecular Biology and Genetics:** Basic concepts in genetics, DNA Structure Function, DNA Mutation and Repair, Extrachromosomal genetic elements, Transcription, Translation, Recombinant DNA technology, Operon regulation, Transcription enhancers and attenuators, Transgenic plants and animals.
- 5) **Medical Microbiology and Immunology:** Virulence, Cell adhesion, New emerging pathogens, Antimicrobial agents and chemotherapy, Basic concepts in immunology, Humoral and cellular immunity, Diversity of TCR and BCR, Monoclonal antibodies and their applications.
- 6) **Applied and Environmental Microbiology:** Basic concepts in fermentation technology, Downstream processing, Biocontrol agents, Biosensors, Genetically engineered microorganisms.
- 7) **Advanced Biological and Molecular Techniques:** Chromatographic techniques, Immunological techniques, Electrophoretic techniques, Spectroscopic techniques, polymerase chain reaction, DNA and Protein Sequencing, Blotting and hybridization.