

## Paper – I: Research Methodology

(4 Units)

### UNIT-I: Research Problem and Design

1. Introduction to Research Methodology: Meaning of Research, Objectives of Research, Motivations in Research, types of Research, Research Approaches, Significance of Research, Research Methods v/s Methodology, Research and Scientific Methods, Research Process, Criteria of Good Research.
2. Defining the Research Problem: Concept and need, Identification of Research problem, defining and delimiting Research problem.
3. Research Questions and Hypothesis: Variables, Research question, characteristics of good Hypothesis and formulation of hypotheses-directional and non-directional hypotheses, Basis for hypotheses.
4. Research design: Meaning, Need, Features of Good Design, Concept, Types. Basic principles of Experimental Design, various methods of Research: Survey, Philosophical, Historical, Experimental, Causal, Comparative, Genetic and Case Studies.

### UNIT-II: Literature Searching and Report Writing

1. Tools for Data Collection: Collection of Primary Data, Collection of Data through questionnaires and Surveys, Observation, Interview Methods.
2. Collection of Secondary Data. Selection of appropriate method for data collection, Reliability and validity of Research tools.
3. Writing Research Report: Format and style, Review of related literature and its implications at various stages of research. (Formulation of research problem, hypothesis, interpretation and discussion of results).
4. Major findings, Conclusions. Citation of References and Bibliography.

### UNIT-III: Statistical analysis & Bioinformatics

1. Statistical analysis: descriptive statistics and inferential statistics.
2. Chi-Square Test, T-Test. Standard deviation, Coefficient of variation. Correlation.
3. Bioinformatics: Types of databases; Search tools: BLAST and FASTA. Sequence analysis of biological data. Major Bioinformatics resources (NCBI, EBI, ExPASy).
4. Phylogenetic analysis: Concept of phylogenetic trees and multiple sequence alignment methods; Protein structure prediction, Proteomics and Genomics; EMBOSS.

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Received  
Savitri  
21/12/22

SM

K.P.S

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Dr. Karuna Rupula

Dr. S. Suma

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K. Madhukar

Received  
Y. Vijay  
21/12/22  
(Vijay Ghemath)

Received  
Rajya  
21/12/22

#### UNIT-IV: Analytical Techniques

1. Spectroscopy: Principle of spectroscopy: Laws governing light absorption (Beer-Lambert's Law). Principles and biological applications of UV and visible spectroscopy, Flame photometry, Atomic Absorption Spectrophotometry. Basic principles and applications of X-ray diffraction, Fluorescence, IR, NMR and Mass spectroscopy.
2. Separation techniques: Principles and biological applications various Chromatography techniques, Electrophoresis methods, Centrifugation techniques.
3. Microscopy: Principles and applications of Light and Phase Contrast, Fluorescent, Scanning and Transmission Electron Microscopy.
4. Flow cytometry principle and its applications.

#### Reference Books:

- a) Best and Kahn, Research Methodology, PHI Limited.
- b) Kothari, C.R. Research Methodology (Methods and Techniques), New Age Publisher.
- c) Kerlinger, Foundation of Research.
- d) Fundamentals of modern statistical methods by R. Wilcoxon.
- e) Power Analysis for Experimental research A Practical Guide for the Biological, Medical and social Sciences by R. Barker Bausell, Yi-Fang Li Cambridge University Press.
- f) Design of Experience: Statistical Principles of Research Design and Analysis, by Robert O. Kuehl Brooks/Cole.

K. Rajender Reddy

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**PAPER –II: CELL, IMMUNOLOGY AND MOLECULAR BIOLOGY**  
(Broad field of specialization)

**UNIT-I**

1. Cell cycle and its Regulation; Biomembranes: Structure and functions, Membrane transport.
2. General concept of signal transduction mechanisms: Protein Kinases and Second messengers.
3. Receptors and mechanism of action of Hormones. Molecular physiology and Muscle contraction and Neurotransmission.

**UNIT-II**

1. Immunology: Classification of Immunoglobulins, Immunity, Humoral and Cell mediated Immunity.
2. Immunological memory, Adjuvants, Lymphokines, T cell receptors.
3. Hypersensitivity, HLA, Autoimmunity, Complement system, Antibody diversity.

**UNIT-III**

1. DNA Replication, DNA damage and Repair.
2. Mechanism of Transcription and Translation in Prokaryotes and Eukaryotes.
3. Viruses: RNA & DNA viruses, life cycle of T-even phages, TMV, ØX174, SV40 and Retroviruses.

**UNIT-IV**

1. Regulation of Gene Expression: Operon concept, Lytic cascade and lysogenic repression. DNA Methylation, Heterochromatin, Antisense RNA, post transcriptional and post translational modification, Molecular Chaperones. Protein targeting, Signal hypothesis.
2. Oncogenes and molecular basis of Cancer. Tumor suppressor genes, Apoptosis and its regulation.

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MAHATMA GANDHI UNIVERSITY, NALGONDA  
PAPER-III: RESEARCH PUBLICATIONS AND ETHICS  
(APPLICABLE TO ALL FACULTIES)  
2 Credits; 2 PPW

UNIT - I

**A. PHILOSOPHY AND ETHICS:** Introduction to philosophy: definition, nature and scope, concept, branches. Ethics: Definition, moral philosophy, nature of moral judgments and reactions.

**B. SCIENTIFIC CONDUCT:** Ethics with respect to research in science disciplines and research in social sciences, Intellectual honesty and research integrity, scientific misconducts: Falsification, Fabrication and Plagiarism (FFP), Redundant publications: Duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data.

**C. PUBLICATION ETHICS:** Publication Ethics : Definition, importance, Best practices / standards setting initiatives and guidelines: COPE, WAME etc., Conflicts of interest, Publication misconduct : Definition, concept, problems that lead to unethical behavior and vice versa, types, Violation of publication ethics, authorship and contributorship, Identification of publication misconduct, complaints and appeals, predatory publishers and journals. References. Bibliography.

UNIT - II

**A. OPEN ACCESS PUBLISHING:** Open access publications and initiatives, SHERPA/Romeo online resource to check publisher copyright & self-archiving policies, Software tools to identify predatory publications developed by SPPU, Journal finder / journal suggestion tools viz. JANE, Elsevier Journal finder, Springer Journal Suggester etc..

**B. PUBLICATION MISCONDUCT:** Subject specific ethical issues, FFP, authorship, Conflicts of interest, Complaints and appeals: Examples and fraud from India and abroad.

Use of plagiarism softwares like Turnitin, Urkund and other open source software tools.

**C. DATABASES AND RESEARCH METRICS:** Indexing databases, Citation databases: Web of Science, Scopus etc., ISSN Vs ISBN, Impact Factor of journal as per Journal Citations Report, SNIP, SJR, IPP, Cite Score, Metrics: h-index, g-index, i-10 index, almetrics.

**References:**

Bird, A (2006), *Philosophy of Science*, Routledge

MacIntyre, Alasdair (1967) *A Short History of Ethics*, London

P. Chaddah, (2018) *Ethics in Competitive Research: Do not get scooped: do not get Plagiarized*, ISBN: 978-9387480865

National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009), *On Being a Scientist: A Guide to Responsible Conduct in Research*: Third Edition. National Academies Press.

Resnik, D. (2020, December 23). *What is ethics in research & why is it important?* National Institute of Environmental Health Sciences, Retrieved from <https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>

Becall, J. (2012), *Predatory publishers are corrupting open access*. Nature, 489 (7415), 179-179. <https://doi.org/10.1038/489179a>

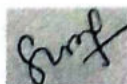
Indian National Science Academy IINSA), *Ethics in Science Education, Research and Governance* (2019), ISBN: 978-81-939482-1-7.

[https://www.insaindia.res.in/pdf/Ethics\\_Book.pdf](https://www.insaindia.res.in/pdf/Ethics_Book.pdf)

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**Pre-Ph.D. QUESTION PAPER PATTERN**

- I. First two papers – 4 Units each  
(Research Methodology & Specialization)  
Part-A: 5 out of 8 Questions; Marks: 5x4=20  
Part-B: 4 Questions with internal choice; Marks: 4x20=80  
Total Marks: 100; Pass Marks: 55% marks
- II. 3<sup>rd</sup> paper: Research & Publication ethics ---Two Units  
Part –A: 2 out of 4 Questions; Marks: 2x5=10  
Part-B: 2 Questions with internal choice; Marks: 2x20=40  
Total Marks: 50; Pass Marks: 55% Marks

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