



**PURNEA UNIVERSITY, PURNIA**

**Paper-I**

**Research Methodology + Zoology**

Full Marks: 100

Duration of Examination: 2 Hours

Questions shall consist of 3 parts:

**Part-A : Short Questions (06 in number of which 04 to be answered, each carrying 10 marks) = 40**

**Part-B : Long Answer Question (04 to be asked of which 02 to be answered, each carrying 30 marks) = 60**

1. Introduction to Research: What is Research; Why is Research Conducted; Stages in Research; Changing Nature and Expanding Scope of Research; Why Research Methodology.
2. Introduction to Major Research Methods: Natural Observation; Historical Research; Ethnographic Research; Cross-Sectional Study; Longitudinal Study; Cohort Study; Case Study; Correlational Research; Action Research; Quantitative and Qualitative Research; theoretical research, applied research and empirical research; Experimental Research: Cause and Effect Relationships, Hypothesis in Experiments, Principles of Experimentation, Classification of Experiments, Experimental Design, Requirements of a Good Experiment; Reasoning in Research : Introduction to Logical Terms; Evidences; Inductive and Deductive Reasoning; Fallacious Reasoning; Formal and Informal Fallacies; Common Fallacies.
3. Research Design: Study designs in quantitative research; Study designs in qualitative research; Other commonly used philosophy-guided designs; Choice of Variables; Constructing hypotheses, Mechanisms and Design for Data Collection; Collection of Primary Data: Observation, Interview, questionnaire and schedule Sample Surveys and Designed Experiments, Estimation without Sampling, Methods of data collection in qualitative research; Collection of Secondary Data; Data Integration; Using Publications and the Library; Using Academic Databases: Search Engines, Citation Indexes and Citation Analysis, Government of India Initiatives for

Mony  
06/11/23  
DSW

Knowledge Management- INFLIBNET: e-ShodhSindhu, Shodhganga, ShodhGangotri, and N-List Projects.

4. Data analysis: Statistical analysis; Thematic analysis; Analysing narrative; Discourse analysis; Content analysis; Grounded Theory; Using computers in data analysis.
5. Ethics and Related Issues in Research: Concepts in Ethics in Research; Intellectual Property Rights; Scientific Values: Needed a Code of Conduct; Fraud and Misconduct in Science; Plagiarism: What is Plagiarism, Acknowledge Sources Appropriately, Paraphrasing, Direct and Indirect Quotations, Plagiarism Checking: ShodhShuddhi, UGC (Promotion of Academic Integrity and Prevention of Plagiarism in Higher Educational Institutions) Regulations, 2018, LNMU Plagiarism Policy and Regulations-2018.
6. Writing a Research Proposal: Introduction; The research problem; Objectives of the study; Hypotheses to be tested; Study design; Measurement procedures; Analysis of data; Structure of the report; Problems and limitations.
7. The Structure of a Thesis: Thesis Vs Dissertation; Parts of a Thesis; Preliminary Pages of a Thesis: Title Pages, Certificate Pages, Acknowledgements, Table of Contents, List of Tables, List of Figures, Dedication; The Subject Proper: Introduction, Review of Literature, Materials and Methods, Results, Analysis/ Discussion, Summary/Conclusion, References, Appendixes; The Abstract; Formatting Requirements of a Thesis: Margins, Page Numbering, Design and Formatting of Chapters, Numbering the Sections, Lay-Out of Tables, Language and Style, Typeface and Fonts, Paper and Text Spacing; Thesis Editing.

MUMU  
06/12/23  
JSDW



**Paper 2: Techniques in Biological Research**

**Introduction to Scientific Research**

- a. Defining scientific questions and categorizing them as basic and applied
- b. Formulating clear cut aims based on scientific questions and planning objectives according to the aim.
- c. Concept of hypothesis generation and basic methods of hypothesis testing

**Reading and Reviewing Scientific Literature**

- a. Introduction to various literature archives such as PubMed, PubMed Central (PMC) and other NCBI Literature Resources such as MeSH and Bookshelf.
- b. Looking for scientific papers of interest amidst the vast resources available.
- c. Introduction to Indian e- resources such as Shoshganga, Shondhsindhu etc
- d. Concept of peer-reviewed journals.
- e. Authorship concerns, acknowledgement of contribution, Intellectual Property Rights (IPR).
- f. Scientific ethics and Plagiarism.

**Scientific Communication**

- a. Poster and oral presentations
- b. Writing scientific papers and review articles
- c. Referencing

**Analytical & Preparative Biochemical Techniques and Instrumentation**

- a. pH measurement
- b. Concept of stoichiometry, preparation of buffers, reagents and solutions
- c. Basic biochemical tests for identification of biomolecules (Starch, Sugar and Proteins).
- d. Physicochemical analysis of water and soil.
- e. Concepts of Colorimetry and Spectrophotometry
- f. Principle and types of Centrifugation
- g. Principle and types of Gel Electrophoresis
- h. Principle of Chromatography
- i. Immunological techniques
- j. FACS

*Mony*  
*06/11/23*  
*DSW*

**Microscopy and Image Analysis**

- a. Concepts of Bright field; Dark Field, Phase Contrast, fluorescence and Confocal microscopy
- b. SEM and TEM
- c. Photomicrography and Grid Preparation
- d. Software Tools for Molecular Microscopy

**Genetical and Molecular Biological Techniques**

- a. Aseptic technique and preparation of media
- b. Types of cell culture
- c. Cloning and sequencing of genes
- d. DNA Amplification through Polymerase Chain Reaction
- e. DNA fingerprinting, VNTR Profiling, STR Profiling, mitochondrial DNA profiling and SNP Profiling
- f. Genome expression analysis: Blotting Techniques and Microarray
- g. Metagenomics and Epigenomics
- h. Gene targeting, Genome Editing and its applications

**Histological and Histochemical Techniques**

- a. Tissue fixation, sectioning and staining
- b. Histochemical techniques for detection of various biomolecules: carbohydrates, proteins and lipids
- c. Enzyme histochemistry

**Recombinant DNA Technology**

- a. Enzymes, Vectors, Cloning Strategies
- b. Construction and screening of DNA libraries
- c. Applications of recombinant DNA Technology

**Bioinformatics**

- a. Concept of Information Technology
- b. Concept of dry experiments and digital laboratory
- c. Introduction to data archiving systems: FASTA format, Accession, and GI-Number
- d. Introduction to various literature archives such as PubMed, PubMed Central (PMC) and other NCBI Literature Resources such as MeSH and Bookshelf.
- e. Databases (DNA and Protein) search and retrieval: NCBI, Swiss-prot, PIR, PDB, KEGG, PubMed 5.
- f. Concept of homology: BLAST, Clustal-W and their applications
- g. Protein structure bioinformatics: Protein visualization, structure comparison, homology modelling

*Handwritten notes:*  
 11/11/23  
 06/12/23  
 RSW

## Biostatistics

- Concept of parametric and non parametric tests.
- Depiction of continuous frequency distribution table in the form of histogram, frequency polygon and ogive
- Calculations of mean, median and mode from hypothetical data
- Calculation of variance, standard deviation, standard error and coefficient of variation from hypothetical data.
- Chi-square test
- Student t-test
- One-way and Two-way ANOVA and post-hoc tests
- Introduction to various statistical softwares such as Microsoft Excel, SPSS, MATLAB etc.

## Model systems, Model Organisms, Animal Handling and Ethics

- Pre-requisites of a model system; in vitro systems;
- Prokaryotic model organisms
- Eukaryotic model organisms
- Maintenance of animals
- CPCSEA guidelines; Institutional ethics committees
- Ethical consideration in research on human beings

## Suggested Readings:

- Alberts et al, 2008, Molecular Biology of the Cell, Garland.
- Boyer, 2005, Modern Experimental Biochemistry and Molecular Biology, Benjamin
- Brown, 1995, Gene Cloning, Stanley
- Brown, 2007, Genomes
- Drlica, 2003, Understanding DNA and Gene Cloning, Wiley
- Futuyma, 2005, Evolution, Sinauer.
- Gardner et al, 2006, Principles of Genetics, John Wiley.
- Glick & Pasternak, 1994, Molecular Biotechnology, ASM press
- Hartl & Clark, 2007, Principles of Population Genetics, Sinauer.
- Hartl & Jones, 2009, Essential Genetics: A Genomic Perspective, Jones & Bartlet
- Lesk, 2006, Bioinformatics 2/e, Oxford
- Lewin, 2011, Genes X, Jones & Bartlett
- Micklos & Freyer, 1990, DNA Science, CSHL
- Mount, 2006, Bioinformatics 2/e, CBS
- Nelson et al, 2007, Lehninger's Principles of Biochemistry, 5th Edition, MacMillan Worth
- Primrose & Twyman, 2006 Principles of Gene manipulation and Genomics, Blackwel.

MMY  
 06/12/23  
 RSW

17. Sambrook et al. 2001, Molecular Cloning: A Laboratory Manual (Vol I, II, III), CSHL.
18. Snedecor & Cochran, 1968, Statistical Methods, Oxford & IBH
19. Snustad & Simmons, 2010, Principles of Genetics, John Wiley.
20. Sokal & Rohlf, 2000, Biometry, Freeman.
21. Steel & Torrie, 1980, Principles and Procedure of Statistics: A Biometrical Approach, McGraw Hill Book Co
22. Strachan & Read, 2011, Human Molecular Genetics, Wiley.
23. Voet & Voet, 2004, Biochemistry, 4th Edition, John Wiley.
24. Watson et al., 2004, Molecular Biology of the Gene, Pearson Education.
25. Westhead et al. 2003, Bioinformatics Instant Notes, Viva Books (Indian ed)
26. Wilson & Walker, 2006, Principles of Biochemical and Molecular Biological Techniques, Cambridge Univ. Press.
27. Zar, 2003, Biostatistical Analysis, Pearson

Nigam  
08/12/23  
D.W