



Paper-I

Research Methodology + Chemistry

Full Marks: 100

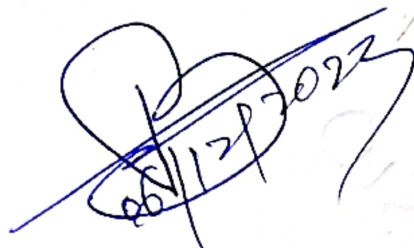
Duration of Examination: 2 Hours

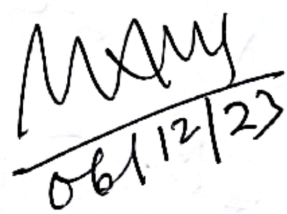
Questions shall consist of 3 parts:

**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

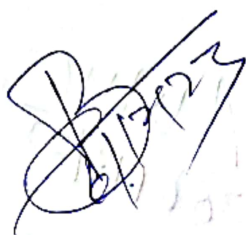
  
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Knowledge Management- INFLIBNET: e-ShodhSindhu, Shodhganga, ShodhGangotri, and N-List Projects.

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.

  
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## PAPER-II

## Elective

## Unit -I

## A- Safety, Hazards and precautions in laboratory

Brief idea about toxicity, explosive nature and ill effects of various chemicals generally used in research and precautions to handle them.

## B- Purification of Chemicals

An idea about LR, GR and AR grade chemicals. A brief knowledge about various techniques such as distillation, fractional distillation, crystallization, fractional crystallization, chromatography etc.

## Unit -II

## A- Experimental Methods in Chemical Research

SEM, TEM, LEED, DTA, TGA, Magnetic Susceptibility

## B-Structure elucidation of spectral data (IR, UV, NMR, ESR, Mass)

## C-Data Analysis

Errors in chemical analysis, classification of errors, determination of accuracy of methods, significant figures, mean and standard deviation, least square method of analysis of fitting the data.

## Unit -III

## A-General Aspects of Medicinal Chemistry, Pro-drugs and drug delivery systems, Drug metabolism

## B- Modern Synthetic Procedures in Chemistry, Formation of C-C bonds via organometallic reagents,

## C- Supramolecular Chemistry. The chemistry of molecular recognition. Applications of supramolecules

## Unit-IV

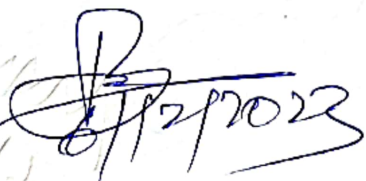
## A- Nanomaterials: Synthesis and Characterization, Chemical Routes Preparation Techniques, Applications of Nanomaterials

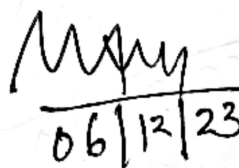
## B- Electrocatalysis, Mechanisms of some technologically important electrochemical reactions

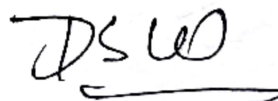
## C- Solar Cells, Introduction to Solar Cells, Various types of Solar Cells, Application of solar cells, Photoelectrochemical (PEC) cells, Dye-sensitized PEC Cells (DSSC)

## Unit-V

Density Functional Theory and Its Applications in Chemistry

  
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# REFERENCES

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5. George S. Zweifel, Michael H. Nantz, 2007, Modern Organic Synthesis - An Introduction, 1st Edition, ISBN: 978-0-716-77266-8, Ed. W. H. Freeman
6. J. Clayden, N. Greeves, S. Warren and P. Wothers, 2001, Organic Chemistry, Oxford University press INC, New York.
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