# MASTER OF PHILOSOPHY

## PHYSICS

### (FT/PT)

**(For the Students admitted in the Academic Year 2021-2022)**

### PART I

### CORE COURSE I
### RESEARCH METHODOLOGY

## UNIT-I: RESEARCH METHODOLOGY

Meaning of research - Objectives of research - motivation of research - Types, approaches and significance - Methods versus methodology - Research in scientific methods - Research process - Criteria for good research - Problem encountered by research in India - Funding agencies.

## UNIT-II: RESEARCH DESIGN

Research Problem: Selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem - Research design - Needs and features of good design - Different research design - Basic principles of experimental designs.

## UNIT-III: DATA COLLECTION AND DOCUMENTATION

Data collection methods - Data types - Processing and presentation of data - Techniques of ordering data - Meaning of primary and secondary data - The uses of computers in research - The library and internet - Uses of search engines - virtual libraries - common software for documentation and presentation.

## UNIT-IV: DATA AND ERROR ANALYSIS

Statistical analysis of data - Standard deviation - Correlation - Comparison of sets of data - Chi squared analysis for data - Characteristics of probability distribution - Binomial, Poisson and normal distribution - Principle of least square fittings - Curve fitting - Measurement of errors - Types and sources of errors - Determination and control of errors.

## UNIT-V: RESEARCH COMMUNICATION

Meaning of research report - Logical format for writing thesis and paper - Essential of scientific report: abstract, introduction, review of literature, materials and methods and discussion - Write up steps in drafting report - Effective illustrations: tables and figures - Reference styles: Harvard and Vancouver systems.

## REFERENCE BOOKS:

1. Research Methodology, Methods and Techniques - C.R. Kothari - Wishwa Prakasam Publications, II Edition.
2. Research: An introduction - Robert Ross - Harper and Row Publications.
3. Research methodology - P. Saravanavel - Kitlab Mahal, Sixth Edition.
4. A Hand book of Methodology of Research - Rajammal P.A. Devadass - Vidyalaya Press
5. Introduction to Computers - N. Subramanian
6. Statistical methods - G.W. Snedecor and W. Cocharan - Oxford and IBH, New Delhi.
7. Research Methodology Methods and Statistical Techniques - Santosh Gupta.
8. Statistical Methods - S.P. Gupta
9. Scientific social surveys and research - P. Young - Asia Publishers, Bombay.
10. How to write and publish a scientific paper - R.A. Day - Cambridge University Press.
11. Thesis and Assignment writing - Anderson - Wiley Eastern Ltd.

## CORE COURSE II
## ADVANCED PHYSICS I

## UNIT-I: QUANTUM MECHANICS

Second quantization of Schrodinger and Klein-Gordon fields - Creation and annihilation operators - Commutation relations - Second quantization of Dirac field - Covariant and anti-commutation relations for Dirac field.

## UNIT-II: NUCLEAR AND PARTICLE PHYSICS

Compound nucleus and statistical theory - Experimental evidence - Statistical assumption - Average cross section - Angular distribution - Transmission coefficients - Level density - Decay of the statistical compound nucleus - Emission of charged particles. Symmetrices and conservation laws - Gell Mann Nishijima formula - CPT invariance - Quark model.

## UNIT-III: NON-LINEAR AND MOLECULAR MECHANICS

Basics of nonlinearity - Linear and nonlinear oscillators - Autonomous and non-autonomous system - Dynamical systems.

The energy calculations - Energy minimization - Force field paramertization - Conformation analysis - Solvation - Montecarlo methods - Molecular dynamics - Free energy calculation.

## UNIT-IV: SOLID STATE PHYSICS - I

Band structure theory - Band structure for some semiconductors - Semiconductor transport theory - Basics of continuity equation - Theory of generation and recombination - Theory of PN junction - PN junction solar cells - Ionic conductivity - Normal and super ionic conductors - Application of super ionic solids: Battery, Fuel cells, Electrochromic display.

## UNIT-V: SOLID STATE PHYSICS - II

Basic concepts of dielectrics: Static fields - Time dependent fields - Static dielectric constant: Dipolar interaction - dipolar molecules in gases and dilute solutions - Onsager equation - Debye equations - Dielectric relaxation and loss - Distribution of relaxation time - Complex plane diagrams - Cole-Cole, Cole-Davidson plots.

## REFERENCE BOOKS:

1. Advanced Quantum Mechanics - B.S. Rajput - Pragathi Praksan
2. Physics of the Nucleus - M.A. Preston - Addison - Wesley
3. Elementary Particles - D. Griffiths.
4. Nonlinear dynamics - M. Lakshmanan and S. Rajasekar - Springer International
5. Computational Chemistry - Guy H. Grant and W. Graham Richards - Oxford University Press
6. Semiconductor Devices - S.M. Sze
7. Electronic Properties of materials - Rolf E. Hummel - Springer
8. Super ionic Solids - S. Chandra - North Holland Publishing Company Ltd.
9. Theory of Dielectrics - H. Frohlich - Oxford University Press
10. Theory of electric polarization Vol. I and II - C.J.F. Botcher - Elsevier scientific Publication.