RESEARCH METHODOLOGY

Subject Code – MREM0-101   **L T P C**   **Duration – 45 Hours**

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UNIT–I (11 Hrs)

Introduction to Research: Meaning, Definition, Objective and Process

Research Design: Meaning, Types - Historical, Descriptive, Exploratory and Experimental

Research Problem: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature

Design of Experiment: Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, Factorial Design.

Hypothesis: Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

UNIT–II (10 Hrs)

Sources of Data: Primary and Secondary, Validation of Data

Data Collection Methods: Questionnaire Designing, Construction

Sampling Design & Techniques – Probability Sampling and Non Probability Sampling

Scaling Techniques: Meaning & Types

Reliability: Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability

Validity: Content Validity, Criterion Related Validity and Construct Validity

UNIT–III (13 Hrs)

Data Process Operations: Editing, Sorting, Coding, Classification and Tabulation

Analysis of Data: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number

Testing of Hypothesis: T-test, Z- test, Chi Square, F-test, ANOVA

UNIT – IV (11 Hrs)

Multivariate Analysis: Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi Dimensional Scaling

Report Writing: Essentials of Report Writing, Report Format

Statistical Software: Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

*Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs

Recommended Books

1. R.I Levin and D.S. Rubin, 'Statistics for Management', Pearson Education New Delhi, Seventh Edition
2. N.K. Malhotra, 'Marketing Research–An Applied Orientation', Pearson Education New Delhi, Fourth Edition
3. Donald Cooper, 'Business Research Methods', Tata McGraw Hill New Delhi
4. Sadhu Singh, 'Research Methodology in Social Sciences', Himalaya Publishers
5. Darren George & Paul Mallery, 'SPSS for Windows Step by Step', Pearson Education New Delhi
6. C.R.Kothari, 'Research Methodology Methods & Techniques', New Age International Publishers, Second Edition.

Research Lab (Radiation/Computational Physics)

Subject Code:-PPHY-100   **L T P C**   **Duration: 48 Hrs**
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Note: Students of Pre PhD course work will be required to perform at least eight to ten experiments from the given list of experiments.

Programming software: Fortran/C++/Monte Carlo Method.

1. Research data analysis and graph plotting.
2. Counting statistics and error analysis.
3. Monte Carlo Integration.
4. Test of randomness for random numbers generators.
5. Calculate the Radioactivity and disintegration rate of a given radioisotopes.
6. Calculate the half and mean life of radioactive isotopes.
7. Calculation of Absorbed dose and Radiation Exposure for a given situation.
8. Estimation of Photon attenuation coefficient in high and low Z material.
9. Radiation shielding calculation.
10. Calculate the range of alpha particle and mono-energetic electrons.
11. Calculation of thicknesses of lead and concrete needed to reduce the gamma ray intensity to a particular value.
12. Calculation of binding energy of a given nucleus.

SEMINAR

Subject Code:-PPHY-101　　　**L T P C**　　　　　**Duration: 24 Hrs**
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The Pre PhD course work candidate will do literature review of minimum 10 research paper of reputed journals related to the research field and will finally present the seminar.

Evaluation: Satisfactory/Unsatisfactory by a committee of three faculty member including head of the department.

NUCLEAR ACCELERATORS & RADIATION PHYSICS (NARP)

Subject Code:- MPHY1-460　　　　**L T P C**　　　　　　**Duration: 48 Hrs.**
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Unit 1

Interactions of Nuclear Radiations and Neutron Detection (12 Hrs)

Introduction to radiations, types of radiations, Radiation dose, units, safety limits, Biological effects of radiation, radiation monitoring. Neutron discovery, neutron classification, neutron sources, Neutron detectors, Diffusion of thermal neutrons.

UNIT 2

Nuclear Radiation Detectors (12 Hrs)

Detection of nuclear radiation, classification of detectors, Gas filled detectors, multiplicative regions, ionization chamber, Proportional counter, Geiger-Muller counter, Solid state detectors, Cerenkov detector, Wilson cloud chamber, Bubble chamber, Spark chamber, Nuclear emulsions, Solid state nuclear track detectors, Semiconductor detectors.

Unit 3

Nuclear Accelerators (10 Hrs)

Introduction of accelerators of charged particles: Classification and performance characterstics of accelerator, ion sources, Electrostatic accelerators (Cockroft---Walton accelerators), Cyclotron, Betatron, principle of phase stability, Synchro-cyclotron, Electron and Proton synchrotron, Microtron, Linear accelerator, drift tube and wave guide accelerator.

Unit 4

Nuclear reactors (14 Hrs)

Nuclear chain reactor, Four factor formula, reactor design, classification of reactors, research reactor: graphite moderator, water boiler, swimming pool, light water-moderator, tank type; Heavy water-moderator: tank type, production reactor, power reactor: pressurized water reactor, Boiling water reactors, heavy water moderated reactors, organic moderated reactors, Gas cooled reactors, Sodium graphite reactors, Liquid fuel reactor, Fast reactor, breeder reactors.

References:-
1. Edward J.N. Wilson "Ann introduction to Paricle Accelerators", Oxford University Press,2003.
2. James Rosenzweig "Fundamantal of Beam Physics", Oxford University Press,2001.
3. P N Cooper "Introduction to Nuclear Radiation Detectors", Cambridge University press, 1986.
4. Kapoor S S and Ramamurthy V S "Nuclear Radiation Detectors", Wiley Eastern, new Delhi, 1986.
5. Knoll G. F., Radiation Detection and Measurement, John Wiley & Sons (1989).
6. Krane K. S., Introductory Nuclear Physics, John Wiley & Sons (1975).
7.Singuru R. M., Introduction to experimental nuclear physics, Wiley Eastern Publications(1987).

ADVANCED MATHEMATICALPHYSICS

Subject Code:-MPHY1-356   **LTPC**   **Duration: 48 Hrs.**
                                     4 0 0 4

Unit 1

Complex Analysis(12 Hrs)

Limits, Continuity and Derivative of the function of Complex variable, Analytic Function, Cauchy- Riemann Equations, Harmonic Function, Orthogonal System, Conjugate Function, Taylor and Laurent series, Complex integration: Line Integral, Singularities, Cauchy integration Theorem, Cauchy's Integral formula, residues and evaluation of integrals, Contour Integration.

Unit 2

Group Theory (12 Hrs)

Definition of a group, Composition table, Conjugate elements and classes of groups, directs product, Isomorphism, homeomorphism, permutation group, Definitions of the three dimensional rotation group and SU(2), O(3).

Unit 3

Sampling and Probability Distribution (12 Hrs)

Random Variables: Definition, Probability distribution-Binomial, Poisson and Normal distributions. Sampling Distributions: Population and samples, Concept ofsampling distributions-Student's t test, F-test and Chi-square test, Curve Fitting, Least square fitting.

Unit 4

Tensors (12 Hrs)

Review of tensor, Equality of Tensors - Symmetric and Skew – symmetric tensors - Outer multiplication, Contraction and Inner Multiplication - Quotient Law of Tensors - Reciprocal Tensor of Tensor - Relative Tensor - Cross Product of Vectors, Riemannian Space - Christoffel Symbols and their properties.

Suggested Books

1. Complex Analysis, J.N. Sharma, Krishna Publishers (2nd Edition).
2. Mathematical Statistics, S.C.Gupta&V.K. Kapoor, S.ChandPublishers (2nd Edition)
3. Contemporary Abstract Algebra, Josaph A Gallian, NarosaPublishers(2nd Edition)
4.Advanced Mathematical Physics by ErwinKreyszig, Wiley New York (8th Edition)
5.J.L.Synge and A.Schild, Tensor Calculus, Toronto, 1949 (Latest Edition).