

BUNDELKHAND UNIVERSITY, JHANSI
DEPARTMENT OF PHYSICS

SYLLABUS 2010-11

M.Phil (PHYSICS)

Papers Name	Theory	Internal	Total
First Semester			
Compulsory Papers			
MPPHY-101 Research Methodology	70	30	100
MPPHY-102 Numerical Techniques & Programming	70	30	100
Optional Paper (Any one paper)	70	30	100
MPPHY-103 (O) Reactor Physics			
MPPHY-104 (O) Crystal Growth & Thin Films Technology			
MPPHY-105 (O) Ultrasonics			
MPPHY-106 (O) Nanotechnology			
		Total	300
Second Semester			
MPPHY-201 Seminar			100
MPPHY-202 Dissertation			200
		Total	300
		Grant Total	600

**M.Phil First Semester
MPPHY-101**

RESEARCH METHODOLOGY

Research methods and Methodology, Importance of Research Methodology in research, types of research, Selection of research topics and problems, Literature survey, reference collection, Qualitative and Quantitative analysis, research design, presentation of conference report, oral & poster presentation, audiovisual aids in oral presentation, Art of writing research papers, dissertation and Ph.D. thesis.

Sampling and Data Collection, Sampling and techniques, types of sampling, state of sampling, Sampling size problem in determining the sample size, advantage and limit of sampling, data collection through experimental techniques and theoretical calculation, types of data, primary data, secondary data, meaning, data collection method, scrutinizing primary and secondary data.

Statistics, Analysis and interpretation of data obtained, coding, editing, tabulation of data, various kind of charts and diagrams used in data analysis, applications of statistical techniques for analyzing the data, uses of data analysis tools, SPSS, ORIGIN. Testing of significance, mean, proportion, variance and correlation, testing for difference between mean, proportion, variance and correlation coefficients.

Instrumentations and experimental techniques, Electron Spin Resonance (ESR), Nuclear Magnetic Resonance (NMR), X-ray Crystallography, Electron Microscopy, ESCA, Ultrasonic low frequency techniques, High frequency techniques, Interferometric techniques, Nondestructive evaluation techniques, Flaws and defect detection of materials.

Recommended Books:

1. Research Methodology- Methods & Techniques: C. R. Kothari; Wiley Eastern, New Delhi, 1985.
2. Research Methodology and Statistical Measurement: Reddy and Rao
3. Crystallography for Solid State Physics: Verma & Shrivastava.
4. Ultrasonic Testing: K. C. Shrivastava.

**M.Phil First Semester
MPPHY-102**

NUMERICAL TECHNIQUES & PROGRAMMING

Numerical integration: Trapezoidal formula, Simpson rule and Newton's cote formula, error analysis and solution, Differential equations: Euler and Huens method, Runga Kutta method, solution of system of equations, stiffness and multistep methods.

Elementary ideas of solutions of partial differential equations (Finite difference and finite element methods). Boundary-value problem: Temperature distribution in a road. Shooting method, Random variate, Random number Generation, Monte Carlo method.

Introduction to Modern digital computers, Organization of a digital computer, computer instructions and programs, Motivation and choices of higher-level languages, reduction in execution time, algorithm writing and flow chart preparation.

Fundamental of C++, Structure of C++, Control Statement, Arrays, Functions, Character handling in C++, Pointers, Structure and Unions, Classes and Objects, Inheritance, input and output operation in C++, advanced features in C++, Simple programs in C++.

Recommended Books:

1. Numerical Methods for Scientist and Engineering Computation: M K Jain; New Age International Publishing, 2007.
2. Numerical Methods for Engineers: S K Gupta; New Age International Publishing, 2001.
3. Elements of Group Theory for Physicist: A W Joshi; Wiley Eastern.
4. Object Oriented programming in C++: Robert Lafore; Galgotia Publishers, New Delhi.

**M.Phil First Semester
MPPHY-103 (O)**

REACTOR PHYSICS

Introduction: Fundamentals of nuclear fission-neutron chain reaction-multiplication factor-condition for criticality, the diffusion of neutrons-neutron current density-the equation of continuity-Fick's law- the diffusion equation-Boundary conditions of diffusion parameters, flux distribution for point source and infinite plane source.

Neutron moderation: scattering of neutrons and energy loss in elastic collisions-slowning down power and densities- lethargy- slowing down in infinite non-absorbing media- Hydrogen and greater mass media, Fermi age theory- age equation and solutions.

Reflector savings: Critical reactor parameters and their experimental determination, critical and geometrical Buckling.

Reactor control: Control rod worth- one control rod- modified one group and two group theories.

Recommended Books:

1. The Elements of Nuclear Reactor Theory: S. Glasstone & M.C. Edlund; D Van Nostrand Company, Inc., 1953.
2. Introduction of Nuclear Engineering: Murray.
3. Introduction to Nuclear Reactor Theory: J R Lamarsh; Addison Wesley, 1966.

**M.Phil First Semester
MPPHY-104 (O)**

CRYSTAL GROWTH & THIN FILMS TECHNOLOGY

Crystal growth-Nucleation, Concept of Formation of the Nucleus, Shapes of Nucleus Phase Diagrams, Phase Rules, Methods of Melt Growth, Vapour Growth, Slow Cooling. Gel Growth, Structure and Properties.

Thin film deposition techniques (Special reference to vacuum evaporation and cathodic sputtering). Concept of vacuum gauge uniform and non-uniform deposit, masking, multiple film deposition. Effect of Parameters (Humanities, Electrode and thickness) Thickness measurements.

Laue diffraction and stereographic projection, The oscillation (Power) method, the Weissenberg photographic technique, concepts of unique data, use of equivalent reflection. Interpretation of intensity data, concept of structure factor.

Recommended Books:

1. Thin Film Phenomenon: K L Chopra.
2. Thick Film of Material Science: Ken; International Thomson Publishing Inc., 1997.
3. Crystallography for Solid State Physics: Verma & Shrivastava.

**M.Phil First Semester
MPPHY-105 (O)**

ULTRASONICS

Ultrasonic waves, Piezo-electric effect, Transducer, Production and Detection of ultrasonic waves, Ultrasonic wave velocities and elastic constants, Measurement of velocity and attenuation, Applications of ultrasonic wave.

Fundamental of ultrasonic testing, Ultrasonic Testing equipments, pulse echo system, ultrasonic flaw detector, Defect detection and their characterization, Ultrasonic velocity and thickness measurement, velocity measurements by pulse echo method, underwater thickness measurement, Limitation of Ultrasonic testing, ultrasonic cleaning, Non-destructive testing, Flaw detection.

Acousto-optic effect, Magneto acoustic memory phenomena, underwater acoustics, linear and nonlinear phenomena, Laser Ultrasonics, Acoustic microscopy, Ultrasound stimulated vibroacoustography, acoustic emission, Saser, Ultrasonic imaging and therapy.

Recommended Books:

1. Fundamental and Applications of Ultrasonics: J. David & N. Checke; CRC Press, 2002.
2. Ultrasonics: Fundamental, Technology & Applications: Ensminger; CRC Press, 1988.
3. Ultrasonic Testing: K C Shrivastava.

**M.Phil First Semester
MPPHY-106 (O)**

NANOTECHNOLOGY

Properties of individual nanoparticles, Metal nano clusters, modeling of Nanoparticles, Bulk to nano transitions, Method of Synthesis, Chemical methods, CVD, PVD thermolysis, electrode deposition and pulsed laser method.

Carbon nano structures, natures of carbon clusters, discovery of C_{60} , crystal structure of C_{60} , and its conductivity.

Carbon nanotubes, Synthesis, structure, electrical and mechanical properties. Quantum walls, wires and dots, properties of quantum nanostructures, size effects. Conduction electrons, and dimensionality, properties on density of states.

Quantum Computation, Moore's law, quantum computers, Qubits, quantum error correction, Shor algorithm.

Recommended Books:

1. Malva (editor): Handbook of Nanostructures materials.
2. P M Ajayan: Fundamentals of nanotechnology.
3. Pole and Owens: Introduction to nanotechnology.
4. A K Bandhopadyay: Nanomaterials.