Course Details *M. Phil. I Semester Physics*

JULY – DECEMBER 2017

Note: There will be two courses. Each course shall be of 100 Marks, out of which 20 marks are allotted to internal assessment and 80 marks for University examination. Internal assessment comprise of a seminar of 10 marks and a test of 10 marks. Minimum pass marks for the internal assessment is 06. Internal assessment and university examination taken together should come to a minimum of 50 marks for clearing a paper.

Paper 101 : Research Methodology in Physics Max. Marks 80

Note: *The paper has been divided into five units. In all five questions are to be set, one from each unit. However internal choice within the unit shall be provided*.

Unit –I:

Research modes in science. Steps in scientific research. Difference between scientific and non-scientific methods. Research design. Exploratory research and its importance. Literature survey. Descriptive research design and its importance. Case research design. Statistical design. Alternative research designs. Simulation. Experimental research design. Limitations of experimentation. Purpose and validity of experimentation. Field setting v/s laboratory setting. Advantages and disadvantages of laboratory experiments. External influencing factors. Types of data. Internal and external data. Secondary data. Methods of primary data collection. Techniques of survey. Motivation, checking and cheating of interviewers.

Unit - II :

Solution of Algebric and transcendental equations, Bisection, modified False position and Newton Raphson methods, Their algorithms and analysis, solution of simultaneous linear equations, Guass elimination, Jacobi and Guass seidal methods, Their algorithms and analysis, solutions of a set of non-linear equations, Iteration methods. Interpolation and extrapolation(derivation and algorithms), Forward and Central finite differences and their symbolic relations.

Unit – III :

Forward interpolation and Extrapolation formula, Newton's backward interpolation and extrapolation formula, Newton's general interpolation and Langrange's interpolation formula for unevenly spaced points, Guass central difference formula, Sterling and Besssel's central difference interpolation formula. Numerical integration(derivation and algorithms), Trapezoidal formula, Error analysis and solution, Simpson rule and Newton-Cotes formula, Differential equations(algorithms and solutions), Picard's methods of successive approximation and Runge Kutta method, Least square fit (algorithm and solution), Linear regression and polynomial regression.

Unit – IV :

Introduction to Modern Digital computers, Organization to a digital computer, computer instructions and programs, Motivation and choices of higher level languages, Reduction in execution time, algorithm writing, Basic elements of C or FORTRAN, Quantities and types, arithmetic expressions, operators, standard arithmetic functions, Assignment statements, Logical assignments, Logical operators and their rules.

Unit – V :

Various types of control statements: If statement, Do statement, nesting of If and Do loops, look up time, optimization of loops, case structure, concept of main program, functions, subprogram and subroutines, Declaration statements, Detailed study of INPUT and OUTPUT statements, formats, writing and execution of programs related to numerical methods, concept of debugging of programs.

Recommended Books:

1. FORTRAN programming by V. Rajaraman
2. Programming in C++ by Balaguruswami.
3. Numerical Analysis by James D. Scarbrough
4. Numerical Analysis by Conte-de-Boor
5. Numerical Computational methods by Patil and Verma (Narosa Pub. New Delhi)
6. Research - Principles, applications and cases by D D Sharma (S Chand and sons)

Paper 102: Selected Topics in Physics

Max. Marks 80

Note: The paper has been divided into five units. In all five questions are to be set, one from each unit. However internal choice within the unit shall be provided.

Unit – I

Occurrence of Plasma in nature, Definition of plasma, concept of temperature, Debye shielding, the plasma parameters, criteria for plasma, Plasma diagnosis by Langmuir probe and by microwave techniques, Waves in plasma, dispersion relation for electromagnetic waves in plasma, E M waves in presence of electric and magnetic field (a) ordinary wave E || B (b) extra ordinary E $\perp$ B, cut off and resonance, EM waves parallel to Bo, Whistler mode, Faraday rotation, Dispersion relation for wave (electromagnetic only), Hydro magnetic wave and Magneto static waves.

Unit – II

Matheissen's rule, choice of material for (i) conductors (ii) contact materials (iii) heating elements (iv) resistance thermometer, Idea of ferroelectrics, Dipole theory of ferroelectric materials, Susceptibility and their measurements (AC and DC both), Super ionic conductors and devices, Thin film deposition techniques (special reference to vacuum evaporation and cathodic sputtering), Concept of vacuum gauge , uniform and non uniform deposits, masking, multiple film deposition, preparation and synthesis of high T_c ceramic superconductors and their properties.

Unit – III

Laue diffraction and stereographic projection, symmetry elements in space groups, The oscillation method, The Weissenberg photographic technique, concept of unique data, use of equivalent reflections, interpretation of intensity data, concept of structure factor, multiplicity, Lorentz, Absorption, polarization and temperature factors, Test for the lack of centre of symmetry, Symmetry in x-ray photography, information from systematic absences.

Unit – IV

Photovoltaic effect, concept of solar cells, idea of conversion efficiency of PN junction solar cells: spectral response, I-V characteristic, temperature and radiation effect, energy band diagram of homojunction solar cells, Schottky barrier and MIS solar cells, Thin film solar cells, Hetero junctions, energy band model of hetero-junction solar cells.

Unit – V

Basic principles, instrumentation and applications of the followings:-

Photometry, Colorimetry and Spectrophotometry, Spectroscopy- Atomic absorption and emission, Basic principles, instrumentation and applications of (i) Electron paramagnetic resonance (EPR) (also known as electron spin resonance (ESR)) (ii) Nuclear magnetic resonance (NMR) (iii) x-ray crystallography (iv) Electron microscopy, light, phase contrast, scanning and transmission.

Recommended Books:

1. Introduction to Plasma Physics by S.S. Chen
2. Plasma Physics by Uman
3. Material Science and Engineering by V.Raghavan
4. Thin film Phenomenon by K.L.Chopra
5. X-ray Structure Determination by M.M.Woolfson
6. Physics of Semiconductor Devices by S.M.Sze.

Course Details *M. Phil. (Physics) II Semester*

JANUARY – JUNE, 2018

Note: There will be one theory paper and a dissertation on a selected topic. Theory paper shall be of 100 Marks, out of which 20 marks are allotted to internal assessment and 80 marks for University examination. Internal assessment comprise of a seminar of 10 marks and a test of 10 marks. Minimum pass marks for the internal assessment is 06. University examination and internal assessment taken together should come to a minimum of 50 marks.

Paper-201: ADVANCED TOPICS IN PHYSICS

Max. Marks 80

Note: The paper has been divided into five units. In all five questions are to be set, one from each unit. However, internal choice within the unit shall be provided.

Unit-I: Plasma Processing and Nano –Materials

Plasma production by dc and ac discharge, Plasma oxidation, Plasma etching, Polymerization, Quantum size effect, Electron-confinement in infinitely deep square- well, Confinement in one and two dimensional well, Idea of quantum structure, Quantum dots and wires.

Unit-II: Methods of Crystal Growth

Growth of Crystals from the solutions and melts (Kyropolous, Czochralski, Bridgemann, float zone Methods), Gel method, Epitaxial growth, Idea of MBE, LPE and CVD techniques.

Unit-III: Thin Films

Evaporation theory: Kinetic energy of gases - mean free path and impingement rates of molecules, evaporation theory - evaporation rates, evaporation mechanisms, directionality of evaporating molecules, Nucleation and Growth: Condensation process and nucleation, Capillary theory of nucleation-various stages of growth (qualitative treatment).

Unit-IV: Advanced Instrumentation

X-ray spectrometers, Raman spectrometer, Mass spectrometer, IR and UV Spectrophotometer, ESCA and STEM microscopy, Environment, Pollution measuring instruments.

Unit-V: Uses of computer

Introduction to Windows, GUI, Control panel, Icon, Taskbar, MS-office: Introduction to MS-word, text writing, editing, table preparation, printing, MS-excel, worksheet preparation, creation of graphs, saving, editing, printing of graphs, mathematical functions, Preparation of slides for power point presentation.

Books Recommended:

1. Introduction to Plasma Physics by S.S. Chen
2. Plasma Physics by Uman
3. X-ray Structure Determination by M.M.Woolfson
4. Crystal growth Process and Methods by P. Santhanaraghawan and Ramaswami
5. Thin film Phenomenon by K.L.Chopra

Course Details ***M. Phil. (Physics) III Semester***

JULY – DECEMBER, 2018

Note: During III semester candidate has to submit a dissertation. There will be an internal pre-presentation of DISSERTATION of 100 marks. The open external viva-voce examination shall be conducted by an external examiner appointed by the University and the supervisor shall act as internal examiner.

During the open viva voce examination, the valuation of the Dissertation will be done by both the external and the internal examiners in terms of whether the dissertation is ACCEPTED or REJECTED. The report shall be submitted to the University.

Jiwaji University, Gwalior

Scheme of Examination

M. Phil. I Semester (Physics) July-Dec. 2017

		Theory		Internal Assessment		Total Marks	
Paper		Max.	Min	Max.	Min	Max.	Min.
101	Research Methodology in Physics	80	24	20	06	100	50
102	Selected Topics in Physics	80	24	20	06	100	50

M. Phil. II Semester (Physics) January-June 2018

		Theory		Internal Assessment		Total Marks	
Paper		Max.	Min	Max.	Min	Max.	Min.
201	Advanced Topics in Physics	80	24	20	06	100	50

M. Phil. III Semester (Physics) July-Dec. 2018

		External viva-voce	Internal Assessment		Total Marks	
		Accepted/ rejected	Max.	Min	Max.	Min.
	Dissertation		100	50	100	50