DEPARTMENT OF PHYSICS AND ELECTRONICS
RANI DURGAVATI VISHWAVIDYALAYA, JABALPUR
Ph.D. in PHYSICS
(From 2016-17 on wards)
Course Work
(According to Ordinance – 16 Revised)
(As per 90th meeting of Co-ordination committee, vide S.No. 34, Dated 26-06-2015 and minutes of meeting of Executive Council ,vide S.No. 20 Dated 19/02/2016)

Ph.D. student shall be required to undertake course work of **15 credits/ 250 marks** of one semester, for which he/she has to deposit a prescribed fee. The course work shall be treated as Pre – Ph. D. preparation. The examination scheme of credit/marks is as approved by the university. The course work comprises of:

S.No.	Title of Paper	Max. Marks	Min. Passing Marks	Credit
1.	Research Methodology	100	50	5
2.	Computer Application	50	25	3
3.	Review of Published Research in the relevant field	50	25	3
4.	Comprehensive Viva	50	25	4

A candidate shall be declared to have successfully completed the course; if/she obtains minimum 50% passing marks or equivalent grade (c) in all the papers separately.

PAPER – I **100 Marks; 5 Credits**

Research Methodology, Quantitative methods and Experimental Techniques

UNIT – I

Research Methods and Design: Nature and objectives of research, Methods of research: historical, descriptive and experimental research process. Research Approaches and types of research. Research and the scientific Methods, Criteria of good research, Defining the research problem.
Research Design: Meaning and need for research design. Features of good design, Different research designs. Basic principles of experimental design. Limitations of experimentation.

UNIT – II

Quantitative Methods: Nature and purpose of mathematical statistics. Experimental and collection of data. Tabulation and statistical inference, analysis of the solution and its Physical significance. Tabular and graphical representation of data. Bar and Pi diagrams, Relative frequencies, sample mean and sample variance. Random experiments, outcomes and events. Probability distribution (Binomial, Poission and Normal). Random sampling. Introduction to random and pseudo random numbers random number generators. Estimation of parameters, confidence intervals. Testing of hypothesis and decisions. types of errors, goodness of fit χ^2 –test, method of least squares, fitting straight lines and polynomials. Data analysis using Fourier techniques. Idea of convolution and deconvolution.

UNIT-III

Quantitative Methods-II: Solution of coupled differential equation by Runge Kutta methods. Application to solution of Schrödinger equation for one dimensional box, one dimensional potential barrier and one dimensional harmonic oscillator. Solution of partial differential equation by the lattice method. Application to the solution of laplace equations(using BASIC).
General idea of mathematical modeling and simulations. Monte Carlo technique. Simulation of radioactive decay and random walk problem (using BASIC).

UNIT-IV

Experimental Techniques-I: General ideas of preparation of crystalline, nanocrystalline, and polymeric materials with grain size in micron as well as nanometer region-crystal Pulling method, solid state reaction method, wet chemical method, sol-gel method, rapid quenching method, r.f. induction method, r.f. sputtering method, mechanical grinding, and size control by capping agent, molecular beam epitaxy, electro-deposition method, gas consolidation method. Idea for measurement of thickness of thin film.

UNIT-V

Experimental techniques-II: General idea of characterization of crystalline, noncrystalline and polymeric materials using Optical Absorption and Emission, Interferometry, Mechanical Testing,TSDC, XRD, SEM, DSC, IR, NMR, AFM, Impedance spectroscopy, General idea of observing space data and its applications, Extracting scientific information from space data, General idea of types of noise in experiments and methods of minimization.

Reference Books :

1. Research Methodology – Method and Techniques – C.R. Kothari, New Age International Publisher, New Delhi – 2004.
2. Research Principles, Application and Laser – D.D. Sharma, S. Chand & Sons. Publisher.
3. Computational Physics – An Introduction – R.C. Verma, P.K. Ahluwalia & K.C. Sharma New Age International Publisher, New Delhi – 1999.
4. Advanced Engineering Mathematics – E. Kreyszig, Wiley Eastern Ltd.
5. Experimental Methods in Modern A.C. Mellissions, A.P. New York, London.
6. Instrumental Methods of Analysis – Willard
7. Thin Films – K.L. Chopra
8. Nanotechnology : Principle and practices – S.K. Kulkarni
9. Semi conductor Measurement – Runyan

PAPER-II 50 Marks; 3 Credits

COMPUTER APPLICATION

UNIT-I

Concept of Computer Architecture : General Idea of Microprocessor types and specifications, Processor sockets and slots, Concept of computer interface, chip set, motherboard, Concept of bus systems and types, Memories : SRAM, DRAM, FRAM, EDORAM, SIMM, DIMM, DDR, Serial and Parallel communication ports : standard, use and configuration, USB, RS232, IEEE 488 interface.

UNIT-II

Introduction to UNIX/Linex operating system : Command cells, special character, command path and syntax, Directory layout, Commands for files systems and finding things, Pipe lining and re-direction, Information commands and other utilities, Concepts of PYTHON with simple examples.

UNIT-III

Advanced concept of Mathematica : Commands and variables, Symbolic computations with example, Manipulation of matrix, Plot of data and function, Use of import and export commands, Reading of data with special examples.

UNIT-IV

Introduction to Multisim Software : Commands, Wiring the schematic, Simulating the circuit, Transferring to PCB layout, Introduction to LAB VIEW : Environment basics, graphical programming, Basic commands and debugging tools, Introduction of exp EYES with computer control data acquisition system.

Unit-V

1. Writing a program in BASIC for single Numerical Intergration of a function by Trapezoidal rule and Gaussian quadrature. Verification by MATHEMATICA/MATLAB /SCILAB.
2. Writing a programme in BASIC for plotting a function. Verification by MATHEMATICA/MATLAB /SCILAB.
3. Writing a programme in BASIC for Fourier Analysis/ Fourier synthesis of periodic signals Verification by MATHEMATICA/MATLAB /SCILAB.
4. Study the behavior of RC circuits using exp EYES.
5. Development of programme to read data in a .DAT file and calculate value of micro hardness and creates plots of micro hardness vs load using EXCEL.
6. Writing a programme in BASIC for least square fitting of data to a state line. Verification by MATHEMATICA/MATLAB /SCILAB.
7. PYTHON code to solve simple Physics problem and creating icon.
8. Design of simple electronic circuit and its simulation using multisim.

References:

1. Computer System Architecture, Moris Mano, Third Edition, Pearson Education
2. IBM PC and Clones : Govindraju, McGraw Hill Education
3. The Complete PC upgrade Guide, Mark Minasi,16th Edition, Joel Fugazotto
4. Complete guide to upgrading and repairing PC : Petter Nortorn, 2nd Edition, Sams
5. Introduction to LINUX command : Victor Gedris.
6. Manual of Mathematica
7. Manual of Multisim by National Instruments
8. Manual of LAB View by National Instruments
9. e-Manual of exp EYES
10. Numerical Methods for Scientific and Engineering Computations : M.K. Jain, S.R. K. Iyenger and R.K. Jain, 3rd Edition, New Age International (P) Ltd
11. Numerical Mathematical Analysis- James B. Scharborough, Oxford & IBH
12. Numerical Methods, E. Balaguruswamy Tata McGraw Hill
13. Computational Physics, K.C. Sharma, P.K. Ahluwalia, R.C. Verma, New Age International (P) Ltd