List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

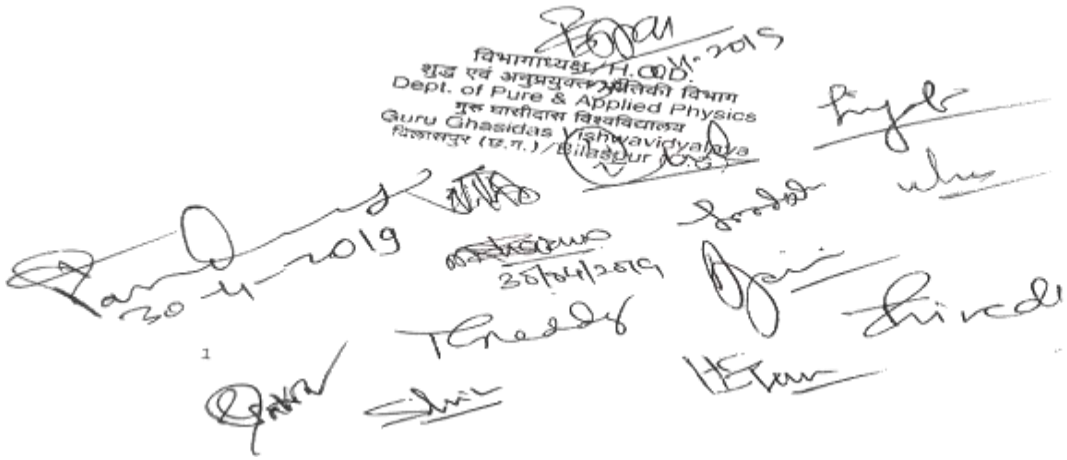
Department : *Pure and applied physics*

Programme Name : Master of Science in Physics

Academic Year : 2018-19

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	PT-104	Basic Electronic Devices
02.	PT-302	Introductional to Computational Physics
03.	PT-401	Experimental Technique in Physics
04.	PT-402	Accelerator Physics
05.	PT_304	Materials science



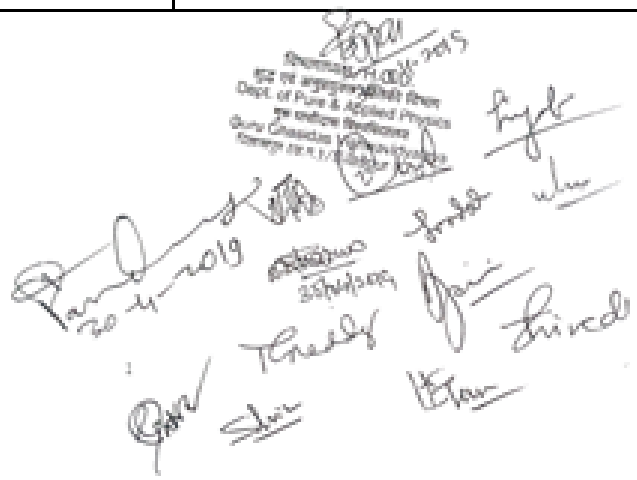
Scheme and Syllabus

Course Structure
M.Sc. Physics Syllabus

Department of Pure and Applied Physics
Guru Ghasidas Vishwavidyalaya, Bilaspur-495 009 (C.G.)

Semester-I	Semester-II
PT-101-Mathematical Physics	PT-201-Atomic and Molecular Physics
PT-102-Classical Mechanics	PT-202- Nuclear and Particle Physics
PT-103-Quantum Mechanics-I	PT-203- Solid State Physics
PT-104-Basic Electronic Devices	PT-204- Quantum Mechanics-II
PT-105- Lab Course	PT-205- Lab Course
Semester-III	**Semester-IV**
PT-301- Statistical Mechanics	PT-401-Experimental Technique in Physics
PT-302-Introductional to Computational Physics	PT-402- Accelerator Physics
PT-303- Electrodynamics	PT-403-Molecular Physics and Group Theory
PT-304-Specilization Material Science –I	PT-404- Specialization Material Science –II
PT-305- Lab Course	PT-405- Project Work

w. e. f.: 2019-20
BoS: 30.04.2019



PT-104 Basics of Electronic Devices

Objectives: This course provides the student with the fundamental skills to understand the basic of semiconductor and components like diode, transistor, FET, MOSFET and operational amplifier It will build mathematical and numerical background for design of electronics circuit & component value.

UNIT I Introduction to Electronic Materials, Energy bands, Fermi levels in intrinsic and doped semiconductors, degenerate semiconductors, derivation of intrinsic carrier concentration, carrier mobility and drift velocity, Resistivity and Conductivity, diffusion phenomenon, Haynes- Shockley experiment, Einstein's relationship, carrier injection & Direct band gap, recombination processes (direct)

UNIT II PN junction: thermal equilibrium condition, depletion region (abrupt and linearly graded junctions), depletion capacitance: C-V characteristics, impurity distribution, I-V characteristics; generation-recombination and high-injection effects, temperature effect, charge storage and transient behaviour; minority carrier storage, diffusion capacitance, junction breakdown: tunnelling effect and avalanche multiplication; semiconductor heterojunctions.

UNIT III Majority Carrier diodes

Tunnel diode- principle of operation and V-I characteristics, Tunnel diode as circuit element, Backward diode- basic ideas, Schottky barrier diode- Formation of barrier, Basic ideas of Schottky Mott theory, Ohmic contacts and heterojunctions

Unit IV Other electronic devices: Electro-optic, Magneto-optic and Acousto-optic effects, Material properties related to get these effects, Important ferro electric, liquid crystal and polymeric materials for these devices, Piezoelectric, electrostrictive and magnetostrictive effects, important materials exhibiting these properties and their applications in sensors and actuator devices.

Outcome: To give knowledge of some basic electronic components and circuits. .To introduce basics of diode and transistor circuits .To understand working of some I C based circuits .To study logic gates and their usage in digital circuit .To expose the students to working of some power electronic dev ices, transducers and application of transducers.

Reference:

1. Semiconductor devices- Physics and Technology by S.M.Sze
2. Introduction to semiconductor devices by M.S. Tyagi

PT-302 Computer Programming and Numerical Analysis

Objectives:

The goal is to provide a basic understanding of the derivation, analysis, and use of these numerical methods, along with a rudimentary understanding of finite precision arithmetic and the conditioning and stability of the various problems and methods. This will help you choose, develop and apply the appropriate numerical techniques for your problem, interpret the results, and assess accuracy.

Unit–I: Basic computer programming, Flow chart, FORTRAN programming preliminaries, FORTRAN constants & variables

Unit–II: Arithmetic expression, I/O statements, control statements (Do, if, while loop), format specification, logical expression, Function/subroutines, File processing, Examples

Unit-III: Methods for determination of Zeroes of linear and nonlinear algebraic equations and transcendental equations, convergence of solutions. Solution of simultaneous linear equations, Gaussian elimination, pivoting, iterative Method, Matrix inversion.

Unit-IV: Eigen values and eigenvectors of matrices, power and Jacobi method Finite Differences, interpolation with equally spaced and unevenly spaced point, Curve fitting Polynomial least squares, Numerical solution of ordinary differential equation, Euler & Runga- Kutta method, Numerical integration, Trapezoidal rule, Simpson's method.

Outcome:

The students will be able to understand the problems (i) systems of linear equations, linear least squares problems, and eigenvalue calculation; (ii) interpolation, approximation, and integration of functions; (iii) FORTRAN programming

References:

1. Sastry : Introductory methods of Numerical Analysis
2. Rajaraman : Numerical Analysis and Fortran Programming

PT-401 Experimental Techniques in Physics

Objective- The course mainly focuses on developing the experimental and instrumentation skills of the students. It is an advanced level experimental techniques course which is useful forthose who opt research in experimental research of Physics.

Unit – I

Signal processing techniques: pre-amplifiers, filters; Measurement techniques: sensors and transducers, general instrumentation, measurement of voltage, current, charge, frequency etc.

Unit – II

Vacuum: Rotary vane pump, Roots blower pump, Diffusion pump, Ionization pump, Diaphragm pump, Adsorption pump, Turbo molecular pump; Measurement of Vacuum: Pirani/Thermocouple gauge, Penning/Ionization Gauge (hot cathode and cold cathode), Leak detection.

Unit – III

Production, properties and applications of x-rays, x-ray absorption and its roll in structure evaluation, x-ray detectors, structure factor, form factor, Small Angle X-ray Scattering (SAXS), x-ray fluorescence (XRF), energy dispersive x-ray (EDX), particle induced x-ray emission (PIXE).

Unit – IV

Surface morphology using Transmission electron microscopy (TEM), Scanning Electron Microscopy (SEM), Scanning Tunneling Microscopy (STM) and Atomic Force Microscopy (AFM). Depth profiling by ion beam sputtering and secondary ion mass spectrometry (SIMS), Low energy ion scattering (LEIS), Rutherford Back Scattering Spectrometry (RBS), Nuclear reaction analysis (NRA).

Outcomes- Understanding of sensors and transducers for temperature, pressure, optical and vibration measurements

- A detailed understanding of vacuum technology involving generation and measurement of vacuum, Principles of rotary pump, diffusion pump, turbomolecular pump and ion pump, Measurement of vacuum using pirani, penning and ion gauges

References:

1. Analog and Digital Electronics for Scientists (2nd Ed.) (Wiley – Inter-science, New York).
2. Surface Analysis Methods in Materials Science : D. J. O. Conner (Springer Verlag).
3. Characterization of Solid Surface: P.F. Kane (Plenum).
4. R. Sahu, Physics of solid, nuclei and particle, Narosa publishing house, 2006.
5. K. L. Chopra,Thin film phenomena , Mcgraw- Hill book company latest Edition.
6. C. C Julian, Introduction of electron Scanning Tunneling Microscopy, Coulombia university press, 2006
7. V. V. Rao, T. B. Ghosh and K. L. Chopra, Vacuum Science and Technology, Allied Publishers – 1998.
8. N. Harris, Modern Vacuum Practice [Freely available on net] (www.modernvacuumpractice.com/editor/user_DocView.asp?DocumentID=18)
9. D. M. Hoffman, B. Singh & J. H. Thomas, Handbook of Vacuum Science and technology, Academic press: 2005.
10. J. M. Lafferty, Foundations of Vacuum science and Technology, John Wiley and Sons, New York, 1998.
11. A. Chambers, R. K. Fitch & B. S. Halliday, Basic Vacuum technology, 2nd Ed, Overseas press, New Delhi -2005 or CRC press – 1998.
12. J. A. Nielson and D. Mc Morrow, Elements of Modern X-ray physics, John Wiley & sons, 2001.
13. G. V. Pavlinsky, Fundamentals of x-ray physics, Cambridge International sci Pub, 2008.

14. A. K. Singh, Advanced X-ray Techniques in Research and Industry, Capital Publishing Company, 2006.

15. N. Kasai, M. Kakudo, X-ray diffraction by macromolecules, Springer, 2005

(vi) Special Paper : Material Science -I

Unit-I: Laws of Thermodynamic functions, Concept of free energy, stability and metastability, Relative stability of phases and phase rule and phase diagrams solid solutions, limited and unlimited solid solubility, interstitial and substitutional solid solutions, Hume Rothery rules, Unary and Binary phase diagrams (Lead-tin and Iron-carbon phase diagram), Lever rule, homogeneous and heterogeneous nucleation, growth and transformation kinetics, microstructural changes during cooling and heating.

Unit-II: Preparation of bulk, thin film and nano-materials: solid state reactions method, sol-gel method, precipitation method, nanomaterials: Bottom up method, cluster beam evaporation, ion beam deposition, chemical bath deposition, Top down method, ball milling, lithography, advantages and disadvantages of various synthesis methods.

Unit-III: Polymers, mechanism of polymerization, Molecular weight distribution in linear polymers, condensation. polymers, size distribution in polymer molecules, Effect of polymer structure on properties conducting polymer , introduction to liquid crystalline materials, mechanism of liquid crystal display devices.

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Unit-IV: Introduction to Dielectrics, magnetic and multiferroic materials: Dielectric materials, linear and non-linear dielectrics, Ferroelectric materials, important characteristics and applications of ferro-electric materials, para, ferro, anti-ferro magnetic properties of materials, hysterisis losses, hard and soft magnetic materials, structure and properties of spinals, garnets and hexagonal ferrites and their uses, magnetic bubbles.

References:

1. Materials Science & Engineering : V. Raghavan
2. Elements of materials science & Engineering : L.H. Van
3. The Structure and properties of materials : R.M. Rose & J. Wulff
4. KP Jain, Physics of semiconductor nanostructures, Narosa Publishing House.