1.1.3

List of Employability/ Entrepreneurship/ Skill Development Courses with Course Contents

Colour Codes		
Employability Contents	**Green**	
Entrepreneurship Contents	**Light Blue**	
Skill Development Contents	**Pink**	
Name of the Subjects/Related to all three Components (Employability/ Entrepreneurship/ Skill Development)	**Yellow**	

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Pure and applied physics*

Programme Name : Master of Science in Physics

Academic Year : 2016-17

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	**PT-304**	Material Science –I
02.	**PT-401**	Experimental Technique in Physics
03.	**PT-402**	Accelerator Physics
04.	**PT-404**	Material Science –II

विभागाध्यक्ष/H.O.D.
शुद्ध एवं अनुप्रयुक्त भौतिकी विभाग
Dept. of Pure & Applied Physics
गुरु घासीदास विश्वविद्यालय
Guru Ghasidas Vishwavidyalaya
बिलासपुर (छ.ग.)/Bilaspur (C.G.)

Scheme and Syllabus

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

PT304

Special Paper : Material Science -I

Laws of thermodynamics, Thermodynamic functions, Concept of free energy, Stability and metastability, Relative stability of phases, Phase rule and phase diagrams, Solid solutions, Limited and unlimited solid solubility, interstitial and substitutional solid solutions, Hume Rothery rules, Uniary (single component) and Binary phase diagrams (Lead - tin and Iron-carbon phase diagram), Lever rule, Homogeneous and heterogeneous nucleation, growth and transformation kinetics, Micro-structural changes during cooling and heating.

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.

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,

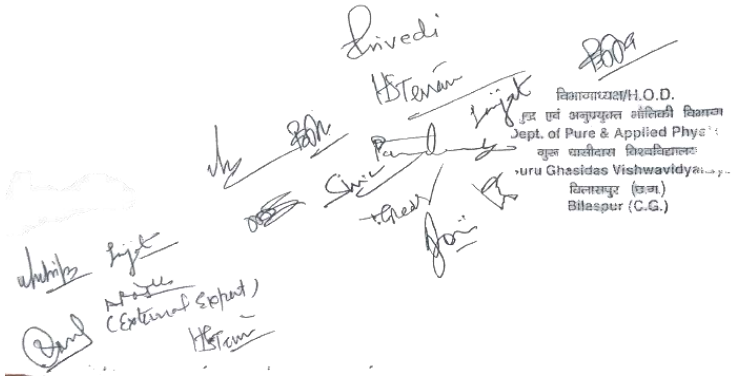
Introduction to Dielectric, magnetic and multiferroic materials: Dielectric materials, linear and non-linear dielectrics, Ferro-electric materials, Important characteristics and applications of ferro-electric materials, Para, ferro, anti-ferro magnetic properties of materials, hysteresis losses, hard and soft magnetic materials, Structure and properties of spinals, garnets and hexagonal ferrites, and their uses. magnetic bubbles.

Books Recommended :

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. Wulf



PT 401

Experimental Technique in 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

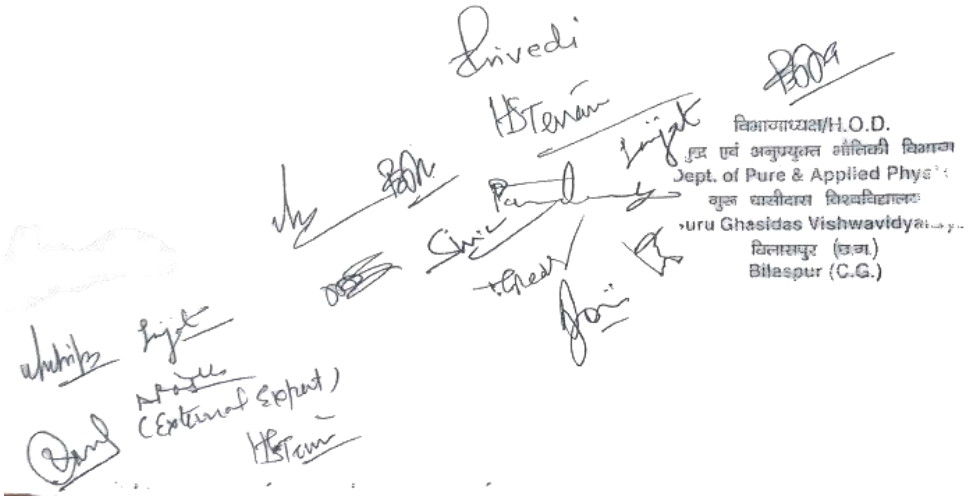
Production, properties and applications of x-rays, x-ray absorption and its roll in structure evaluation, x-ray detectors, structure factor, form factor, Small Angle X-ray Scattering (SAXS), x-ray fluorescence (XRF), energy dispersive x-ray (EDX), particle induced x-ray emission (PIXE).

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).

TEXT AND REFERENCE BOOKS

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.



PT404

Special Paper : Materials Science-II

Elementary idea of Advanced materials: General features and classifications, Structure models for amorphous materials, Structure and properties of metallic glass and amorphous semiconductors, Quasicrystalline materials, Materials for solar cell applications, Hydride materials (Hydrogen storage materials), Materials for Sensors and transducers application,

Materials Characterization techniques: X- ray diffraction methods for materials characterisation, powder diffraction methods, Indexing of powder diffraction patterns, Determination of particle size, Increase in x-ray diffraction peaks of nanoparticles, Shift in photo luminescence peaks, Raman and FTIR spectroscopy of materials, Photoemission microscopy,

Light / Optical Microscopy: Optical microscope- Basic principles & components, Different examination modes (Bright field illumination, Oblique illumination, Dark field illumination, Phase contrast, Polarised light, Hot stage, Interference techniques), Electron Microscope and its applications in materials characterisation.Principle of Scanning Electron Microscope, study of microstructure, determination of grain size etc, Advantages of Neutron diffraction.

Thermal Analysis: Thermal analysis,Thermogravimetric analysis, Differential thermal analysis, Differential Scanning calorimetry, Thermomechanical analysis and dilatometry,

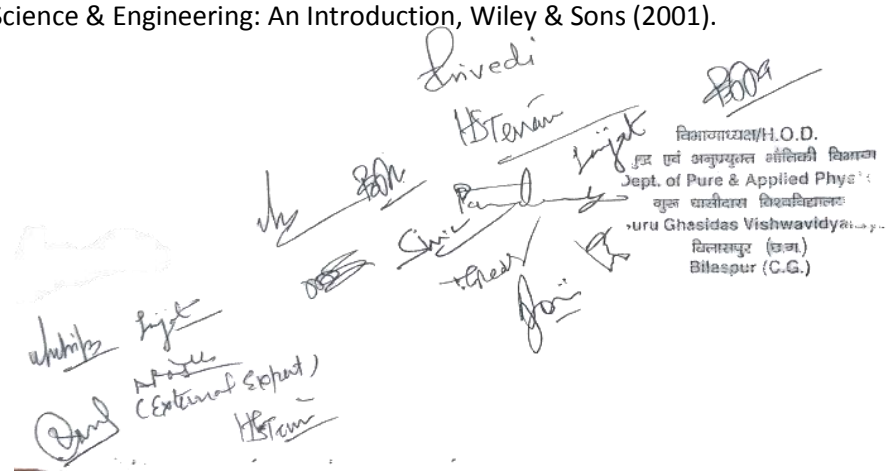
Book Recommended:

1. Introduct ion to solid state physics : C.Kittel

2. Superconduct ivity Today : T.V. Ramkr ishnan and C.V. R.R

3. Raghvan, V., Materials Science & Engineering, PHI (1998).

4. Callister, W.D., Materials Science & Engineering: An Introduction, Wiley & Sons (2001).



PT-402 Accelerator Physics

UNIT-I

History of Accelerators, Brief descriptions of Accelerators centers worldwide, Accelerator Centers in India, Motion of charge particle in electric and magnetic field, Hamiltonian for particle motion Accelerator, Linear betatron motion, Particle motion dipole and quadrupole, Liouville's theorems, Emittance, Brightness DC Accelerators: Van-de-Graaff, Tandem and Pelletron Accelerator, DC accelerators in India, Bilaspur accelerator.

UNIT-II

Circular Accelerator: Synchrotron, Longitudinal equation of motion, evolution of synchrotron phase space ellipse, Injection & extraction, Circular accelerator: Simple cyclotron, Superconducting accelerators, Cyclotrons in India, colliders and storage

UNIT-III

Linear Accelerator: Fundamental properties of accelerator structure; transit time, shunt impedance , Particle Accelerator by EM waves, Longitudinal particle dynamics in LINAC, Transversal beam dynamics in LINAC, Druft tube Linac, Radio Frequency Quadrupole,

UNIT-IV

Production of charged particles, space charges limitation; n-tou product, Extraction & focusing geometries, positive ion sources; penning ionization source, ECR source, Electron beam ion source, negative ion sources; SNICS, TORVIS, duo-plasmatron.

Beam optics: Transfer matrix method, dipole, quadrupole, sextupole, octupole, Einzel lens, solenoid, beam analyzers, steerer, beam line components.

Applications: Solid State physics & materials science, Nuclear physics, high energy particle physics, industrial applications, medical applications

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