List of Revised Courses

Department : *Pure and Applied Physics*

Program Name : *M.Sc. (Physics)*

Academic Year : 2018-19

List of Revised Courses

Sr. No.	Course Code	Name of the Course
01.	PT-103	Quantum Mechanics-I
02.	PT-201	Atomic and Molecular Physics
03.	PT-303	Electrodynamics
04.	PT-401	Experimental Techniques in Physics
05.	PT-402	Accelerator Physics

Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2018-19	
School	: *School of Physical Sciences*
Department	: *Pure and Applied Physics*
Date and Time	: *April 30, 2019 – 11:30 AM*
Venue	: *Smart Class Room*

The scheduled meeting of member of Board of Studies (BoS) of Department of Pure and Applied Physics, School of Studies of Physical Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, was held to design and discuss the M. Sc. (Physics), scheme and syllabi.

The following members were present in the meeting:

1. Dr. R. P. Prajapati
2. Dr. M. N. Tripathi
3. Dr. R. K. Pandey
4. Dr. Parijat Thakur
5. Dr. H. S. Tewari
6. Prof. D. P. Ojha (Exterenal expert)
7. Prof. P. K. Bajpai

The committee discussed and approved the scheme and syllabi. The following courses were revised in the M. Sc. (Physics):

- Quantum Mechanics-I (PT-103)
- Atomic and Molecular Physics (PT-201)
- Electrodynamics (PT-303)
- Experimental Techniques in Physics (PT-401)
- Accelerator Physics (PT-402)

Signature & Seal of HoD

Scheme and Syllabus

PT-103: QUANTUM MECHANICS – I

Objectives: To introduce the modern concepts of quantum mechanics in a stimulating, elegant, exhaustive and explanatory manner. To explore the nature of the microscopic world into substantial depth in terms of meaning and interpretation so as to acquaint the learners to initiate thinking and analyzing the physically observable phenomena quantum mechanically without exceeding the mathematical level of complexity.

Unit-I: Introduction to Schrodinger equation; probability interpretation, probability current, continuity equation; Ehrenfest theorem; Admissible wave functions; Stationary states, Schrodinger equation in one dimensional problems, wells and barriers; Harmonic oscillators by Schrodinger Equation

Unit-II: Uncertainty relation of x and p, States with minimum uncertainty product; General Formalism of wave mechanics; Commutation Relations; Representation of states and dynamical variables; Completeness of eigen functions; Dirac delta function; Bra and ket Notation; Matrix representation of an operator ; Unitary transformation. Solution of Harmonic oscillator by operator method.

Unit-III: Angular momentum in QM; Central force problems: Solution of Schrodinger equation for spherically symmetric potentials; Hydrogen atom problem.

Unit-IV: Time independent perturbation theory; Non-degenerate and degenerate cases; Applications such as Stark effect etc.

Outcome: The basic concepts of quantum mechanics including the solution of wave equation, interpretation of dynamical variables and applying wave mechanicsto various situations in terms of boundary value problems so as to understand the quantum well, barriers and particle motion in different types offorce field (potentials).

References:

1. Quantum mechanics, by L I Schiff
2. Quantum physics by S Gasiorowicz
3. Quantum mechanics by B Craseman and J D Powell

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.)

30-4-2019

30/04/2019

SECOND SEMESTER

PT-201: ATOMIC AND MOLECULAR PHYSICS

Objectives:

Understanding of the classical and quantum mechanical description of the atomic structure and related phenomena. Vector atom model and coupling of spin and angular momenta.

Unit-I: Quantum state of one electron atoms, Atomic orbits, Hydrogen spectrum Pauli's principle, Spectra of alkali elements, Spin orbit interaction and fine structure in alkali spectra.

Unit-II: Equivalent and non-equivalent electrons, normal and anomalous Zeeman effect- Paschen Back effect-Stark effect, Two electron systems –interaction energy in L-S and J-J coupling –Hyperfine structure (qualitative), Line broadening mechanisms (general ideas).

Unit-III: Type of molecules-Diatomic linear symmetric top, asymmetric top and spherical top molecules, Rotational spectra of diatomic molecules as a rigid rotor – Energy levels and spectra of non-rigid rotor-intensity of rotational lines –stark modulated microwave spectrometer (qualitative).

Unit-IV: Vibration energy of diatomic molecule –PQR branches, IR spectrometer (qualitative). General idea of IR and Raman spectroscopy, analysis of simple diatomic molecules, Intensities of vibrational lines. Selection rules.

Outcome:

Understanding of the origin of different molecular spectra. Molecular symmetry, vibrational and rotational spectra and phenomena related to it.

References:

1. Introduction to atomic spectra-H.E.White (T)
2. Fundamentals of molecular spectroscopy-C.B.Benwell (T).
3. Spectroscopy Vol. I II III- Walker & Straughen.

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.)

PT-303: Electrodynamics and Plasma Physics

Objectives:

Understand the characteristics and the Propagation of Electro Magnetic Waves. Describe propagation of electromagnetic waves in different media using Maxwell's equations

Unit-I: Review of Four-vector and Lorentz transformation in four dimensional space, electromagnetic field tensor in four dimensions and Maxwell's equations, Dual field tensor, Wave equation for vector and scalar potential and solution retarded potential, Lienard-Wienchert Potential, Electric and magnetic fields due to a uniformly moving charge and accelerated charge, linear and circular acceleration and angular distribution of power radiated, Bremsstralung,

Unit-II: Motion of charged particle in electromagnetic field, Uniform E and B fields, Nonuniform fields, Diffusion across magnetic fields, Time varying E and B fields, Adiabatic invariants, First, second and third adiabatic invariant.

Unit-III: Elementary concepts of plasma, derivation of moment equation from Boltzman equation, plasma oscillations, Debye shielding, plasma parameters,

Unit-IV: Hydrodynamical description of plasma, Fundamental equations, hydrodynamic waves, magnetosonic Alfven waves, Wave phenomena in magneto plasma, polarization, phase velocity, group velocity, cut-offs, resonance for electromagnetic wave propagating parallel and perpendicular to the magnetic field, Appleton-Hartee formula and propagation through ionosphere and magnetosphere,

Outcome: Students will be able to understand the Maxwell's equations and electromagnetic boundary conditions. The laws of reflection, refraction are outcomes of electromagnetic boundary conditions. They will also be able design dielectric coatings which act like antireflection coatings. They will be able to distinguish between a good metal and a good dielectric. Students will be grasped the idea of electromagnetic wave propagation through wave guides and transmission lines.

References :

Penofsky and Philips, Classical electricity and Magnetism.
Bittencourt, Plasma Physics
Chen, Plasma Physics.

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.)

30-4-2019

30/04/2019

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), Lowenergy 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

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).

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.)

30-4-2019

30/04/2019

PT-402 Accelerator Physics

Objective- To develop the basic skills and knowledge of accelerators, ion sources and beam transport.

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

Outcomes-

- Students understand the basic principle, type of accelerators, working and operation of Accelerators.

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.)