SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar-388120

B.Sc. (Semester - 4)

Subject: Physics

Course: US04CPHY21

Electromagnetic Theory and Spectroscopy

(Four Credit Course –4 Hours per week)

(Effective from June-2019)

UNIT - I Electrostatics

Electric field: Brief introduction to Gradient, Divergence and Curl, Line, Surface and Volume integrals, Spherical and Cylindrical Coordinate Systems, The Dirac delta function, Coulomb's Law, The Electric field, Continuous charge distribution, **Divergence and curl of Electrostatic fields:** Field lines, Flux and Gauss's law, The Divergence of **E**, Applications of Gauss's law, The Curl of **E**, **Electric Potential:** Introduction to potential, Comments on potential, Poisson's equation and Laplace's equation, The potential of a localized charge distribution, Boundary conditions, **Work and Energy in Electrostatics:** The work done to move a charge, The energy of a point charge distribution, The energy of a continuous charge distribution

UNIT - II Magnetostatics

The Lorentz Force Law: Magnetic fields, Magnetic forces, Cyclotron motion, Cycloid motion, Currents, **The Biot-Savart law:** Steady currents, The Magnetic field of a steady current and its applications, **The Divergence and Curl of B:** Straight-Line currents, The Divergence and Curl of **B**, Ampere's law and its applications, Comparison of Magnetostatics and Electrostatics, **Magnetic Vector Potential:** The Vector potential, Boundary conditions, **Magnetization:** Diamagnets, Paramagnets, Ferromagnets, Torques and forces on magnetic dipoles, Effect of a magnetic field on atomic orbits

UNIT - III Atomic Spectra

Investigation of Spectra, Production of Spectra, Types of Spectra, Wave Number, Shortcomings of Bohr theory, Criticism and limitations of old quantum mechanical models, The Spinning Electron, Space Quantization, Quantum Numbers and their Physical Interpretation, Fine structure of Hydrogen atom, Spectral terms and their notations, Positronium, Mesonic atoms, L-S Coupling, J-J Coupling, Experimental study of Zeeman Effect, Classical Interpretation of Normal Zeeman Effect, Vector model and normal Zeeman effect, Paschen-Back effect, Stark Effect

UNIT - IV X-ray Spectra

Production of X-rays, Origin of X-Radiations according to electromagnetic theory, X-rays, Light and Electromagnetic Spectrum, Measurement of X-Radiations, Diffraction of X-Radiations, Bragg's law, Laue spots, Bragg's spectrometer, Continuous X-ray spectrum, Characteristic Emission Spectrum, Characteristic absorption Spectrum, A Close Survey of Emission Spectrum, Explanation of Emission and Absorption Spectra, Energy levels, Comparison of Optical and X-ray Spectra, Moseley's Law, The Fluorescence yield and Auger Effect, Satellites

Text Books:

1. Introduction to Electrodynamics
   David J Griffiths, (4th Edition) Prentice-Hall of India Private Ltd.
2. Elements of Spectroscopy
   S L Gupta, V Kumar, R C Sharma
   (24th Edition) Pragati Prakashan

Reference Books:

1. Electricity and Magnetism
   A S Mahajan and A A Rangwala
   Tata McGraw Hill Publishing Company Ltd
2. Molecular structure and Spectroscopy
   G Aruldhas, Prentice-Hall of India Private Limited

SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar-388120

B.Sc. (Semester - 4)

Subject: Physics

Course: US04CPHY22

Classical, Quantum and Solid State Physics

(Four Credit Course –4 Hours per week)

(Effective from June-2019)

UNIT- I **Inverse square law field, potential and Motion in a central force field**

Introduction, Law of gravitational and electrostatic forces, Gravitational and electrostatic fields and potentials, Lines of force and equipotential surfaces, Fields and potentials of dipole and quadrupole, Field equations, Equivalent one body problem, Motion in a central force field, General features of the motion, Motion in an inverse square law force field, Equation of orbit, Kepler's laws of planetary motion

UNIT- II **Formulation of the Schrödinger Equation**

Quantum theory of radiation: Introduction, Black body radiation, Wien's law, Rayleigh Jean's law, Planck's radiation formula, Compton Effect, De Broglie's Hypothesis, The motion of a free wave packet: Classical approximation and uncertainty principle, Uncertainties introduced in the process of measurement, Approximate classical motion in slowly varying fields, **The Schrödinger Equation:** A free particle in one dimension, Generalization to three dimensions, The operator correspondence and the Schrödinger equation for a particle subject to forces, **Physical Interpretation and Condition on Ψ:** Normalization and probability interpretation, Non-normalizable wave functions and box-normalization, Conservation of probability, Expectation value and Ehrenfest's theorem, Admissibility conditions on the wave function

UNIT-III **Crystal Physics and X-Ray Diffraction**

Introduction, Lattice points and space lattice, The basics and crystal structure, Unit Cells and lattice parameters, Unit Cell versus Primitive Cell, Crystal systems, Crystal symmetry, The twenty three symmetry elements in a cubic crystal, Combination of symmetry elements, Rotation-Inversion axis, Translation symmetry elements, Space groups, The Bravais space lattices, Metallic crystal structures(sc, bcc, fcc, hcp) , Relation between the density of crystal materials and lattice constant in a cubic lattice, Other cubic structures, Directions planes and Miller Indices, Important features of Miller indices of crystal planes, Important planes and directions in a cubic crystals, Separation between lattice planes in cubic crystal

UNIT-IV **Interatomic Forces and Bonding in Solids**

Introduction, Force between atoms, Cohesion of atoms and cohesive energy, Calculation of cohesive energy, Bonding in solids, Ionic bonding, Bond energy of NaCl molecule, Calculation of lattice energy of ionic crystals, Calculation of Madelung constant of ionic crystals, Calculation of repulsive exponent from compressibility data, The Born–Haber cycle, Properties of ionic solids, Covalent bond, Saturation in covalent bond, Directional nature of covalent bond, Hybridization, Properties of covalent compounds, Metallic bond, Properties of metallic crystals, Intermolecular bonds, Dispersion bonds, Dipole bonds, Hydrogen bonds, Van der Waals bonding, Atomic size, Ionic radii, Empirical ionic radii, variation of ionic radii, Covalent radii, Metallic radii, Van der Waals radii

Text Books:

1. Introduction to Classical Mechanics
   R G Takwale and P S Puranik
   Tata McGraw Hill Education Pvt Ltd.
2. Atomic Physics
   J B Rajam (Reprint 2002), S Chand & Co. Ltd.

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3. A Textbook of Quantum Mechanics
   P M Mathews and K Venkatesan, (2nd Edition),
   Tata McGraw Hill, New Delhi
4. Solid State Physics
   S O Pillai, (7th Edition), New Age International Publisher
5. Solid State Physics
   M A Wahab, (2nd Edition), Narosa Publishing House.

Reference Books:

1. Classical Mechanics
   Herbert Goldstein, Charles P. Poole and John Safko
   Third Edition, Pearson
2. Classical Mechanics
   Aruldhas, PHI Learning Pvt Ltd, New Delhi
3. Concepts of Modern Physics,
   Arthur Baiser
   Tata McGraw Hill, New Delhi
4. Introduction to Quantum Mechanics
   David J Griffiths, Second Edition, Pearson
5. Quantum Mechanics Theory and applications
   Ajoy Ghatak and S Lokanathan, McMillan Publishers India Limited, Delhi
6. Introduction to Solid State Physics
   C Kittel, (7th Edition) Wiley Eastern Ltd.
7. Elements of Solid State Physics
   J P SrivastavaPrentice-Hall of India

SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar - 388 120

B.Sc. (Semester - 4)

Subject: Physics (Practical)

Course No. US04CPHY23

(Two Credit Course –4 Hours per week)

(Effective from June-2019)

List of Practical:

1. Determination of 'g' by Kater's pendulum (variable distance)
2. Characteristics of FET
3. Study of a Hartley Oscillator
4. Study of a Colpitts Oscillator
5. Frequency Response of RC Coupled amplifier (with negative feedback)
6. Inductance L by Anderson's Bridge
7. Study of L-C-R parallel resonance circuit
8. Hybrid parameters of a BJT (CE configuration)
9. Verification of Stefan's law
10. Numerical Integration

Note: To provide flexibility up to the maximum of 20% of total experiments can be replaced/ added as per the availability of local facilities of the college.

Books Recommended:

1. Advanced Practical Physics for students
   B L Wosnop and H T Flint
   Methuen and Co. Ltd., London
2. B.Sc. Practical Physics
   C L Arora
   S.Chand & Co. Ltd., New Delhi
3. Advanced Practical Physics
   M S Chauhan and S P Singh
   Pragati Prakashan, Meerut
4. Advanced Practical Physics
   S L Gupta and V Kumar
   Pragati Prakashan, Meerut

SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar - 388 120

B.Sc. (Semester - 4)

Subject: Physics (Practical)

(Two Credit Course –4 Hours per week)

(Effective from June-2019)

List of Practical:

1. Miller Indices using X-Ray diffraction pattern
2. de-Broglie Relation using electron diffraction pattern
3. Wave length of a monochromatic light 'λ' using double slit method
4. Study of a Thermocouple
5. Wave length of a monochromatic light 'λ' using Lloyd's mirror
6. Cauchy's Constants
7. Absorption co-efficient of liquid using photocell
8. Identification of chemical elements using absorption spectra
9. To study double refraction in Calcite OR Quartz prism
10. Error analysis

Note: To provide flexibility up to the maximum of 20% of total experiments can be replaced/ added as per the availability of local facilities of the college.

Books Recommended:

1. Advanced Practical Physics for students
   B L Wosnop and H T Flint
   Methuen and Co. Ltd., London
2. B.Sc. Practical Physics
   C L Arora
   S.Chand & Co. Ltd., New Delhi
3. Advanced Practical Physics
   M S Chauhan and S P Singh
   Pragati Prakashan, Meerut
4. Advanced Practical Physics
   S L Gupta and V Kumar
   Pragati Prakashan, Meerut