

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar-388120
B.Sc. (Semester - 4)
Subject: Physics
Course: US04CPHY01
Optics, Spectroscopy, Electrostatic & Magnetism
(Three Credit Course –3 Hours per week)
(Effective from June-2011)

UNIT- 1 Polarization - I

Introduction, Polarization of transverse waves, Polarization by reflection, Brewster's law, Double refraction, Properties of ordinary ray and extraordinary ray, Principal section of a crystal, Principal plane, Nicol prism, Nicol prism as an analyzer.

UNIT - 2 Polarization – II

Huygens explanation of double refraction in uniaxial crystal., Elliptically and circularly Polarised Light, Superposition of waves linearly polarized at right angles, Quarter Wave plate, Half Wave Plate, Production of Plane, Circularly and Elliptically Polarised Light, Detection of Plane, Circularly and Elliptically Polarised Light.

UNIT – 3 Spectroscopy - I

Investigation of spectra, Production of spectra, Types of spectra, Wave number. Pauli's exclusion principle, Spin orbit splitting, L-S and j-j coupling, Zeeman effect, Explanation of normal Zeeman effect, Anomalous Zeeman effect, Stark effect. Stern –Gerlach Experiment, Production of x-rays, properties of x-rays, uses of x-rays, comparison of optical and x-ray spectra.

UNIT – 4 Spectroscopy - II

Molecular Spectra and types of molecular spectra, Regions of the spectrum, The Molecules as rigid rotator: Explanation of Rotational Spectra. Diatomic molecule as a non-rigid rotator, Determination of the inter nuclear distance and moment of inertia, Isotope effect in rotational spectra, Raman effect and its salient features, Observation of Raman spectra. Classical theory of Raman Effect, Quantum Theory of Raman Effect

UNIT- 5 ELECTROSTATICS

Electric Field: Introduction to electric field, 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, Application of Gauss's law, The Curl of E
Electric Potential: Introduction to electric potential, comments on potential, Poisson's equation and Laplace's equation

UNIT – 6 MAGNETOSTATICS

Magnetic Fields in Matter: Diamagnets, Paramagnets and Ferromagnets, Torques and Forces on magnetic Dipoles, Magnetization, The equation $B = \mu_0 M + \mu_0 H$, Hysteresis, B-H curve

The Lorentz Force Law: Magnetic Fields, Magnetic Forces, Currents

The Biot- Savart law: Steady Currents, The Magnetic Field of a Steady Current

The Divergence and Curl of B: Straight-line currents, The Divergence and Curl of B, Comparison of Magnetostatics and Electrostatics

Scope of syllabus:

Text book:

1. A Text Book of Optics
N. Subrahmanyam and Brijlal S
Chand & Company Limited
2. Elements of Spectroscopy
S.L. Gupta, V. Kumar and R.C. Sharma
Pragati Prakashan , Meerut
3. Introduction to Electrodynamics (Third edition)
David J Griffiths,
Pentice-Hall of India Private limited,

Reference book:

1. A Text Book of Light
D.N. Vasudev
Atma Ram and Sons
2. Physical Optics
A.K. Ghatak,
Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. Principles of Physics
N. Subramanyam and Brijlal ,
S. Chand & Company Ltd. New Delhi,
4. Electromagnetics
B.B. Laud,
New age international Publishers
5. Electricity and Magnetism
A.S. Mahajan and A.A. Rangwala
Tata McGraw – Hill Publishing Company Limited
6. Molecular Structure and Spectroscopy
G. Aruldhas
Prentice-Hall of India Pvt. Ltd., New Delhi

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar-388120
B.Sc. (Semester - 4)
Subject: Physics
Course: US04CPHY02
Classical, Quantum and Nuclear Physics
(Three Credit Course –3 Hours per week)
(Effective from June-2011)

UNIT - 1 Inverse square law - Field and Potential

Laws of gravitational and electrostatic force, Gravitational and electrostatic fields and potentials, Lines of force and equipotential surfaces, Fields and potential of dipole and quadrupole, Potential and intensity due to charge distribution in the form of a spherical shell, Potential due to charge distribution at large distance, Field Equations

UNIT – 2 Motion in a central force field

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 the orbit, Kepler's law of planetary motion

UNIT – 3 Quantum Mechanics -I

De-Broglie hypothesis, The motion of a free wave packet classical approximation and the uncertainty principle, Uncertainties introduced in the process of measurement, Diffraction phenomena: Interpretation of the wave particle dualism, Complimentarity, The Schrodinger equation, A free particle in one dimension, Generalization to three dimensions, The operator correspondence and the Schrodinger equation for a particle subject to forces, Normalization and probability interpretation, Non-normalizable wave functions and box normalization

UNIT – 4 Quantum Mechanics - II

Conservation of probability, Expectation values; Ehrenfest's theorem, Admissibility Conditions, Stationary states: The Time-independent Schrodinger equation, Particle in a Square Well potential, Bound States in Square Well ($E < 0$), The Square Well: Non-localized states ($E > 0$)

UNIT – 5 Artificial Nuclear Disintegration

Transmutation by alpha particles: alpha-proton reactions, The balance of mass and energy in nuclear reactions, The neutron: alpha neutron reactions, Transmutation by Protons, Transmutation by Deuterons, Transmutation by Neutrons, Transmutation by Photons

UNIT – 6 Artificial Radioactivity

The discovery of artificial radioactivity, The artificial radionuclide, electron and positron emission, orbital electron capture, The transuranium elements, The artificial radionuclide : alpha emitters, The velocity and energy of alpha-particles, The absorption of alpha-particles: range, ionization and stopping power

Scope of syllabus:

Text book:

1. Introduction to classical mechanics
R. G. Takwale and P. S. Puranik,
Tata McGraw Hill Publishing Co. Ltd., New Delhi
2. A Text Book of Quantum Mechanics
P. M. Mathews and K. Venkatesan,
Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. Nuclear Physics
Irving Kaplan,
Narosa publishing House, New Delhi

Reference book:

1. Classical Mechanics
H. Goldstein,
Narosa Publishing House, New Delhi
2. Quantum Mechanics (Theory and Applications) 4th Edition
Ajay Ghatak, S. Loknathan,
Macmillan India Ltd.

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar - 388 120
B.Sc. (Semester - 4)
Subject: Physics (Practical)
Course No. US04CPHY03
(Three Credit Course –6 Hours per week)
(Effective from June-2011)

List of Practical

1. Characteristics of FET
2. Miller Indices
3. De-Broglie Relation
4. ' λ ' by Double Slit
5. Hartley Oscillator
6. Colpitts Oscillator
7. Thermal Conductivity (K) by Lee's method
8. Frequency Response of RC Coupled amplifier with negative feedback.
9. Parallel Resonance
10. Lloyd's mirror
11. Thermocouple
12. Cauchy's Constants
13. Stefan's Index
14. Numerical Integration
15. Propagation of errors

Note:

To provide flexibility up to the maximum of 20% of total experiments can be replaced/ added to the list by the board of studies.

SARDAR PATEL UNIVERSITY
B.Sc. (Semester - 4)
Subject: Biophysics
Course: US04EPHY01
(Two Credit Course –2 Hours per week)
(Effective from June-2011)

UNIT - 1 Biomechanics

Introduction to Biophysics: The paradigm of life, Life feeds on Negative Entropy, The Living Automation, Order out of Chaos, Biostatics: Forces and Torques ,Biophysics of Muscle: Muscle Power, Mass specific Muscle Power; Strength of Bones; Biodynamics: Newton's Laws, Frictional forces and Stokes Law; Locomotion on Land: Walking, Jumping, Propelling; Locomotion in Air: General Aerodynamics, Wind Force, Bird's Aerodynamics, Turbulence, Power of Flight; Locomotion in Water; Role of Gravity.

UNIT – 2 Physics of Vision

Wave nature of light: Polarization, Particle nature of light; Geometrical Optics: Refraction, Gradient-index Lens, Spherical Aberration, Chromatic Aberration; Refractive Power: Refractive power of Eye, Reduced Eye model, Accomodation, Refractive errors; Retina and Photoreceptors: Photochemistry of Receptor cells, intensity Sensitivity, Spectral Sensitivity; Photoreceptors and fiber optics: Fiber Optics; Resolving power of Eye, Diffraction; Polarization and Vision: Optical rotation, Birefringence and Dichroism.

UNIT – 3 Light and Electron Microscopy

Introduction, Elementary geometrical optics, The limits of resolution, Different types of microscopy: Bright field microscopy, Dark field microscopy, Phase contrast, Fluorescence microscopy, Polarizing microscopy.

Introduction, Electron optics, The transmission electron microscopy (TEM), The scanning electron microscopy (SEM), Preparation of the specimen for electron microscopy, Image reconstruction, Electron diffraction, The tunnelling electron microscopy, Atomic electron microscopy.

UNIT – 4 Biophysics and Gas Transport

The ideal gas: Dalton's law of partial pressure, vapour pressure, Solutions and Henry's law; convective transport of gases: Airway Resistance, Transport of O₂ in blood, Transport of CO₂ in blood; Diffusion of gases: Fick's laws: Gas exchange in Lungs, Gas Exchange in Tissues, Physiology of respiration: Physics of Alveoli, Work of breathing.

Text book:

1. Elementary Biophysics
P K Srivastava
Narosa Publishing House
2. Biophysics (second edition)
Vasantha Pattabhi, N Gautham
Narosa Publishing House

SARDAR PATEL UNIVERSITY
B.Sc. (Semester - 4)
Subject: Advanced Geophysics & Remote Sensing
Course: US04EPHY02
(Two Credit Course –2 Hours per week)
(Effective from June-2011)

UNIT -1 Principles, types and uses of Geophysical methods - I

Gravity methods

Introduction, Gravity and Geology Measuring, Density and Specific Gravity, Gravity Survey, Gravity Data Reduction, Free Air Correction Bouguer Correction, Latitude Correction, Terrain Correction. their Applications(Introduction only)

Geomagnetic methods

Magnetic Minerals, Earth's Magnetic Field, Magnetic Instruments, Magnetic Surveys, their Applications(Introduction only)

UNIT -2 Principles, types and uses of Geophysical methods –II

Seismic Methods

Seismic Refraction Profiling, Seismic Reflection Profiling, Continuous Surface-Wave System (CSWS), Down hole Seismic Surveys, Cross hole Seismic Surveys, Cross hole Seismic Tomography and their Applications(Introduction only)

UNIT – 3 Introductions to Remote Sensing & Electromagnetic Radiation

Introduction, Sun and atmosphere, Concept of signatures, Multi-spectral concept, Remote sensing system, Remote sensors, Platforms, Data products generation, Data analysis : visual interpretation and digital techniques, End utilization, Why observe earth from space?, Introduction to electromagnetic radiation, Polarization, Coherent Radiation, Some more wave properties of EM radiation : Diffraction and Doppler effect, Attenuation, Absorption, Scattering, Quantum nature of EM radiation

UNIT – 4 Fundamentals of Radiometry

Measurement geometry – concept of the solid angle, Radiometric quantities : radiant energy, radiant flux, Irradiance, radiant intensity, Radiance, Surface characteristics for radiometric measurements, Observation geometry in remote sensing, Principles of satellite motion, Kepler's laws, Locating a satellite in space, Types of orbit, Geosynchronous and geostationary orbit, Sun-synchronous orbit

Scope of Syllabus:

1. Core and Geomagnetism
Jacobs J.A.
Academic Press, London
2. D.C.Geolectric Sounding: Principles and Interpretation
Bhattacharya & Patra
Banaras Hindu University
3. Fundamentals of Geophysical Prospecting
Clarbout Telford et al
Banaras Hindu University
4. Gravity and Magnetics
B.S.R Rao, I.V.Radhakrishna Murthy and C. Visweswara Rao
Banaras Hindu University
5. Remote Sensing ,
Teekshadulu & Rajan
Indian Academy of Sciences
6. Fundamentals of Remote Sensing,
George Joseph
University Press, New Delhi