Syllabus

Bridging Semester for BS Physics

Intake from Associate Degree in Science

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Course Code	Course Title	Credit Hours
PHY-505	Modern Physics-I	3 (3 – 0)
PHY-506	Properties of Matter	4(3 – 1)
PHY-507	Circuit Theory	4 (3 – 1)
PHY-508	Optics	3 (3 – 0)
PHY-509	Modern Physics-II	4 (3 -1)
Total		**18**

PHY-505 MODERN PHYSICS-I Credit Hours: : 3(3-0)

Pre-requisites: Mechanics, Electricity and Magnetism

Objective(s):
To understand the non-classical aspects of Physics, the emphasis is on the applications of Quantum Physics in microscopic-scale Physics, atomic and molecular structure and processes.

Motivation for Non--Classical Physics: Blackbody radiation and ultraviolet catastrophe, Planck's quantization.
Wace-Particle Duality: Photoelectric effect, Compton effect, production and properties of X-rays, diffraction of X-rays, concept of matter waves, de Broglie relationship, Quantum interference electrons are waves, electron diffraction, particulate nature of matter, contributions of Faraday (atoms exist), Thomson (electron exists), Rutherford (nucleus exists) and Bohr (quantization of energies inside
an atom), wave packets and wave groups, dispersion, Heisenberg uncertainty principle, direct confirmation of quantization through Franck-Hertz experiment and spectroscopy, working of electron microscopes.
Quantum Mechanics in One Dimension: The concept of a wavefunction, time independent Schrodinger equation and interpretation of the equation, solving the Schrodinger equation for a free particle, for a particle inside an infinite box, relationship between confinement and quantization, working of a CCD camera.
Quantum Mechanical Tunneling: Concept of tunneling, reflection and transmission of wave functions from barriers, applications: radioactivity, scanning tunneling microscope, decay of black holes.

Recommended Books:
1. R.A. Serway, C.J. Moses and C.A. Moyer, "Modern Physics", Brooks Cole, 3rd ed. 2004.
2. Paul A. Tipler and Ralph A. Llewellyn, "Modern Physics", W H Freeman and Company 6th ed. 2012.
3. Arthur Beiser, "Concepts of Modern Physics", McGraw-Hill, 6th ed. 2002.
4. R. M. Eisberg and R. Resnick, "Quantum Physics of Atoms, molecules, Solids, Nuclei and Particles", John Wiley, 2nd ed. 2002.

PHY-506 PROPERTIES OF MATTERS Credit Hours: 04(3-1)

Objective To study some basic properties of matter including elasticity, elastic modulus and liquid flow, viscosity of a liquid.

CONTENTS:
ELASTIC PROPERTIES OF MATTER: Physical Basis of Elasticity; Tension, Compression & shearing, Different Moduli of Elasticity; Poisson's Ratio; Relation between Elastic Moduli; Experimental Methods for determination of Elastic Moduli; Determination of Poisson's Ratio.
VISCOSITY: Streamline and Turbulent Flow; Flow of a Liquid through a Capillary Tube (Poiseuille's Formula); Experimental Determination of the Coefficient of Viscosity of a Liquid; Motion in a Viscous Medium (Stokes's Formula'); Measurement of viscosity of liquid by falling sphere method (Stokes's method).

SURFACE TENSION: Molecular Theory of Surface Tension; Angle of Contact and Curvature of Liquid Surface; Surface Energy and Surface Tension; Formation of Drops and Bubbles; Capillarity and Measurement of Surface Tension of a Liquid.

Practical:

1. Modulus of Rigidity by Static method (Barton's Apparatus).
2. Modulus of Rigidity by Dynamic method (Maxwell's needle).
3. Measurement of viscosity of liquid by Stoke's / Poiseulli's method.
4. Surface tension of water by capillary tube method.
5. To study the conservation of energy (Hook's law).

BOOKS RECOMMENDED

1. Resnick, D. Halliday and K.S. Krane 'Physics' Volume I and II 5/e .John Wiley (2002)
2. Halliday. R. Resnick and J. Walker 'Fundamentals of Physics' John Wiley Latest Edition
3. I.D. Young and R.A. Freedman 'Sears and Zamansky's University Physics' 11/e Pearson Education (2004)
4. P.A. Tipler 'Physics for Scientists and Engineers' 5/e, W.H. Freeman (2003)
5. R..A. Serway and J.W. Jewett Jr. 'Physics for Scientists and Engineers' 6/e or Latest Edition, Thomson (2004)
6. D C. Giancoli 'Physics for Scientists and Engineers with Modern Physics' 2/e or Latest edition Prentice Hall

PHY- 507 CIRCUIT THEORY Credit Hours: 4(3-1)

OBJECTIVE

To study the combinations of circuit different, related laws and rules, different techniques of circuit analysis, network theorems, charge storing devices and make the students familiar with circuit maker software.

CONTENTS

(1) Introduction:

Resistance, temperature effect on resistance, thermistors, super conductors, types of resistors, varistor, strain gauge, resistor color code, ohms law, power, and energy, efficiency, home electricity billing system.

(2) Series and parallel circuits:

series circuit, voltage sources in series, Kirchhoff's voltage law, voltage divider rule, voltage sources and ground, voltage regulation and the internal

resistance of voltage sources, protoboards (breadboards), parallel circuit, Kirchhoff's current law, current divider rule, voltage sources in parallel, open and short circuits, series and parallel combinations, potentiometer loading

(3) Method of analysis:

current sources, source conversions, current sources in parallel, current sources in series, branch-current analysis, mesh analysis (general approach), mesh analysis (format approach), nodal analysis (general approach), nodal analysis (format approach), bridge networks, y- delta and delta –y conversions,

(4) Network theorem:

Superposition theorem, Thévenin's theorem, Norto's theorem, maximum power transfer theorem, Millman's theorem, substitution theorem, reciprocity theorem

(5) Capacitors:

Capacitance, capacitor construction, internal structure and capacitance analysis, types of capacitors, temperature effects, capacitor labeling, transients in capacitive networks (the charging phase, discharging phase), instantaneous values, capacitors in series and in parallel, energy stored by a capacitor

(6) Inductors:

Magnetic field, electromagnets and their applications, inductance, inductor construction, induced voltage, RL transients, reluctance, ohm's law for magnetic circuits, magnetizing force, Ampère's circuital law, RLC series and parallel circuits.

Practical:

1. Prove of Kirchhoff voltage law using Series circuits.
2. Prove of Kirchhoff current law using parallel circuits.
3. Determine the charging and discharging effect of capacitor.
4. Determine instantaneous values, capacitors in series and in parallel
5. Study of RL/ RLC circuits

SOFTWARE: Analysis of circuits in all chapters using multisim or circuit maker software

BOOKS RECOMMENDED

1. Robert L. Boylestad. Introductory Circuit Analysis, 12th /e,
2. Hayt & Kimberly Circuit Analysis - Electrical and Computer Engineering, McGraw-Hill Book Company 8th /e

PHY-508 OPTICS Credit Hours: 3(3-0)

Pre-Requisites: Waves and Oscillations

Objective(s): To understand the optical phenomena and their uses in physical systems

Propagation of Light & Image Formation: Huygens' Principle, Fermat's Principle, Laws of Reflection and Refraction, Refraction at a Spherical Surface, Thin Lenses, Newtonian Equation for a Thin Lens.

Matrix Methods in Paraxial Optics: Ray Transfer Matrices, Thick Lens, Significance of System Matrix Elements, Cardinal Points of an Optical System with examples, Optical Instruments including Simple Magnifiers, Telescopes and Microscopes, Chromatic and Monochromatic Aberrations, Spherical Aberrations, Coma, Distortion, Stops, Pupils, Windows.

Superposition & Interference: Standing Waves, Beats, Phase and Group Velocities, Two-Beam and Multiple-Beam Interference, Thin Dielectric Films, Michelson and Fabry-Perot Interferometers, Resolving Power, Free-Spectral Range.

Polarization: Jones Matrices, Production of Polarized Light, Dichroism, Brewster's Law, Birefringence, Double Refraction.

Fraunhofer Diffraction: from a Single Slit, Rectangular and Circular Apertures, Double Slit, Many Slits, Diffraction Grating, Dispersion, Resolving Power Blazed Gratings.

Fresnel Diffraction: Zone Plates, Rectangular Apertures, Cornu's Spiral

Coherence & Holography: Temporal Coherence, Spatial Coherence, Holography of a Point object and an Extended Object

Laser Basics: Stimulated Emission, Population Inversion, Resonators, Threshold and Gain, Multi-layered Dielectric Films.

Recommended Books:

1. F.Pedrotti, L.S. Pedrotti and L.M. Pedrotti,"Introduction to Optics", Pearson Prentice Hall, 3rd ed. 2007.
2. E. Hecht and A. Ganesan, "Optics", Dorling Kindersley, 4th ed. 2008.
3. M. V. Klein and T. E. Furtak, "Optics", John Wiley, 2nd ed. 1986.
4. K. K Sharam, "Optics: Principles and Applications", Academic Press, 2006.

5. C. A. Bennett, "Principles of Physical Optics", John Wiley, 2008.

PHY-509 MODERN PHYSICS-II Credit Hours: 4(3-1)

Objective(s): To understand the non-classical aspects of Physics, the emphasis is on the applications of Quantum Physics in microscopic-scale Physics, atomic and molecular structure and processes.

Special Theory of Relativity: Inertial and non-inertial frame, Postulates of Relativity, The Lorentz Transformation, Derivation, Assumptions on which inverse transformation is derived, Consequences of Lorentz transformation, Relativity of time, Relativity of length, Relativity of mass, Transformation of velocity, variation of mass with velocity, mass energy relation and its importance, relativistic momentum and Relativistic energy, (Lorentz invariants)

Quantum Mechanics in Three Dimensions: The Hydrogen atom, orbitals, angular momentum and its quantization, orbital magnetism, concept of spin, Building of the periodic table, magnetic resonance and MRI, why is iron magnetic? White dwarfs, and neutron stars.

Nuclear Structure: Size and structure of nucleus, nuclear forces, radioactivity and nuclear reactions, radiocarbon dating.

Practical:

1. Determination of ionization potential of mercury.
2. Variation of Photoelectric current with intensity of light.
3. To study the characteristic curves of a G. M. tube.
4. Determination of range of α particle.
5. Study of the parameter of wave i.e. amplitude, phase and time period of a complex signal on an oscilloscope.

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1. R.A. Serway, C.J. Moses and C.A. Moyer, "Modern Physics", Brooks Cole, 3rd ed. 2004.
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Solids, Nuclei and Particles", John Wiley, 2nd ed. 2002.