

Veer Narmad South Gujarat University, Surat
Syllabus of Applied Physics for S Y B Sc
SEMESTER- III
PAPER – III: MECHANICS
(Effective from the academic year 2012-13)

Unit I Moment of inertia and gyroscopic motion:

Moment of inertia and its physical significance-Radius of gyration, Expression for moment of inertia, Torque, Practical method for determination of moment of inertia (i) moment of inertia of a fly wheel (ii) moment of inertia of a disc, Angular moment and angular impulse, Law of conservation of angular momentum, laws of rotation, kinetic energy of rotation, acceleration of a body rolling down and inclined plane, functions of the fly wheel in stationary engine.

Elements of properties of matter-by D S Mathur: 3.1 to 3.3, 3.9 to 3.18,3.20 to 3.22

Unit II Harmonic oscillations and free, forced and resonant vibration

Two-coupled pendulum, Energy exchange (Beats) between two coupled identical oscillators, two coupled masses. Free vibrations, undamped vibrations, Damped vibrations, damped SHM in electrical circuit, forced vibrations, resonance and sharpness of resonance, phase of resonance, quality factor, examples of forced and resonant vibrations.

Waves and oscillations-by Brijlal & Subramanyam, IInd revised edition: 1.26 to 1.27, and 3.1 to 3.9

Unit III Vibrations in strings and Air column:

Velocity of transverse waves along a stretched string, laws of transverse vibration of string, verification of laws of transverse vibration of strings, vibrations of air column, Resonance, velocity of sound in air by resonance method, Organ pipe, closed end organ pipe, open end Organ pipe, vibrations in Rods, Kundt's Tube, vibrations in plates (Chladni's figures)

Waves and oscillations-by Brijlal&Subramanyam,IIndrevised edition:7.1,7.3,7.4,7.6-7.14

Reference Books

1. Waves and Oscillations by N K Bajaj
2. Physics by Resnick, Halliday and Walker Extended 8th Ed
3. Mechanics by Klepner
4. Mechanics by Landau & Lifshitz

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SEMESTER- III
PAPER – IV : OPTICS & SPECTRA
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Unit I Lens aberrations

Introduction, aberrations, first order theory, third order theory, spherical aberration, Coma, Astigmatism, curvature of the field, Distortion, Chromatic aberration, Chromatic aberrations in a lens, circle of a least chromatic aberration, achromatic lenses, Oil immersion objective of high power microscope, corrector plates.

A text book of Optics by Brij lal, Subramanyam and revised by Avadhanulu; 9.1 to 9.19

Unit II Polarization:

Introduction, polarization of transverse waves, plane of polarization, polarization by reflections, Brewster's law, Brewster's window, polarization by refractions, Malu's law, Double refraction, principle section of the crystal, principle plane, Nicol prism, Nicol prism as an analyzer, Experimental determination of refractive index, Double image polarizing prism, Quarter wave plate, half wave plate,

A textbook of Optics by Brij lal, Subramanyam: 10.1 to 10.4, 10.6 to 10.14, 10.21, 10.22, 10.24 & 10.25

Unit III Polarization and Spectra:

Optical rotation, Laws of rotation of plane of polarization, Origin of Optical activity, Franel's explanation of optical activity, polarimeter, Optical rotation by magnetic and electrical fields. Spectra-introduction, Littrow spectrograph, Constant deviation spectrographs, Monocromaters, Quarts spectrographs, Spectrographs for far UV, spectrographs for the IR, Absorption spectroscopy, some typical spectra, Raman spectroscopy

Optics and Atomic physics by D P Khandelwal; 17.1 to 17.6, and 18.1 to 18.8 & 18.10

Recommended Books

1. Optics by Jenkins and White
2. Optics by Ajay Ghatak
3. Optics by Max Born

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SEMESTER- III
PAPER –V: MODERN PHYSICS
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UNIT I Theory of Special Relativity

Frames of reference: transformations: electromagnetic theory Michelson-Morley experiment, attempted explanation of the null result, Einstein's postulates: Theory of special relativity, Insufficiency of Galilean transformations, Lorentz transformations, Derivation of Lorentz Transformation equations, consequences of Lorentz transformation equations. Einstein's velocity addition theorem, Derivation of mass Variation relation, Mass-energy equivalence, Relativistic formula for KE, Other important relativistic formulae, General theory of relativity. Predictions of general relativity.

Atomic and Nuclear Physics by A B Gupta and Dipak Ghosh (Chapter 1.1 to 1.11, 1.14 to 1.18, 1.21 to 1.24)

UNIT II Particle Properties of Waves

Failures of classical mechanics, Black body radiation: Spectral distribution, Planck's hypothesis and radiation law, Planck's quantum theory, Properties of Photons, Photoelectric effect, Characteristics of photoelectrons, Fundamental laws of photoelectric emission, Einstein's photoelectric equation, Photoelectric cells.

Concepts of Modern Physics by S L Gupta & S Gupta (Chapter 3.1 to 3.10)

UNIT III Wave properties of Particles

Compton effect, Wave and Particle duality of radiation, De-Broglie concept of matter waves, Properties of matter waves, Davisson and Germer's electron diffraction experiment, G.P Thomson experiment, Wave velocity and group velocity, Heisenberg's uncertainty principle, Experimental illustrations of uncertainty principle, Time-Energy uncertainty principle, Applications of uncertainty principle. Complementary principle.

Concepts of Modern Physics by S L Gupta & S Gupta (Chapter 3.11 to 3.23)

Recommended Books

1. Theory of special Relativity by Robert Resnick
2. Concepts in Modern Physics by A. Beiser
3. Modern physics by Krane

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SEMESTER- III
Subject: PHYSICS PRACTICALS
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PAPER III

1. Determination of moment of inertia of a flywheel.
2. Determination of Torque and rotational equilibrium.
3. Moment of inertia of a wheel and axle on an inclined plane.
4. Study of resonance in an LCR circuit.
5. Study of Chladni's figures.
6. To prove $n_2V = \text{constant}$ in the case of narrow necked resonator

PAPER IV

1. Spherical aberration of a planoconvex lens
2. Verification of Malus law
3. To determine the refractive index of the prism material using the Brewster's law
4. Determination of specific rotation of sugar by Laurent's half shade Polarimeter.
5. Absorption spectrum of Iodine Vapour (vibrational constant and Force constant)
6. Determination of refractive indices of o-and e-rays using double refracting prism.

PAPER V

1. Determination of Planck's constant by photocell method.
2. Determination of Planck's constant by stopping potential method.
3. Studying the variations in spectral distribution with change of temperature of a black body.
4. Verification of Stefan's fourth power law.
5. Studying the dependence of the saturation current on the intensity of radiation.
6. Studying the variations of V_s versus $1/\lambda$ graphs for various photoemissive cells.

References:

1. A Laboratory Manual of Physics for Undergraduates by D P Khandelwal
2. University Practical physics by D C Tayal-Himalayan publishing house.
3. Advanced Practical Physics by Worsnop & Flint.
4. Instructions manual-Kit developed for doing experiments in Physics (At BSc. and M.Sc. Physics levels) by R Srinivasan and K R S Priolkar-Indian Academy of Science, Bangalore.

Veer Narmad South Gujarat University, Surat
Syllabus of Applied Physics for S Y B Sc
SEMESTER-IV
PAPER – III : MATHEMATICAL & MODERN PHYSICS
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Unit I Vector analysis

Gradient, Divergence and Cur 1, Vector integration, Gauss divergence theorem, Green's theorem, Stoke's theorem.

Chap 4, 5, and 6 of Vector analysis By Murray R Spiegel

Unit II Superconductivity

Historical introduction, a survey of superconductivity, Mechanism of superconductors, Effects of magnetic field, A.C. resistivity, Critical currents, Flux exclusion-Meiser effect, Thermal properties, The energy gap, Isotope effect, Mechanical effect, The penetration depth, Type I & II super conductors, New super conductors, Potential applications of superconductivity.

Solid-state physics: Revised and enlarge edition by S.O. Pillai, 8.1 to 8.13, 8.22, 8.24

Unit III Plasma physics

Introduction, Interaction of particles, concept of collisions, conservation of energy and momentum, Effective cross section of collision, Elastic collision, excitation of atoms and molecules, Dissociation of molecules, Ionization of Ion's and molecules, kinetic theory of Plasma, Laboratory equipment for maintaining Plasma, Production of Plasma, Quasi neutrality of a Plasma, Plasma oscillation, Properties of Plasma, Space Plasma.

Fundamentals of solid state Physics by: Saxena-Gupta-Saxena, 19.1 to 19.8, 19.11 to 19.15, and 19.21

Reference Books

1. Mathematical Physics by Rajput
2. Mathematical Physics by Satya Prakash
3. Mathematical Physics by Arfken
4. Introduction to SolidState Physics by C.Kittel.
5. Superconductivity by T V Ramakrishnan and C N R Rao.
6. Solid State Theory by W A Harrison

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SEMESTER-IV
PAPER – IV : QUANTUM MECHANICS & LASERS
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UNIT I Atomic Structure

Bohr's atomic model, Bohr's theory of Hydrogen atom, Electron energy levels in hydrogen atom, Diagrammatic representation of series of spectrum of hydrogen atom, Bohr's quantum condition from de-Broglie hypothesis, Shortcomings of Bohr's theory, Correction for finite mass of the nucleus, Excitation and ionization of atoms, Sommerfeld relativistic atom model, Vector atom model, Stern-Gerlach experiment (verification of space-quantization concept and electron spin)

*Concepts of Modern Physics by S L Gupta & S Gupta Dhanpat Rai & Sons New Delhi
(Chapter 5.6 to 5.12, 5.14 to 5.17 and 5.31)*

UNIT II Quantum mechanics

Equation of motion of matter waves, Physical interpretation of wave function ?, Solution of Schrodinger equation, Postulates of wave mechanics, The free particle, Particle in a box, Energy levels of a particle enclosed in one dimensional potential box of infinite height, A single step barrier (Potential step)

*Concepts of Modern Physics by S L Gupta & S Gupta Dhanpat Rai & Sons New Delhi
(Chapter 4.1 to 4.3, 4.5 to 4.9)*

UNIT III Laser

Introduction, Relation between spontaneous and stimulated emission probabilities. Einstein's theory. Principle of laser, Population inversion: Different methods Gain constant, Basic laser system: Properties of a laser beam, Typical lasers, Applications of laser.

Atomic and Nuclear Physics by A.B.Gupta, Dipak Ghosh Chapters 8

Reference Books

1. Concepts of Modern Physics by S L Gupta & S Gupta Dhanpat Rai & Sons, New Delhi
2. Atomic and Nuclear Physics by A.B.Gupta, Dipak Ghosh
3. Concepts of Modern Physics by Arthur Beiser
4. An Introduction to Lasers Theory and Applications by M N Avadhanulu.
5. Quantum Mechanics by Satya Prakash
6. Modern Physics by Kenneth Krane, Second ed., Wiley Student Edition

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SEMESTER-IV
PAPER –V : CRYSTALLOGRAPHY & MATERIAL SCIENCE
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UNIT I CRYSTALLOGRAPHY

Introduction, Crystalline and non-crystalline materials, Isotropy and non isotropy, Lattice, basis and crystal structure, Unit cells, Crystal systems, Bravais lattices, Cubic unit cells, HCP structure, Comparison of atomic radius, Coordination number and packing density of SC, BCC, FCC and HCP unit cell, Crystal planes and Miller indices, Relation between inter planar distance and inter atomic distance, Directions of planes and Miller indices, Some crystal structures, Polymorphism and allotropy.

Engineering Physics by A.Marikani, PH,EE Edition 6.1 to 6.9, 6.11,6.13,6.15,6.17 and 6.18

UNIT II CONDUCTING, SEMICONDUCTING AND MAGNETIC MATERIAL

Introduction, Classical free electron theory of metals, Quantum free electron theory, Fermi energy, Fermi velocity and Fermi temperature, Work function of a metal, Conductivity of a semiconducting material, Expression for the band gap of a semiconductor, Experimental determination of the band gap by four probe method, Hall effect-Theory, Experimental measurement of Hall Effect, uses of Hall Effect. Magnetic materials-Introduction, Definition of some fundamental terms, Classification of magnetic materials, Origin of permanent dipole moment, Ferromagnetic materials, Antiferromagnetic materials, Soft and hard magnetic materials.

Engineering Physics by A.Marikani, PH,EE Edition 8.1,8.2,8.4,8.11,9.5,9.16,10.1-10.6,10.8

UNIT III DIELECTRIC AND MODERN ENGINEERING MATERIALS

Introduction, Definition of some fundamental terms, Polarization in a dielectric material, Clausius-Mosotti equation, Dielectric loss, Dielectric breakdown, Frequency dependence of polarization, Temperature dependence of polarization, Application of dielectric materials, Ferroelectric materials. Introduction, Metallic Glasses (MGs), Types of MGs, Preparation of MGs, Properties of MGs, Applications of MGs, Shape Memory Alloys (SMAs), Two different phases, Types of SMAs, Characteristics of SMAs, Characterization of SMAs, Commercial SMAs, Application of SMAs.

Engineering Physics by A.Marikani, PH,EE Edition 11.1-11.3,11.5-11.11,15.1-15.3

Reference Books

1. Solid-state physics: Revised and enlarge edition by S.O. Pillai
2. Solid State Physics by A J Dekker

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PHYSICS PRACTICALS
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PAPER III

1. Interactive Plasma Physics Experience.
2. Determining critical temperature T_c using Meisner effect.
3. Superconducting transition in YBCO metal insulator transition in $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$
4. Percolation-study of electrical resistivity of white cement-Graphite mixtures
5. Dipole moment of an organic molecule, Acetone
6. Verification of Curie -Weiss law for a ferroelectric material –temp. Dependence of a ceramic capacitance

PAPER IV

1. Determination of Rydberg's constant with the help of diffraction grating and Hydrogen discharge tube.
2. Particle size determination using Diode Laser.
3. Determination of Laser parameters – Wavelength, and Angle of divergence.
4. Thermal and electrical conductivities of copper to determine the Lorentz number
5. Thermal diffusivity of brass
6. Dielectric constant of a non-polar liquid

PAPER V

1. Determination of magnetic susceptibility of a solution by Quincke's method
2. To draw B-H or hysteresis loop for a given ferromagnetic substance.
3. Determination of hysteresis loss in a ferromagnetic material.
4. Calibration of magnetic fields by Hall probe method.
5. Experimental determination of Hall voltage.
6. Electrical conductivity by Four probe method.

Reference Books

1. A Laboratory Manual of Physics for Undergraduates by D P Khandelwal
2. University Practical physics by D C Tayal-Himalayan publishing house
3. Instructions manual-Kit developed for doing experiments in Physic(At BSc. and M.Sc. Physics levels) by R Srinivasan and K R S Priolkar-Indian Academy of Science, Bangalore.
4. Advanced Practical Physics by Worsnop & Flint