TELANGANA EAPCET

CHAPTERWISE SOLUTIONS

2024-2018

Physics

Dharmendra Singh

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Sales & Support Offices
Agra, Ahmedabad, Bengaluru, Bareilly, Chennai, Delhi, Guwahati, Hyderabad, Jaipur, Jhansi, Kolkata, Lucknow, Nagpur & Pune.

PRICE ₹405.00

PO No : TXT-XX-XXXXXXX-X-XX

Published by Arihant Publications (India) Ltd.

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Contents

1.	Physical World, Units and Measurements	1-12
2.	Kinematics	13-48
3.	Laws of Motion	49-69
4.	Work, Energy and Power	70-92
5.	Rotational Motion	93-112
6.	Gravitation	113-125
7.	Mechanical Properties of Solids	126-133
8.	Mechanical Properties of Fluids	134-149
9.	Thermal Properties of Matter	150-164
10.	Thermodynamics	165-177
11.	Kinetic Theory of Gases	178-189
12.	Oscillations	190-200
13.	Waves	201-212
14.	Electric Charges and Fields	213-222
15.	Electrostatic Potential and Capacitance	223-234
16.	Current Electricity	235-254
17.	Magnetic Effects of Current	255-277
18.	Magnetism and Matter	278-284
19.	Electromagnetic Induction	285-293
20.	Alternating Current	294-302

21. Electromagnetic Waves 303-309

22. Ray Optics and Optical Instruments 310-322

23. Wave Optics 323-330

24. Dual Nature of Radiation and Matter 331-341

25. Atoms 342-349

26. Nuclei 350-359

27. Semiconductor Electronics : Materials, Devices and Simple Circuits 360-376

28. Communication Systems 377-382

- **Practice Sets** (1-3) **383-406**

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Mock Test 1 Mock Test 2 Mock Test 3

Syllabus

1. PHYSICAL WORLD

What is physics? Scope and excitement of Physics, Physics, technology and society, Fundamental forces in nature, Gravitational Force, Electromagnetic Force, Strong Nuclear Force, Weak Nuclear Force, Towards Unification of Forces, Nature of physical laws.

2. UNITS AND MEASUREMENTS

Introduction, The international system of units, Measurement of Length, Measurement of Large Distances, Estimation of Very Small Distances: Size of a Molecule, Range of Lengths, Measurement of Mass, Range of Masses, Measurement of time , Accuracy, precision of instruments and errors in measurement, Systematic errors, random errors, least count error, Absolute Error, Relative Error and Percentage Error, Combination of Errors, Significant figures, Rules for Arithmetic Operations with Significant Figures, Rounding off the Uncertain Digits, Rules for Determining the Uncertainty in the Results of Arithmetic Calculations, Dimensions of Physical Quantities, Dimensional Formulae and dimensional equations, Dimensional Analysis and its Applications, Checking the Dimensional Consistency of Equations, Deducing Relation among the Physical Quantities.

3. MOTION IN A STRAIGHT LINE

Introduction, Position, path length and displacement, Average velocity and averagespeed, Instantaneous velocity and speed, Acceleration, Kinematic equations foruniformly accelerated motion, Relative velocity.

4. MOTION IN A PLANE

Introduction, Scalars and vectors, Position and Displacement Vectors, Equality of Vectors, Multiplication of vectors by real numbers, Addition and subtraction of vectors - graphical method, Resolution of vectors, Vector addition - analytical method, Motion in a plane, Position Vector and Displacement, Velocity, Acceleration, Motion in a plane with constant acceleration, Relative velocity in two dimensions. Projectile motion, Equation of path of a projectile, Time of Maximum height, Maximum height of a projectile, Horizontal range of projectile, Uniform circular motion.

5. LAWS OF MOTION

Introduction, Aristotle's fallacy, The law of inertia, Newton's first law of motion, Newton's second law of motion, Momentum Impulse Newton's third law of motion, Conservation of momentum, Equilibrium of a particle, Common forces in mechanics, friction, rolling friction, Circular motion, Motion of a car on a level road, Motion of a car on a Banked road, Solving problems in mechanics.

6. WORK, ENERGY AND POWER

Introduction, The Scalar Product, Notions of work and kinetic energy : The work energy theorem, Work, Kinetic energy, Work done by a variable force, The work energy theorem for a variable force, The concept of Potential Energy, The conservation of Mechanical Energy, The Potential Energy of a spring, Various forms of energy: the law of conservation of energy, Heat, Chemical Energy, Electrical Energy, The Equivalence of Mass and Energy, Nuclear Energy, The Principle of Conservation of Energy, Power, Collisions, Elastic and Inelastic Collisions, Collisions in one dimension, Coefficient of Restitution and its determination, Collisions in Two Dimensions.

7. SYSTEMS OF PARTICLES AND ROTATIONAL MOTION

Introduction, What kind of motion can a rigid body have?, Centre of mass, Centre of Gravity, Motion of centre of mass, Linear momentum of a system of particles, Vector product of two vectors, Angular velocity and its relation with linear velocity, Angular acceleration, Kinematics of rotational motion about a fixed axis, Torque and angular momentum, Moment of force (Torque), Angular momentum of particle, Torque and angular momentum for a system of a particles, conservation of angular momentum, Equilibrium of a rigid body, Principle of moments, Moment of inertia, Theorems of perpendicular and parallel axes, Theorem of perpendicular axes, Theorem of parallel axes, Dynamics of rotational motion about a fixed axis, Angular momentum in case of rotations about a fixed axis, Conservation of Angular Momentum, Rolling motion, Kinetic Energy of Rolling Motion.

8. OSCILLATIONS

Introduction, Periodic and oscillatory motions, Period and frequency, Displacement, Simple harmonic motion (S.H.M.), Simple harmonic motion and uniform circular motion, Velocity and acceleration in simple harmonic motion, Force law for Simple harmonic Motion, Energy in simple harmonic motion, Some systems executing Simple Harmonic Motion, Oscillations due to a spring, The Simple Pendulum, Damped simple harmonic motion, Forced oscillations and resonance.

9. GRAVITATION

Introduction, Kepler's laws, Universal law of gravitation, The gravitational constant, Acceleration due to gravity of the earth, Acceleration due to gravity below and above the surface of earth, Gravitational potential energy, Escape speed, Earth satellite, Energy of an orbiting satellite, Geostationary and polar satellites, Weightlessness.

10. MECHANICAL PROPERTIES OF SOLIDS

Introduction, Elastic behaviour of solids, Stress and strain, Hooke's law, Stress-strain curve, Elastic moduli, Young's Modulus, Determination of Young's Modulus of the Material of a Wire, Shear Modulus, Bulk Modulus, Poisson's Ratio, Elastic Potential Energy in a Stretched Wire, Applications of elastic behaviour of materials.

11. MECHANICAL PROPERTIES OF FLUIDS

Introduction, Pressure, Pascal's Law, Variation of Pressure with Depth, Atmospheric Pressure and Gauge Pressure, Hydraulic Machines, Streamline flow, Bernoulli's principle, Speed of Efflux: Torricelli's Law, Venturi meter, Blood Flow and Heart Attack, Dynamic Lift, Viscosity, Variation of Viscosity of fluids with temperature, Stokes' Law, Reynolds number, critical velocity, Surface tension, Surface Energy, Surface Energy and Surface Tension, Angle of Contact, Drops and Bubbles, Capillary Rise, Detergents and Surface Tension.

12. THERMAL PROPERTIES OF MATTER

Introduction, Temperature and heat, Measurement of temperature, Ideal-gas equation and absolute temperature, Thermal expansion, Specific heat capacity, Calorimetry, Change of state, Regelation, Latent Heat, Heat transfer, Conduction, thermal conductivity, Convection, Radiation, Black body Radiation, Greenhouse Effect, Newton's law of cooling.

13. THERMODYNAMICS

Introduction, Thermal equilibrium, Zeroth law of thermodynamics, Heat, Internal Energy and work, First law of thermodynamics, Specific heat capacity, Specific heat capacity of water, Thermodynamic state variables and equation of State, Thermodynamic process, Quasistatic process, Isothermal Process, Adiabatic Process, Isochoric Process, Isobaric process, Cyclic process, Heat engines, Refrigerators and heat pumps, Second law of thermodynamics, Reversible and irreversible processes, Carnot engine, Carnot's theorem.

14. KINETIC THEORY

Introduction, Molecular nature of matter, Behaviour of gases, Boyle's Law, Charles' Law, Kinetic theory of an ideal gas, Pressure of an Ideal Gas, Kinetic interpretation of temperature, Law of equipartition of energy, Specific heat capacity, Monatomic Gases, Diatomic Gases, Polyatomic Gases, Specific Heat Capacity of Solids, Specific Heat Capacity of Water, Mean free path.

15. WAVES

Introduction, Transverse and longitudinal waves, Displacement relation in a progressive wave, amplitude and phase, wavelength and angular wave number, time period, angular frequency and frequency, The speed of a travelling wave, speed of transverse wave on stretched string, speed of a longitudinal wave (speed of sound), The principle of superposition of waves, Reflection of waves, standing waves and normal modes, Beats, Doppler effect.

16. RAY OPTICS AND OPTICAL INSTRUMENTS

Introduction, Reflection of Light by Spherical Mirrors, sign convention, focal length of Spherical Mirrors, mirror equation, Refraction, Total Internal Reflection, Total Internal Reflection in nature and its technological applications, Refraction at Spherical Surfaces and by Lenses, power of a lens, combination of thin lenses in contact, Refraction through a Prism, Dispersion by a Prism, Some Natural Phenomena due to Sunlight, the rainbow, scattering of light, Optical Instruments, eye, microscope, telescope.

17. WAVE OPTICS

Introduction, Huygens Principle, Refraction and reflection of plane waves using Huygens Principle, refraction of a plane wave, refraction in a rarer medium (at the denser medium boundary), reflection of a plane wave by a plane surface, the Doppler effect, Coherent and Incoherent Addition of Waves, Interference of Light, Waves and Young's Experiment, Diffraction, the single slit, resolving power of optical instruments, the validity of ray optics, Polarisation, polarisation by scattering, polarisation of reflection.

18. ELECTRIC CHARGES AND FIELDS

Introduction, Electric Charges, Conductors and Insulators, Charging by Induction, Basic Properties of Electric Charge, Coulomb's Law, Forces between Multiple Charges, Electric Field, Electric Field due to a system of charges, physical significance of Electric field, Electric Field Lines, Electric Flux, Electric Dipole, the field of an Electric Dipole, physical significance of dipoles, Dipole in a Uniform External Field, Continuous Charge Distribution, Gauss's Law, Application of Gauss's Law, field due to a an infinitely long straight uniformly charged wire, field due to a uniformly charged infinite plane sheet, field due to uniformly charged thin spherical shell.

19. ELECTROSTATIC POTENTIAL AND CAPACITANCE

Introduction, Electrostatic Potential, Potential due to a Point Charge, Potential due to an Electric Dipole, Potential due to a System of Charges, Equipotential Surfaces, relation between field and potential, Potential Energy of a System of Charges, Potential Energy in an External Field, potential energy of a single charge, potential energy of a system of two charges in an external field, potential energy of a dipole in an external field, Electrostatics of Conductors, Dielectrics and Polarisation, Capacitors and Capacitance, The Parallel Plate Capacitor, Effect of Dielectric on Capacitance, Combination of Capacitors – series and parallel, Energy Stored in a Capacitor, Van de Graaff Generator.

20. CURRENT ELECTRICITY

Introduction, Electric Current, Electric Currents in Conductors, Ohm's law, Drift of Electrons and the Origin of Resistivity, mobility, Limitations of Ohm's Law, Resistivity of various Materials, Temperature Dependence of Resistivity, Electrical Energy, Power, Combination of Resistors — Series and Parallel, Cells, emf, Internal Resistance, Cells in Series and in Parallel, Kirchhoff's Laws, Wheatstone Bridge, Meter Bridge, Potentiometer.

21. MOVING CHARGES AND MAGNETISM

Introduction, Magnetic Force, sources and fields, magnetic field Lorentz force, Motion in a Magnetic Field, Motion in Combined Electric and Magnetic Fields, velocity selector, cyclotron, Magnetic Field due to a Current Element, Biot-Savart Law, Magnetic Field on the Axis of a Circular Current Loop, Ampere's Circuital Law, The Solenoid and the Toroid, Force between Two Parallel Current carrying conductors, the Ampere (unit), Torque on Current Loop (rectangular current loop), circular current loop as a Magnetic Dipole, the magnetic dipole moment of a revolving electron, The Moving Coil Galvanometer.

22. MAGNETISM AND MATTER

Introduction, The Bar Magnet, the magnetic field lines, bar magnet as an equivalent solenoid, the dipole in a uniform magnetic field, the electrostatic, analog, Magnetism and Gauss's Law, The Earth's Magnetism, magnetic declination and dip, Magnetisation and Magnetic Intensity, Magnetic Properties of Materials (diamagnetism, para magnetism, ferromagnetism), Permanent Magnets and Electromagnets.

23. ELECTROMAGNETIC INDUCTION

Introduction, The Experiments of Faraday and Henry, Magnetic Flux, Faraday's Law of Induction, Lenz's Law and Conservation of Energy, Motional Electromotive Force, Energy Consideration: A Quantitative Study, Eddy Currents, Inductance, mutual Inductance, self-Inductance, AC Generator.

24. ALTERNATING CURRENT

Introduction, AC Voltage Applied to a Resistor, Representation of AC Current and Voltage by Rotating Vectors — Phasors, AC Voltage Applied to an Inductor, AC Voltage Applied to a Capacitor, AC Voltage Applied to a Series LCR Circuit, phasor – diagram solution, analytical solution, resonance, sharpness of resonance, Power in AC Circuit: The Power Factor, LC Oscillations, Transformers.

25. ELECTROMAGNETIC WAVES

Introduction, Displacement Current, Electromagnetic Waves, sources of Electromagnetic Waves, nature of Electromagnetic Waves, Electromagnetic Spectrum.

26. DUAL NATURE OF RADIATION AND MATTER

Introduction, Electron Emission, Photoelectric Effect, Hertz's observations, HallWachs and Lenard's observations, Experimental Study of Photoelectric Effect, Photoelectric Effect and Wave Theory of Light, Einstein's Photoelectric Equation: Energy Quantum of Radiation, Particle Nature of Light: The Photon, Wave Nature of Matter, Davisson and Germer Experiment.

27. ATOMS

Introduction, Alpha-particle Scattering and Rutherford's Nuclear Model of Atom, alpha Particle trajectory, electron orbits, Atomic Spectra, spectral series, Bohr Model of the Hydrogen Atom, energy levels, The Line Spectra of the Hydrogen Atom, De Broglie's Explanation of Bohr's Second Postulate of Quantisation.

28. NUCLEI

Introduction, Atomic Masses and Composition of Nucleus, Size of the Nucleus, Mass-Energy and Nuclear Binding Energy, Nuclear Force, Radioactivity, law of radioactive decay, alpha decay, beta decay, gamma decay, Nuclear Energy, fission, nuclear reactor, nuclear fusion – energy generation in stars, controlled thermonuclear fusion.

29. SEMICONDUCTOR ELECTRONICS: MATERIALS, DEVICES AND SIMPLE CIRCUITS

Introduction, Classification of Materials: Metals, Semiconductors and Insulators (on the basis of conductivity, on the basis of energy bands) Intrinsic Semiconductor, Extrinsic Semiconductor, p-n Junction, p-n Junction formation, Semiconductor diode, p-n Junction diode under forward bias, p-n Junction diode under reverse bias, Application of Junction Diode as a Rectifier, Special Purpose p-n Junction Diodes, zener diode, optoelectronic junction devices (photo diode, light emitting diode, solar cell), Junction Transistor, transistor: structure and action, basic transistor circuit configurations and Transistor characteristics (common emitter Transistor characteristics), Transistor as a device (switch, amplifier), Transistor as an amplifier (CE-configuration), feedback amplifier and Transistor oscillator, Digital Electronics and Logic Gates, Logic Gates (NOT gate, OR gate, AND gate, NAND gate, NOR gate), Integrated Circuits.

30. COMMUNICATION SYSTEMS

Introduction, Elements of a Communication System, Basic Terminology Used in Electronic Communication Systems, Bandwidth of Signals, Bandwidth of Transmission Medium, Propagation of Electromagnetic Waves (ground wave, sky waves, space waves), Modulation and its Necessity, Amplitude Modulation, Production of Amplitude Modulated Wave, Detection of Amplitude Modulated Wave.

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