



0. General Physics & Kinematics (3 Core topics)

- Physical world and measurement
- Kinematics
- Laws of motion

1. Mechanics (7 Topics and 59 subtopics)

I . Vector Calculus (7 Core topics)

- Scalar and vector products
- Vector identities
- Background of vector calculus
- Concept of line, surface and volume integrals
- Physical meaning of gradient, divergence and curl
- Gauss's divergence theorem
- Stokes' theorem

II . Rigid Body Dynamics (9 Core topics)

- Centre of mass
- Rotating frame of reference
- Coriolis force
- Motion of rigid bodies
- Moment of inertia
- Theorem of parallel and perpendicular axes
- Moment of inertia of sphere, ring, cylinder and disc
- Angular momentum
- Torque

III . Central Forces & Gravitation (5 Core topics)

- Central force motion
- Kepler's Laws of planetary motion
- Motion of satellite
- Geostationary satellite
- Gravitation principles, work, energy, and power

IV. Special Relativity (9 Core topics)

- Galilean transformation
- Special theory of relativity
- Michelson-Morley experiment
- Lorentz transformation equations
- Variation of mass with velocity
- Length contraction
- Time dilation
- Addition of velocities
- Mass-energy equivalence relation

V. Fluid Mechanics (6 Core topics)

- Streamline and turbulent motions
- Reynolds number
- Stokes' law
- Poiseuille's formula
- Flow of liquid through narrow tube
- Bernoulli's formula with applications

VI. Properties of Matter (6 Core topics)

- Surface tension
- Stress-strain relationship
- Hooke's Law
- Moduli of elasticity and interrelation between them
- Poisson's ratio
- Elastic energy

2. Thermal Physics (4 Topics | 33 sub topics)

I. Thermodynamics Foundations (7 Core topics)

- Concept of temperature and the zeroth law
- First law of thermodynamics and internal energy
- Isothermal and adiabatic changes
- Second law of thermodynamics
- Entropy
- Carnot cycle and Carnot engine
- Absolute scale of temperature

II. Thermodynamic Relations (4 Core topics)

- Maxwell's thermodynamical relations
- The Clausius-Clapeyron equation
- Porous plug experiment and Joule Thomson effect
- Production of low temperatures by adiabatic demagnetization

Kinetic Theory of Gases (9 Core topics)

- Behaviour of ideal gas and molecular theory of gases
- Kinetic theory of gases
- Maxwell distribution law of velocities
- Calculation of mean velocity, root mean square velocity and the Most probable velocity
- Degrees of freedom
- Law of equipartition of energy
- Specific heats of gases
- Mean free path
- Transport phenomena

Radiation (7 Core topics)

- Black body radiation
- Stefan's law
- Newton's law of cooling
- Wien's law
- Rayleigh Jeans' law

- Planck's law
- Solar constant

3. Waves & Oscillations (2 Topics | 14 sub topics)

I. Oscillations & Resonance (6 Core topics)

- Oscillation
- Simple harmonic motion
- Damped harmonic-motion
- Forced oscillations and resonance
- Sharpness of resonance
- Quality factor

II. Wave Propagation (6 Core topics)

- Wave equation
- Plane and spherical waves
- Superposition of waves
- Fourier analysis of periodic waves - square and triangular waves
- Phase and group velocities
- Beats

4. Optics (4 Topics | 26 sub topics)

I. Geometrical Optics (4 Core Items)

- Cardinal points of a coaxial system
- Simple problems on combination of thin lenses
- Ramsden eyepiece
- Huygens eyepiece

II. Interference (7 Core topics)

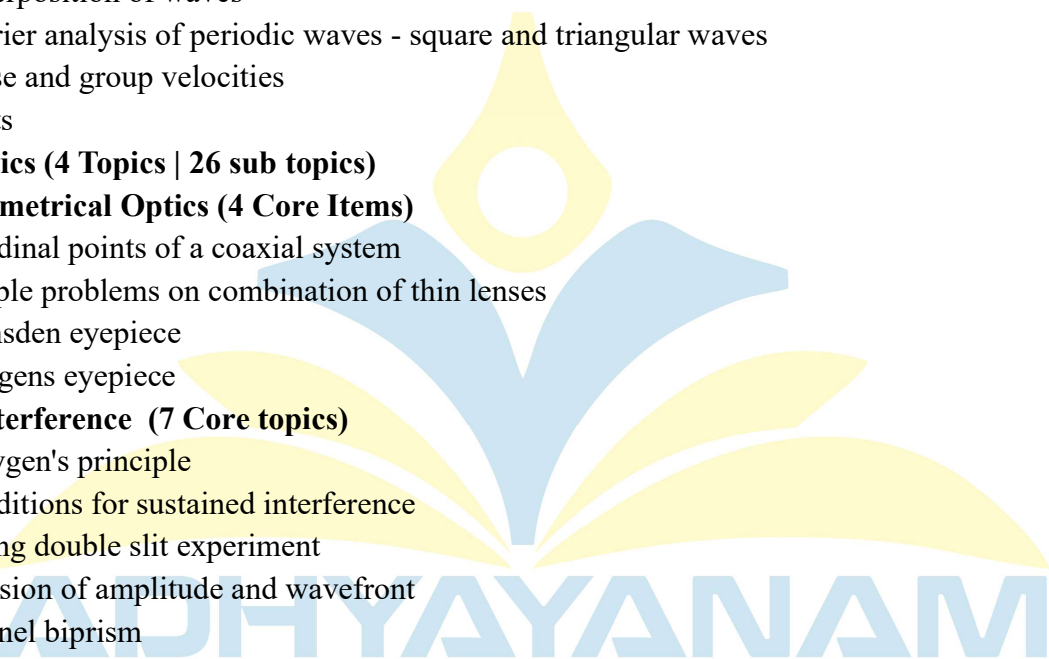
- Huygen's principle
- Conditions for sustained interference
- Young double slit experiment
- Division of amplitude and wavefront
- Fresnel biprism
- Newtons rings
- Michelson interferometer

III. Diffraction & Resolving Power (4 Core Items)

- Diffraction by straight edge
- Single, double and multiple slits
- Rayleigh's criterion
- Resolving power of optical instruments

IV. Polarization (6 Core topics)

- Polarization
- Production and detection of polarized light (linear circular and elliptical)
- Brewster's law
- Huygen's theory of double refraction
- Optical rotation



- Polarimeter

5. Laser (1 Topic | 6 Sub topics)

I. Laser Fundamentals & Systems (5 Core topics)

- Temporal and spatial coherence
- Stimulated emission
- Basic ideas about laser emission
- Ruby laser
- He-Ne laser

6. Electricity & Magnetism (4 Topics | 27 sub topics)

I. Electrostatics & DC Circuits (4 Core topics)

- Gauss law and its applications
- Electric potential
- Kirchhoff's laws and their applications
- Wheatstone's bridge

7. Modern Physics (5 Topics | 41 topics)

I. Atomic Physics & Spectroscopy (11 Core topics)

- Bohr's theory of hydrogen atom
- Electron spin
- Pauli's exclusion principle
- Optical and X-ray spectra
- Spatial quantization and Stern-Gerlach experiment
- Vector model of the atom
- Spectral terms
- Fine structure of spectral lines
- J-J and L-S coupling
- Zeeman effect
- Raman effect

II. Quantum Mechanics Foundations (7 Core topics)

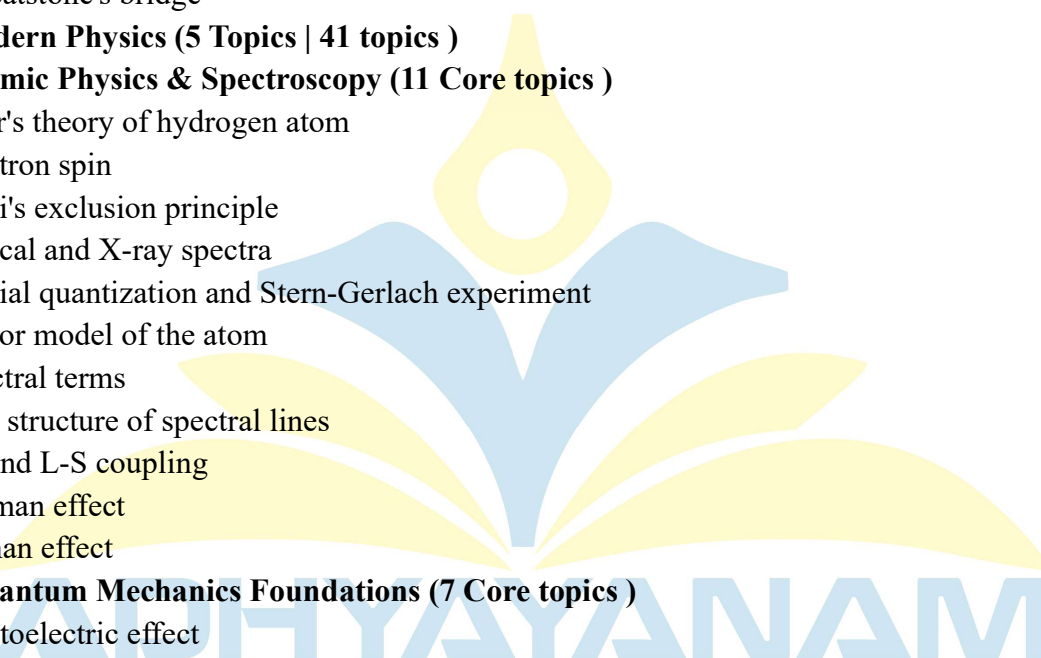
- Photoelectric effect
- Compton effect
- de Broglie waves
- Wave-particle duality
- Uncertainty principle
- Postulates of quantum mechanics
- Schrodinger wave equation

III. Quantum Mechanics Applications (3 Core topics)

- Application: Particle in a box
- Application: Motion across a step potential
- Application: One dimensional harmonic oscillator and eigen values

IV. Solid State Physics (7 Core topics)

- Einstein's and debye theory of specific heat of solids
- Band theory of solids
- Energy band, Kronig-Penny model in one dimension



- Energy gap
- Distinction between metals, semiconductors and insulators
- Variation of Fermi level with temperature and effective mass
- Elementary ideas of super conductivity

V. Nuclear & Particle Physics (8 Core topics)

- Radio activity
- Alfa, beta and gamma radiations
- Elementary theory of alpha decay
- Nuclear binding energy
- Semi empirical mass formula
- Nuclear fission and fusion and nuclear reactors
- Elementary particles
- Particle accelerator, cyclotron, linear accelerator

8. Electronics (3 Topics | 16 topics)

I. Semiconductor Devices (4 Core topics)

- Intrinsic and extrinsic semiconductors
- PN junction, Zener diode and their characteristics
- Unipolar and bipolar transistors
- Solar cells

III. Electronic Circuits & Communication (2 Core topics)

- Use of diode and transistor for rectification, amplification, oscillation, modulation and detection
- R.f. waves

IV. Digital Electronics (2 Core topics)

- Logic gates and their truth tables
- Some applications

