

=> Electricity and Magnetism

Alternating currents

Ampere's law

Biot-Savart law

Capacitors

Conductors

Coulomb's law

Dielectric polarization

Dielectrics

Displacement current

Electric field and potential

Electrostatic boundary conditions

Electrostatic energy

Faraday's law of electromagnetic induction

Gauss's law

Lorentz Force and motion of charged particles in electric and magnetic fields

Maxwell's equations and plane electromagnetic waves

Poynting's theorem

Reflection and refraction at a dielectric interface

Self and mutual inductance

Simple DC and AC circuits with R, L and C components

Solution of Laplace's equation for simple cases

Transmission and reflection coefficients

Volume and surface charges

=> Modern Physics

Blackbody radiation

Bohr's atomic model and X-rays

Compton Effect

Inertial frames and Galilean invariance

Length contraction and time dilation

Lorentz transformations

Mass energy equivalence

Photoelectric effect

Postulates of special relativity

Relativistic velocity addition theorem

Uncertainty principle

Wave-particle duality

Schrödinger equation and its solution for one, two and three dimensional boxes  
Reflection and transmission at a step potential, tunnelling through a barrier  
Pauli Exclusion Principle  
Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics  
Structure of atomic nucleus, mass and binding energy  
Radioactivity and its applications  
Laws of radioactive decay  
Fission and fusion

=> Oscillations, Waves and Optics

Damped and forced oscillators  
Differential equation for simple harmonic oscillator and its general solution  
Diffraction gratings  
Doppler Effect  
Double refraction and optical rotation  
Energy density and energy transmission in waves  
Fermat's Principle  
Fraunhofer diffraction  
General theory of image formation  
Group velocity and phase velocity  
Interference of light, optical path retardation  
Linear, circular and elliptic polarization  
Rayleigh criterion and resolving power  
Resonance  
Sound waves in media  
Superposition of two or more simple harmonic oscillators  
Thick lens, thin lens and lens combinations  
Traveling and standing waves in one-dimension  
Wave equation

=> Kinetic Theory and Thermodynamics

Reversible, irreversible and quasi-static processes  
Carnot cycle  
Elements of Kinetic theory of gases  
First law and its consequences

Ideal gas  
Isothermal and adiabatic processes  
Laws of thermodynamics  
Maxwell's thermodynamic relations and simple applications  
Mean free path  
Phase transitions and Clausius-Clapeyron equation  
Second law and entropy  
Specific heat of Mono-, di- and tri-atomic gases  
Thermodynamic potentials and their applications  
Van-der-Waals gas and equation of state  
Velocity distribution and Equipartition of energy  
Zeroeth law and concept of thermal equilibrium

=> Mechanics and General Properties of Matter

Bernoulli's theorem  
Capillarity  
Centre of mass  
Centrifugal and Coriolis forces  
Conservation of energy  
Conservation of linear and angular momentum  
Conservative and non-conservative forces  
Elastic and inelastic collisions  
Elasticity  
Equation of continuity  
Equation of motion of the CM  
Euler's equation  
Gravitational Law and field  
Hooke's law and elastic constants of isotropic solid  
Kepler's laws  
Kinematics of moving fluids  
Moments of Inertia and products of Inertia  
Motion under a central force  
Newton's laws of motion and applications  
Principal moments and axes  
Rigid body motion, fixed axis rotations  
Rotation and translation  
Stress energy  
Surface tension and surface energy  
System of particles

Uniformly rotating frame  
Variable mass systems  
Velocity and acceleration in Cartesian, polar and cylindrical coordinate systems  
Viscous fluids

=> Solid State Physics, Devices and Electronics

Crystal structure  
Bravais lattices and basis  
Miller indices  
X-ray diffraction and Bragg's law  
Einstein and Debye theory of specific heat  
Free electron theory of metals  
Fermi energy and density of states  
Origin of energy bands  
Concept of holes and effective mass  
Elementary ideas about dia-, para- and ferromagnetism  
Langevin's theory of paramagnetism  
Curie's law  
Intrinsic and extrinsic semiconductors  
Fermi level  
OR, AND, NOR and NAND gates  
Transistors  
P-N junctions  
Amplifier circuits with transistors  
Transistor circuits in CB, CE, CC modes  
Operational amplifiers

=> Mathematical Methods

Algebra of complex numbers  
Calculus of single and multiple variables  
Divergence theorem  
First and linear second order differential equations  
Fourier series  
Green's theorem  
Jacobian, imperfect and perfect differentials  
Matrices and determinants  
Multiple integrals  
Partial derivatives  
Stokes' theorem

Taylor expansion  
Vector algebra  
Vector Calculus