JEE Advanced Syllabus 2025

Physics

General

- Units and dimensions, dimensional analysis
- Least count, significant figures
- Methods of measurement and error analysis for physical quantities:
  - Experiments using Vernier calipers and screw gauge (micrometer)
  - Determination of *g* using simple pendulum
  - Young's modulus - elasticity of material
  - Surface tension of water by capillary rise and effect of detergents
  - Specific heat of a liquid using calorimeter
  - Focal length of concave mirror and convex lens using *u*-*v* method
  - Speed of sound using resonance column
  - Verification of Ohm's law using voltmeter and ammeter
  - Specific resistance of wire using meter bridge and post office box

Mechanics

- Kinematics:
  - One and two dimensions (Cartesian coordinates only)
  - Projectiles
  - Uniform circular motion
  - Relative velocity
- Newton's laws of motion:
  - Inertial and uniformly accelerated frames of reference
  - Static and dynamic friction
  - Kinetic and potential energy
  - Work and power
  - Conservation of linear momentum and mechanical energy
- Systems of particles:
  - Centre of mass and its motion
  - Impulse
  - Elastic and inelastic collisions
- Rigid body:
  - Moment of inertia, parallel and perpendicular axes theorems
  - Moment of inertia of uniform bodies with simple geometrical shapes
  - Angular momentum
  - Torque
  - Conservation of angular momentum

    - Dynamics of rigid bodies with fixed axis of rotation
    - Rolling without slipping (rings, cylinders, spheres)
    - Equilibrium of rigid bodies
    - Collision of point masses with rigid bodies
    - Forced and damped oscillation (1D), resonance
    - Linear and angular simple harmonic motions
    - Hooke's law, Young's modulus
- Gravitation:
    - Law of gravitation
    - Gravitational potential and field
    - Acceleration due to gravity
    - Kepler's laws
    - Geostationary orbits
    - Motion of planets and satellites in circular orbits
    - Escape velocity
- Fluids:
    - Pressure in a fluid, Pascal's law
    - Buoyancy
    - Surface energy and surface tension:
        - Angle of Contact
        - Bubbles
        - Capillary Rise
    - Viscosity (Poiseuille's equation excluded)
    - Modulus of rigidity and bulk modulus
    - Stokes' law, terminal velocity
    - Streamline flow, equation of continuity
    - Bernoulli's theorem and applications
- Waves:
    - Wave motion (plane waves only)
    - Longitudinal and transverse waves
    - Superposition of waves
    - Progressive and stationary waves
    - Vibration of strings and air columns
    - Resonance
    - Beats
    - Speed of sound in gases
    - Doppler effect (sound)

Thermal Physics

- Thermal expansion (solids, liquids, gases)
- Calorimetry, latent heat
- Heat conduction (1D)
- Convection and radiation (elementary concepts)

- Newton's law of cooling
- Ideal gas laws
- Specific heats (C_v and C_p for monoatomic and diatomic gases)
- Isothermal and adiabatic processes, bulk modulus of gases
- Equivalence of heat and work
- First law of thermodynamics and applications (ideal gases only)
- Second law of thermodynamics, reversible and irreversible processes, Carnot engine and efficiency
- Blackbody radiation: absorptive and emissive powers, Kirchhoff's law, Wien's displacement law, Stefan's law

Electricity and Magnetism

- Electrostatics:
  - Coulomb's law
  - Electric field and potential
  - Electrical potential energy (point charges, dipoles in uniform field)
  - Electric field lines
  - Flux of electric field
  - Gauss's law and applications (infinitely long straight wire, uniformly charged infinite plane sheet, uniformly charged thin spherical shell)
  - Capacitance, parallel plate capacitor (with and without dielectrics)
  - Capacitors in series and parallel
  - Energy stored in a capacitor
- Current Electricity:
  - Electric current, Ohm's law
  - Resistances and cells in series and parallel
  - Kirchhoff's laws and simple applications
  - Heating effect of current
- Magnetism:
  - Biot–Savart's law and Ampere's law
  - Magnetic field (current-carrying straight wire, circular coil, long straight solenoid)
  - Force on moving charge and current-carrying wire in uniform magnetic field
  - Magnetic moment of current loop
  - Effect of uniform magnetic field on current loop
  - Moving coil galvanometer, voltmeter, ammeter and conversions
- Electromagnetic Induction:
  - Faraday's law, Lenz's law
  - Self and mutual inductance
  - *RC*, *LR*, *LC* and *LCR* (series) circuits with DC and AC sources

Electromagnetic Waves

- Electromagnetic waves and characteristics

- Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays) - elementary facts and uses

Optics

- Ray Optics:
  - Rectilinear propagation of light
  - Reflection and refraction (plane and spherical surfaces)
  - Total internal reflection
  - Deviation and dispersion by prism
  - Thin lenses
  - Combinations of mirrors and thin lenses
  - Magnification
- Wave Optics:
  - Huygen's principle
  - Interference (Young's double slit experiment)
  - Diffraction (single slit)
  - Polarization, plane polarized light
  - Brewster's law, Polaroids

Modern Physics

- Nuclear Physics:
  - Atomic nucleus
  - α, β and γ radiations
  - Radioactive decay law, decay constant
  - Half-life and mean life
  - Binding energy and calculation
  - Fission and fusion processes, energy calculation
- Quantum Physics:
  - Photoelectric effect
  - Bohr's theory (hydrogen-like atoms)
  - Characteristic and continuous X-rays, Moseley's law
  - de Broglie wavelength