

## UPSC CSE Physics Syllabus 2024

The UPSC Physics syllabus 2024 covers a wide range of core concepts including classical mechanics, thermodynamics, electromagnetism, optics, relativity and quantum mechanics. Candidates are tested on their conceptual grasp of physical theories and ability to apply principles to problem solve real-world scenarios. The paper evaluates critical thinking, analytical reasoning and mathematical skills.

### UPSC CSE Physics Syllabus 2024 Paper 1

#### 1. Mechanics:

- **Mechanics of Particles:**
  - Laws of motion
  - Conservation of energy and momentum
  - Motion under central force
  - Gravitational field and potential
  - Rutherford scattering
- **Mechanics of Rigid Bodies:**
  - Centre of mass, angular momentum
  - Equations of motion
  - Elastic and inelastic collisions
  - Molecular rotations
  - Precessional motion
- **Mechanics of Continuous Media:**
  - Elasticity and Hooke's law
  - Streamline flow and viscosity
- **Special Relativity:**
  - Lorentz transformations
  - Length contraction, time dilation
  - Mass-energy relation

#### 2. Waves and Optics:

- **Waves:**
  - Simple harmonic motion
  - Beats, resonance
  - Stationary waves
- **Geometrical Optics:**
  - Laws of reflection and refraction
  - Matrix method in paraxial optics
  - Chromatic and spherical aberrations
- **Interference:**
  - Young's experiment
  - Newton's rings
  - Michelson interferometer
- **Diffraction:**
  - Fraunhofer and Fresnel diffraction

- Diffraction grating
- **Polarisation and Modern Optics:**
  - Polarised light
  - Optical activity
  - Fibre optics
  - Lasers and holography

### 3. Electricity and Magnetism:

- **Electrostatics and Magnetostatics:**
  - Laplace and Poisson equations
  - Method of images
  - Dielectrics, polarisation
  - Biot-Savart and Ampere's laws
- **Current Electricity:**
  - Kirchhoff's laws
  - Faraday's and Lenz' laws
  - Inductance
- **Electromagnetic Waves and Blackbody Radiation:**
  - Maxwell's equations
  - Displacement current
  - Electromagnetic waves
  - Blackbody radiation

### 4. Thermal and Statistical Physics:

- **Thermodynamics:**
  - Laws of thermodynamics
  - Entropy changes
  - Phase rule and chemical potential
  - Van der Waals equation
- **Statistical Physics:**
  - Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac distributions
  - Specific heat of gases
  - Blackbody radiation
  - Maxwell relations

## UPSC CSE Physics Syllabus 2024 Paper 2

### 1. Quantum Mechanics:

- Wave-particle duality
- Schrodinger equation and expectation values
- Uncertainty principle
- Solutions of one-dimensional Schrodinger equation
- Reflection and transmission by potential barriers
- Angular momentum
- Hydrogen atom

- Spin-half particles and Pauli matrices

## **2. Atomic and Molecular Physics:**

- Stern-Gerlach experiment and electron spin
- Fine structure of hydrogen atom
- Spectroscopic notation and Zeeman effect
- Rotational, vibrational, and electronic spectra of diatomic molecules
- Raman effect and molecular structure
- Fluorescence, phosphorescence, NMR, and EPR
- Lamb shift and its significance

## **3. Nuclear and Particle Physics:**

- Basic nuclear properties and semi-empirical mass formula
- Shell model of the nucleus and nuclear forces
- Violation of parity in beta decay
- Gamma decay, internal conversion, and Mossbauer spectroscopy
- Nuclear fission, fusion, and energy production in stars
- Classification of elementary particles, quark structure of hadrons
- Physics of neutrinos and unification of forces

## **4. Solid State Physics, Devices, and Electronics:**

- Crystalline and amorphous structure of matter
- X-ray diffraction and electron microscopy
- Band theory of solids and thermal properties
- Magnetism: dia, para, and ferromagnetism
- Superconductivity and high-temperature superconductors
- Semiconductors, transistors, amplifiers, and oscillators
- Digital electronics, logic gates, and microprocessors