

# **GATE 2014 Exam Syllabus of Physics**

## **General Aptitude (GA)- Multiple Choice Test**

- **This Paper Consists of Verbal Ability:** English grammar, verbal analogies, instructions, critical reasoning and verbal deduction, Sentence completion, Word groups.

## **Physics-**

- **Mathematical Physics: To develop mathematical methods so as to solve the problems in Physics.** It include topics- Linear vector space; matrices; vector calculus; elements of complex analysis; linear differential equations; Laplace transforms, elementary ideas about tensors, Fourier analysis.
- **Classical Mechanics: Sub-field of mechanics that is related to the set of physical laws to explain the motion of bodies under the action of system of forces.** It include topics- Conservation laws; Kepler problem, central forces and planetary motion; collisions and scattering in laboratory and centre of mass frames; rigid body dynamics; moment of inertia tensor; mechanics of system of particles; non inertial frames and pseudo forces; variational principle; Hamilton's and Lagrange's formalisms; cyclic coordinates, equation of motion, Poisson bracket; small oscillations, periodic motion; normal modes; special theory of relativity – Lorentz transformations, mass-energy equivalence, relativistic kinematics
- **Electromagnetic Theory:Deal with atmospheric electricity.** It include topics- Solution of magnetostatic and electrostatic problems including boundary value problems; conductors and dielectrics ; Ampere's laws and Biot-Savart's; Faraday's law; Maxwell's equations; vector and scala potentials; Lorentz and Coulomb gauges; Electromagnetic waves and their reflection, interference and refraction, diffraction and polarization. Poynting vector, Poynting theorem, momentum and energy of electromagnetic waves; radiation from a moving charge.
- **Quantum Mechanics:Deals with physical phenomena at microscopic levels.** It include topics- Physical basis of quantum mechanics; Schrodinger equation; uncertainty principle; two,one and three dimensional potential problems; harmonic oscillator, particle in a box, hydrogen atom; linear vectors and operators in Hilbert space; spin and angular momentum ; addition of angular momenta; elementary scattering theory, time independent perturbation theory.
- **Thermodynamics and Statistical Physics:It uses techniques of probability theory & statistics to deal with vast populations and approximations to find an answer to physical problems.** It include topics- Laws of thermodynamics; macrostates and

microstates; probability ensembles; phase space; partition function, calculation of thermodynamic quantities; free energy ,classical and quantum statistics; black body radiation; degenerate Fermi gas; and Planck's distribution law; first and second order phase transitions, critical point; Bose-Einstein condensation.

- **Atomic and Molecular Physics:**Study of physical characteristics of molecules and the chemical bonds between atoms as well as molecular dynamics. It include topics- Spectra of one- and many-electron atoms; LS and jj coupling; hyperfine structure; Stark and Zeeman effects; electric dipole transitions and selection rules; X-ray spectra; vibrational and rotational spectra of diatomic molecules; electronic transition in diatomic molecules, Raman effect; NMR and ESR; lasers, Franck-Condon principle
- **Solid State Physics:**Study of rigid matter by the help of techniques crystallography,electromagnetism etc. It include topics- Elements of crystallography; bonding in solids; diffraction methods for structure determination; elastic properties of solids; lattice vibrations ;defects in crystals and thermal properties of solids; band theory of solids; free electron theory ; semiconductors, metals and insulators; transport properties; dielectric ,optical and magnetic properties of solids; elements of superconductivity.
- **Nuclear and Particle Physics:**It studies the nature of particles that are the constituents of matter and radiation. It include topics- Nuclear radii and charge distributions, Electric and magnetic moments; nuclear binding energy; nuclear models, liquid drop model – semi-empirical mass formula, , nuclear shell model; Fermi gas model of nucleus ;nuclear force and two nucleon problem; Alpha decay, Beta-decay, electromagnetic transitions in nuclei;Rutherford scattering,nuclear reactions, conservation laws; fusion and fission; particle accelerators and detectors; elementary particles, photons, mesons, baryons and leptons; quark model.
- **Electronics:**It refers to electrical circuits that include active electrical components such as diode,transistors etc. It include topics- Network analysis; semiconductor devices;, Field Effect Transistors,Bipolar Junction Transistors; Oscillator and amplifier circuits; negative feedback circuits ;operational amplifier ;active filters and oscillators; rectifier circuits, basic digital logic circuits, regulated power supplies ,sequential circuits, counters, flip-flops, registers, D/A and A/D conversion.