



NATIONAL INSTITUTE OF TECHNOLOGY TIRUCHIRAPPALLI - 620015

DEPARTMENT OF PHYSICS SYLLABUS FOR WRITTEN TEST

1. Mathematical Methods of Physics

Dimensional analysis and scaling- Vector algebra and vector calculus- Linear algebra: matrices, determinants, eigenvalues and eigenvectors- Cayley-Hamilton theorem-Ordinary differential equations and special functions- Partial differential equations- Complex analysis: analytic functions, contour integration, residues- Fourier series and Fourier transforms- Laplace transforms- Probability theory and statistics- Tensor analysis and Green's functions.

2. Classical Mechanics

Newton's laws of motion- Conservation laws- Central force motion- Two-body problem Rigid body dynamics- Rotating coordinate systems- Oscillations and normal modes- Lagrangian and Hamiltonian formulations- Poisson brackets and canonical transformations- Special relativity- Nonlinear dynamics and chaos.

3. Electromagnetic Theory

Electrostatics and boundary value problems- Multipole expansion- Magnetostatics-Maxwell's equations- Electromagnetic waves- Waveguides and transmission lines- Poynting theorem- Radiation from moving charges- Lorentz transformations in electrodynamics.

4. Quantum Mechanics

Schrodinger equation- Hilbert space and operators- Commutation relations- Angular momentum algebra- Spin systems- Harmonic oscillator- Hydrogen atom- Approximation methods: Time-independent and time-dependent perturbation theory, Variational method and WKB approximation- Scattering theory- Identical particles.

5. Thermodynamics and Statistical Physics

Laws of thermodynamics- Thermodynamic potentials- Maxwell relations- Kinetic theory of gases- Microcanonical, canonical and grand canonical ensembles- Partition function- Classical and quantum statistics- Bose-Einstein and Fermi-Dirac distributions- Phase transitions- Transport phenomena.

6. Electronics

Semiconductor devices- Diodes and transistors- Amplifiers- Operational amplifiers Digital electronics- Logic gates.

7. Atomic and Molecular Physics

Atomic spectra- Fine and hyperfine structure- Zeeman and Stark effects- LS and JJ coupling- Molecular bonding- Rotational, vibrational and electronic spectra- Lasers and optical pumping.

8. Condensed Matter Physics

Crystal structure- Reciprocal lattice- X-ray diffraction- Phonons- Free electron theory- Band theory- Semiconductors- Superconductivity- Magnetic properties- Dielectric and optical properties.

9. Nuclear and Particle Physics

Nuclear properties- Liquid drop and shell models- Radioactive decay- Nuclear reactions Particle accelerators and detectors- Elementary particles- Quark model- Conservation laws and symmetries

10. Non-destructive Testing

Fundamentals of electromagnetics and eddy current generation- Principles of ultrasonic methods- Nature of sound waves and their modes of propagation in materials- Principles and applications of radiographic testing- Fundamentals of thermal imaging and terahertz imaging techniques.