Learn Physics in Right Way

GATE Physics

Syllabus

Be Part of Disciplined Learning

Syllabus

Section 1: Measurements and Error Analysis

Units and dimensions, dimensional analysis; least count, significant figures; Methods of measurement and error analysis for physical quantities associated with various measurements; 2-probe and 4-probe methods for resistance measurement; Grounding for electrical circuits, Ground loops; Design of DC power supply, Signal processing through lock-in amplifiers.

Section 2: Mathematical Physics

Linear vector spaces: basis, orthogonality and completeness; matrices: similarity transformations, diagonalization, eigenvalues and eigen vectors; linear differential equations: simple applications of first and second order linear differential equations and solutions; complex analysis: Cauchy-Riemann conditions, Cauchy's theorem, singularities, residue theorem and applications; Fourier analysis; tensors: tensor transformations, covariant and contravariant tensors.

Section 3: Classical Mechanics

D'Alembert's principle, Euler-Lagrange equation, Hamilton's principle, calculus of variations; symmetry and conservation laws; central force motion: Kepler problem; small oscillations: coupled oscillations and normal modes; rigid body dynamics: inertia tensor, orthogonal transformations, Euler angles, torque free motion of a symmetric top; Hamiltonian and Hamilton's equations of motion; canonical transformations: Poisson bracket. Special theory of relativity: Lorentz transformations, relativistic kinematics, mass-energy equivalence.

Section 4: Thermodynamics and Statistical Mechanics

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

Section 5: Electromagnetic theory

Solutions of electrostatic and magnetostatic problems including boundary value problems; method of images; separation of variables; dielectrics and conductors; magnetic materials; multipole expansion; Maxwell's equations; scalar and vector potentials; Coulomb and Lorentz gauges; electromagnetic waves in free space, non-conducting and conducting media; reflection and transmission at normal and oblique incidences; polarization of electromagnetic waves; Poynting vector, Poynting theorem, energy and momentum of electromagnetic waves.

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Section 6: Optical Physics

Wave equation: plane and spherical waves, superposition of waves, standing waves, phase and group velocities; Interference: spatial and temporal coherence, dielectric films, Newton's ring, multiple-beam interference, Michelson interferometer, Fabry-Perot interferometer and etalon; diffraction: Fresnel and Fraunhofer diffraction, rectangular and circular aperture, Rayleigh criterion of resolution, diffraction from double slit and many slits. dispersion by a grating; polarization: Jones vectors and matrices for linear, circular and elliptical polarization, birefringence, ray-transfer matrix for mirrors and lenses; lasers: Einstein coefficients, population inversion, two and three level laser systems.

Section 7: Quantum Mechanics

Basic ideas of quantum mechanics; uncertainty principle; linear vectors and operators in Hilbert space; time independent Schrodinger equation; one dimensional potentials: step potential, finite rectangular well, tunnelling from a potential barrier, particle in 1,2,3-dimensional box, particle in single and double delta function potentials, 1,2,3 dimensional harmonic oscillator: concept of degeneracy; central potentials; hydrogen-like atoms; orbital and spin angular momenta; addition of angular momenta; variational method, time independent perturbation theory; elementary scattering theory, Born approximation.

Section 8: Atomic and Molecular Physics

Spectra of one-and many-electron atoms; spin-orbit interaction: L-S and j-j coupling schemes; fine and hyperfine structures; Zeeman, Paschen-Back and Stark effects; electric dipole transitions and selection rules; rotational and vibrational spectra of diatomic molecules; electronic transitions in diatomic molecules, Franck-Condon principle; Raman effect and basics of Raman spectroscopy; NMR, ESR, X-ray and Mossbauer spectroscopies.

Section 9: Solid State Physics

Elements of crystallography; diffraction methods for structure determination; bonding in solids; lattice vibrations and thermal properties of solids; free electron theory; band theory of solids: nearly free electron model; metals, semiconductors and insulators; conductivity, electron and hole statistics in intrinsic and extrinsic semiconductors, mobility and effective mass; metal-semiconductor junctions; ohmic and rectifying contacts; dielectric properties of solids; polarizability, ferroelectricity; magnetic properties of solids; dia, para, ferro, antiferro and ferri magnetism, ferromagnetic domains; superconductivity: type-I and type II superconductors, Meissner effect, London equation, BCS theory, flux quantization.

Section 10: Nuclear and Particle Physics

Nuclear binding energy, electric and magnetic moments; semi-empirical mass formula; nuclear models; liquid drop model, nuclear shell model; nuclear force and two nucleon problem; alpha decay, beta-decay, electromagnetic transitions in nuclei; Rutherford scattering, nuclear reactions, conservation laws; fission and fusion; particle accelerators and detectors; elementary particles; photons, baryons, mesons and leptons; quark model; conservation laws, isospin symmetry, charge conjugation, parity and time-reversal invariance.

Section 11: Electronics

p-n diodes, bipolar junction transistors, field effect transistors; negative and positive feedback circuits; oscillators, operational amplifiers and their applications, active filters; wave form generators: sine wave, square wave and triangular wave; basics of digital logic circuits, combinational and sequential circuits, flip-flops, timers, counters, registers, A/D and D/A conversion.

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Exam Instructions

Be Part of Disciplined Learning

TIME: 3 HOURS **MAXIMUM MARKS: 100**

Mode of Exam: Online

- This question paper consists of **2 sections**, General Aptitude **(GA)** section for **15 marks** and the subject specific section **(PHYSICS)** for **85 marks**. Both these sections are compulsory.
- There will be a total of 65 questions carrying 100 marks.
- The GA section consists of 10 questions. Question numbers 1 to 5 are of 1 mark each, while question numbers 6 to 10 are of 2 marks each.
- The subject specific **PH** section consists of **55** questions, out of which question numbers 11 to 25 are of 1 mark each, while question numbers 36 to 55 are of 2 marks each.
- Use the data given in the question while answering that question. If such data are not given, and the paper has useful data, then the same can be viewed by clicking on the Useful Data button that appears at the top, right-hand side of the screen.
- The question paper consists of Multiple Choice Questions (MCQ), Multiple Select Questions (MSQ) and Numerical Answer Type (NAT).
- (a) Multiple choice type questions have four choices (a), (b), (c) and (d) out of which only ONE is the correct answer.
- (b) Multiple select type questions have four choices (a), (b), (c) and (d) out of which more than own option is the correct answer.
- (c) For Numerical answer type questions, a numerical answer should be entered.
- All those questions that are not attempted will carry zero marks.
- However, wrong answers for multiple choice type questions (MCQ) will carry **NEGATIVE** marks. For multiple choice type questions, a wrong answering will lead to deduction of **1/3** marks for a 1-mark question and **2/3** marks for a 2-mark question.
- There is no negative marking for MSQ and NAT questions.
- Only Virtual Scientific Calculator is allowed. Charts, graph sheets, tables, cellular phone or other electronic gadgets are **NOT** allowed in the examination hall.

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