

For the post of Written Recruitment Test for the post of Postgraduate Assistants in Tamil Nadu Higher Secondary Educational Service.

Syllabus: PHYSICS (Subject Code: P04)

UNIT- I - Vector Fields

General expression for gradient, divergence curl and Laplace operators in orthogonal curvilinear Co-ordinates and their explicit form in Cartesian spherical-co-ordinates, Stokes theorem and Gauss theorem.

Matrix theory

Algebraic operation – Rank of a matrix. Eigen values and Eigen vectors - characteristic equation – Cayley Hamilton theorem – Diagonalisation and Diagonalizability of unitary orthogonal. Hermitian and symmetric matrices.

Special functions

Legendre, Hermite and Lagrange equation basic properties – Gamma and Beta functions.

UNIT-II - Probability and Theory of errors

Basic concept of probability distribution – Exclusive events and addition – Compound events and products – Binomial – Poisson and Gaussian distribution – Normal distribution of error – Standard error – Principle of least squares – Application of solution of linear equation – Curve fitting.

Group theory

Definition – Sub-groups – Homomorphism and isomorphism – Group representations – Irreducible representation – Unitary representation.

UNIT – III - Classical mechanics

Generalised co-ordinates – D'Alembert's principle, Lagrangian equation of motion – Hamiltonian equation – Conservative and non-conservative systems - Hamilton equation, cyclic variables, principle of least action – Theory of small oscillations – Normal co-ordinates and normal modes - Linear Triatomic molecule - Rigid bodies - Moments and products of inertia-Euler's angle - Euler's equation of motion-Symmetric top.

UNIT-IV - Statistical Mechanics

Maxwell Boltzmann statistics Maxwellian distribution of velocities – Mean – root mean square and most probable velocities Bose-Einstein statistics – Distribution function – Phonon gas – Black body radiation – Fermi-Dirac statistics – Distribution function – Electron gas – Pauli paramagnetism – Thermionic emission – Elementary idea of phase transition – Properties of liquid Helium – phase space, Liouville's theorem – statistical equation – micro canonical ensembles – Equation of state-thermodynamic functions of an ideal gas equipartition of energy.

UNIT-V - Electromagnetic theory

Coulomb law – Gauss law – Poisson's equation – Laplace equation and solution to boundary value problem – Electrostatics of dielectric media – Molecular polarisability and its application – Vector – Scalar potential – B and H in a magnetic material – Maxwell's equations and their significance – Poynting theorem – Radiation of oscillating dipole.

Relativistic Mechanics

Basic ideas - Lorentz transformation. Time dilation and Lorentz contraction -Velocity addition law - Momentum and energy in relativistic Mechanics - Centre of mass system for two relativistic particles.

UNIT-VI - Spectroscopy

Rotation spectra – Vibration spectra – Rotation vibration spectra of diatomic and linear molecules – Raman Spectra – experimental techniques and classical theory of Raman Scattering – Electronic state of diatomic molecules – Frank–Condon principle – Hund’s coupling scheme – Evaluation of molecular constant from vibrational spectra data. Interaction between nuclear spin and magnetic field – Nuclear resonance-Chemical shift-Dipole-Dipole interaction-Spin lattice interaction.

UNIT-VII - Solid State Physics

Energy levels and density of states in one, two and three dimensions – Electrical and Thermal conductivities – Wiedmann-Franz law. Energy bands in solids – Transport phenomena in semiconductors operational functions of a junction diode-Schottky diode – Bloch theorem - Krong-Penny model – Brillouin zones – Wave equation of an electron in a periodic potential.

Thermal Properties of solids

Laws of Thermodynamics – Maxwell’s relations and their applications – Phase transitions – Production and measurement of low temperatures –Einstein and Debye theory of specific heats of solids.

Magnetic properties of materials

Langevin’s theory of dia-para-magnetism – Quantum theory of para – magnetism – Ferro – magnetism – Ferri – magnetism – superconductivity – Meissner effect – Thermodynamics of superconducting materials – London equation – B.C.S. theory – Josephson’s effect.

UNIT-VIII - Quantum mechanics

Schrodinger’s wave equation – Free particle – Particle in a potential well and barrier penetration - The probability interpretation – Expectation value – Eigen functions and eigen values – Stationary states – Wave packet – Uncertainty principle – Linear Harmonic oscillator – angular momentum and addition of angular momenta.

Perturbation theory – Transition probability – Constant and harmonic perturbation – Scattering theory – Differential and total scattering cross section – Born approximation – Partial wave analysis and phase shift analysis – Relativistic wave equations – Klein – Gordon equations – Dirac equation and its free particle solution.

UNIT-IX - Nuclear Physics

Binding energy – Semi empirical mass formula – Stability of nuclei – Nuclear forces – Ground state of deuteron – Alpha decay – B decay – Fermi’s theory – Selection rules – Liquid drop model – Nuclear fission – Shell model – Collective models.

Nuclear Instrumentation

Cyclotron - Synchro cyclotron – Proton synchrotron – Detectors – G.M.Counter – Scintillation Counter – Bubble chamber – Nuclear reactors – Neutron cross section – Fission product – Energy release – Chain reaction – Multiplication factor – Moderator – Natural Uranium – Diffusion equation.

Unit X - Electronics (Digital electronics)

Binary - Decimal – Octal and Hexadecimal numbers – 8421 Excess-3 - Gray Codes – Logic gates – Laws Boolean algebra – Half and full adders – Subtractors – RS, RST, JK and M/S Flip-flops – Ripple counter – Decade counter –Up-down counter – Serial and parallel registers.

Operational amplifier

Differential amplifier – Parameters – Applications – Analog integration and differentiation – Analog computation – Comparators – Sample and hold circuits – Oscillator – Hartley-Colpitt-Phase Shift - Wien's bridge oscillators – Astable mono -Bistable multivibrators – Clipping and clamping circuits.

Microwave Physics

Microwave generation – Klystron – Magnetron – Travelling wave tubes – Microwave in rectangular and cylindrical wave guides – Characteristics of Antennas – Short dipole radiation – Antenna gain – Directivity – Radiation resistance – Radiation intensity.

Microprocessor

Evolution of Microprocessors – Organisation of micro-computers- Preliminary concepts – Basic concepts of programming – Architecture – Address – Data and control buses – Memory decoding – Memory mapped I/O and I/O mapped I/O.

Machine and instruction cycles – Addressing modes – Use of arithmetic logical data – Transfer stack and I/O instructions – Instruction set and assembly programming of 8085 microprocessor – Fetch – Execute – overlap – Instruction cycles – Instruction forward – Memories – RAM-PROMS, EPROMS-EEPROMS – Static and Dynamic RAM.