



TEACHERS' RECRUITMENT BOARD, TRIPURA (TRBT)
 EDUCATION (SCHOOL) DEPARTMENT, GOVT. OF TRIPURA
 SYLLABUS: PHYSICS (MCQs OF 150 MARKS)
 SELECTION TEST FOR POST GRADUATE TEACHER(STPGT): 2016

UNIT I: KINEMATICS AND MECHANICS:

- Frame of reference, Motion in a straight line
- Elementary concepts of differentiation and integration in graphical presentation for describing motion, Uniform and non-uniform accelerated motion, conversion of one graphical representation into other Vector algebra and vector calculus, different theorems on vector calculus Motion in a plane, cases of uniform velocity and uniform acceleration-projectile motion, Uniform and non-uniform circular motion.
- Rigid body Mechanics, Principle of virtual work, Lagrangian and Hamiltonian formulation and their applications in simple cases, Rotational motion under constant angular acceleration, kinetic energy of a rotating body, Role of friction in rolling body, Collision of two rolling bodies in rough surface, idea of centre of mass and its motion, Dynamics of Rotational Motion, velocity and acceleration of a particle in plane polar co-ordinates, central force and central orbit, Coriolis's force and explanation of some phenomena by it.

UNIT II: GENERAL PROPERTIES OF MATTER:

- Relation between acceleration due to gravity and gravitational constant, variation of acceleration due to gravity with various parameters, Gravitational potential and intensity for symmetrical bodies, Gauss's theorem in gravitation, Areal velocity, Kepler's laws on planetary motion, satellites, escape speed, geostationary satellite and parking orbits
- Elastic moduli and their relations, expression for strain energy, torsion of a cylindrical wire, torsional oscillation, bending moment, bending of uniform beam clamped at one end, supported at both ends,
- Surface tension, its molecular theory, surface energy, relation between surface tension and surface energy, excess pressure across a curved film with special cases, capillarity, Jurin's law, shape of liquid drops
- Viscosity, Newton's law of viscosity, Critical velocity and Reynold's number, Poiseuille's equation, Stoke's law, Terminal velocity
- Equation of continuity, Bernoulli's theorem and its applications

UNIT III: HEAT AND THERMODYNAMICS:

- Thermal conduction, Fourier's equation, application of thermal conductivity in different cases
- Equation of state of a real gas, Critical constants, Expression for Boyle's temperature
- Basic assumptions of Kinetic theory of gases, concept of pressure, Kinetic interpretation of temperature; r. m. s speed, average speed and most probable speed of gas molecules; degrees of freedom, law of equipartition of energy and application to specific heat capacities of gases

- Thermal equilibrium and definition of temperature (Zeroth law of thermodynamics). Heat, work and internal energy, First law of thermodynamics, Work done in different thermodynamic processes, Different thermodynamic relations, indicator diagram, Carnot's engine its efficiency, Carnot's theorem, Second law of thermodynamics, entropy- its property and significance, Entropy of an ideal gas, Entropy of a mixture of gases, Change of entropy during reversible and irreversible changes, Principle of increase of entropy
- Porus plug experiment, Joule-Thomson experiment, inversion temperature

UNIT-IV: SOUND:

- Study of Simple harmonic motion (S.H.M), its differential equation solution and applications, Lissajous Figures, Damped vibration, differential equation, quality factor, forced vibration- Differential equation, resonance and sharpness of resonance
- Idea of wave motion, elastic waves in solids, liquids and gases, phase and group velocities, differential equation of a travelling wave, distribution of pressure in travelling waves, expression for energy density of a wave, Transverse vibration in a string, Characteristics of plucked and struck string, relative and absolute intensity of sound wave, decibel and Phon, idea of standing waves, interference of waves, Doppler effect and calculation of Doppler's shift in all possible cases,



UNIT-V: OPTICS:

- Fermat's principle, reflection and refraction at plane and curved surfaces, Lens makers' formula, equivalent lens, thick lenses, principal planes, Nodal planes, Helmholtz-Lagrange law
- Aberration-Chromatic and Spherical aberration, their remedies with reference to Ramsden and Huygen's eye-pieces, qualitative ideas of astigmatism, distortion, Angular magnification, resolving power
- Electromagnetic nature of light, Huygen's principle, interference of light, coherent and incoherent sources, Young's experiment and expression for fringe width (deduction not required), interference by division of wave front and division of amplitude
- Diffraction (Fresnel and Fraunhofer class), diffraction pattern due to single slit and plane transmission grating, Rayleigh criterion of resolution, expressions for resolving powers of grating, prism, telescope and microscope (deduction not required), half period zones, principle of Zone plate and its behaviour as convergent lens
- Polarization of light, biaxial and uniaxial crystals, Brewster's law, Law of Malus, ordinary and extraordinary rays, half and quarter wave plates, Optical activity, Faraday effect and Kerr effect.

UNIT - VI: ELECTROSTATICS:

- Electric potential and electric field intensity, Calculation of potential and field due to an electric dipole, torque on a dipole placed in a uniform electric field and work done, Equipotential surface and its properties, Idea of electric flux, Gauss's theorem in electrostatics and its applications, Coulomb's theorem, mechanical force on a charged surface, energy per unit volume of a medium Capacitance of a parallel, spherical and cylindrical capacitor, loss of energy

due to sharing of charges between two conductors, concept of electrical image Electric polarization, electric displacement, dielectric constant

UNIT VII: CURRENT ELECTRICITY

- Drift velocity, mobility and their relation with electric current; Ohm's law in vector form, Combination of cells (series and parallel) with different e. m. fs, internal resistance of cell, Potential divider, Kirchhoff's laws and simple applications. Wheatstone bridge, Carey Foster bridge, end correction of meter bridge, working principle of potentiometer and its applications, network theorems, thermo electricity different types of galvanometer and applications.

UNIT VIII: MAGNETIC EFFECT OF CURRENT, MAGNETISM, ELECTROMAGNETISM AND AC

- Magnetic effect of electric current: Biot-Savart's law in vector form and its applications, Ampere's theorem and its applications, force on a moving charge placed in a uniform magnetic field, Effect of magnetic field on current carrying conductor, Ammeter and voltmeter, Force between two parallel currents,
- Magnetism: Magnetic dipole and its moment, Magnetic potential and intensity at any point due to a short bar magnet and magnetic shell, Magnetic elements of the earth, Effect of magnet on magnet, Gauss's tangent A and tangent B position, Magnetometer, permeability, intensity of magnetization, susceptibility and their relation, Cycle of magnetization, hysteresis, Retentivity and coercivity, Choice of materials for electromagnet and permanent magnet Para-, dia- and ferro - magnetic substances, with examples.
- Electromagnetism: Theory of Electromagnetic induction and its application in different cases
- Varying currents, Growth and decay of currents in LR circuit, charging and discharging of condenser in CR circuit, charging and discharging of condenser in LCR circuit Time constant and logarithmic decrement
- Alternating Current: RMS and average value of alternating e. m. f. and current, Idea of reactance and impedance, Current in LR, CR and LCR series circuit with AC source, Series and parallel resonant circuit, Q-factor, power in an AC circuit, Wattless component of current, choke coil, LC oscillation, Principle of an ideal transformer, various transformer losses

UNIT IX: MODERN PHYSICS

- Millikan's oil drop experiment, Bohr's theory of hydrogen spectra, quantum numbers, Pauli's exclusion principle
- Production of X-rays and its properties, continuous and characteristic X-ray spectra and their origin, Mosley's law, Bragg's law, Compton's effect, Photoelectric effect
- Planck quantum hypothesis, de-Broglie hypothesis, Schrodinger's wave equation, quantum mechanical operator, eigen values and eigen function, Normalization of a wave function, expectation value, Commutation relation and measurement, particle in a box, linear harmonic

oscillator, potential well and barrier problems, hydrogen atom problem, angular momentum, spherical harmonics, parity, atomic spectra, time dependent perturbation method, two electron atom,

- Vector atom model, Space quantization, spin-orbit interaction, LS and J-J coupling, sodium D line, Zeeman and Stark effect
- Molecular spectra, vibration and rotation spectra, Raman effect, Stoke's and anti-Stoke's lines
- Crystal Structure, direct and reciprocal lattice, lattice vibration, simple cubic, b.c.c. and f.c.c. lattices, free electron theory, band theory, Kronig-Penny Model, idea of effective mass, Hall effect
- Statistical mechanics, ensemble, canonical and grand canonical ensemble, BE, FD and MB statistics, BE condensation
- Nuclear physics, nuclear charge, radius, spin, moment, mass defect, nuclear binding energy, condition for the stability of nucleus, nuclear disintegration, Radioactivity, half life and mean life, idea of successive disintegration, nuclear reaction, Q-value, Nuclear fission and fusion, Cyclotron, Betatron
- Laser, population inversion, coherence properties, applications of laser, principle of He-Ne Laser, optical fibre
- Galilean and Lorentz transformations, Time dilation and length contraction, variation of mass with velocity, mass energy equivalence

UNIT X: ELECTRONICS AND COMMUNICATION SYSTEM

- PN Junction diode, Diode as a half, full and bridge rectifiers, Zener diode and its role in voltage stabilization, working principles of photo diode, Light emitting diode (LED) and solar cell
- Bipolar junction transistor, its type and operations, CB, CE and CC configurations, transistor characteristics, hybrid parameters, transistor as an amplifier and a switch,
- Binary system, Conversion from binary to decimal and vice versa, Boolean algebra, Combinational and sequential circuits
- Different types of modulation and demodulation in analog and digital communication, Role of ionosphere in signal transmission
