Module-1 Oscillations and Waves 0 hours

Free Oscillations: Definition of SHM, derivation of equation for SHM, Mechanical simple harmonic oscillators (mass suspended to spring oscillator), complex notation and phasor representation of simple harmonic motion. Equation of motion for free oscillations, Natural frequency of oscillations. Damped and fon:ed oscillations: Theory of damped oscillations: over damping, critical &under damping, quality factor. Theory of forced oscillations and resonance, Sharpness of resonance. One example for mechanical resonance. Shock waves:Mach number, Properties of Shock waves, control volume. Laws of conservation of mass, energy and momentum. Construction and working of Reddy shock tube, applications of shock waves. Numericalproblems **(RBT Levels :Ll, Ll & L3)**

Module-2	Elastic properties of materials	0 hours

Elasticity:Concept of elasticity, plasticity, stress, strain, tensile stress, shear stress, compressive stress, strain hardening and strain softening, failure (fracture/fatigue), Hooke's law, different elastic moduli: Poisson's ratio, Expression for Young's modulus (Y), Bulk modulus (K) and Rigidity modulus (n) in terms of and p. Relation betweenY, n andK, Limits ofPoisson's ratio.

Bending of beams:Neutral surface and neutral plane, Derivation of expression for bending moment. Bending moment of a beam with circular and rectangular cross section.Single cantilever, derivation of expression for Young's'modulus.

Torsion of cylinder: Expression for couple per unit twist of a solid cylinder (Derivation), Torsional pendulum-Expression for period of oscillation. Numerical problems. **(RBT Levels : Ll, Ll & L3)**

| Module-3 | Maxwell's equations, EM waves and Optical fibers | 0 hours |

Maxwell's equations: Fundamentals of vector calculus. Divergence and curl of electric field and magnetic field (static), Gauss'divergence theorem and Stokes' theorem. Description oflaws of electrostatics, magnetismand Faraday's laws of EMI. Current density & equation of Continuity; displacement current (with derivation) Maxwell's equations in vacuum.

EM Waves: The wave equation in differential form in free space (Derivation of the equation using Maxwell's equations), Plane electromagnetic waves in vacuum, their transverse nature, polarization of EM waves (Qualitative).

Optical fibers: Propagation mechanism, angle of acceptance. Numerical aperture. Modes of propagation and Types of optical fibers. Attenuation: Causes of attenuation and Mention of expression for attenuation coefficient. Discussion of block diagram of point to

Module-4	Quantum Mechanics and Lasers	0 hours

Quantum mechanics: Introduction to Quantum mechanics, Wave nature of particles, Heisenberg's uncertainty principle and applications (non confinement of electron in the nucleus), Schrodingcr time independent wave equation, Significance of Wave function, Normalization, Particle in a box, Energy eigen values of a particle in a boxand probability densities.

Lasers: Review of spontaneous and stimulated processes, Einstein's coefficients (derivation of expression for energy density). Requisites of a Laser system. Conditions for laser action. Principle, Construction and working of col and semiconductor Lasers. Application of Lasers in Defense (Laser range finder) and Engineering (Data storage). Numerical problems **(RBT Levels : LI, LI & L3)**

Module-5	Material science	0 hours

Quantum Free electron theory of metals: Review of classical free electron theory, mention of failures. Assumptions of Quantum Free electron theory, Mention of expression for density of states, Fermi-Dirac statistics (qualitative), Fermi factor, Fermi level, Derivation of the expression for Fermi energy, Success of QFET.

Physics of Semiconductor: Fermi level in intrinsic semiconductors, Expression for concentration of electrons in conduction band, Hole concentration in valance band (only mention the expression), Conductivity of semiconductors(derivation), Hall effect, Expression for Hall coefficient (derivation)

Dielectric materials: polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation(Derivation), mention of solid, liquid and gaseous dielectrics with one example each.Application of dielectrics in transformers. Numerical problems.