BLOWUP OF
I/II SEMESTER

ENGINEERING PHYSICS

Sub Code	**:**	**06 PHY-12/06 PHY-22**	**IA Marks**	**:**	**25**
Hrs/ Week	**:**	**04**	**Exam Hours**	**:**	**03**
Total Hrs.	**:**	**52**	**Exam Marks**	**:**	**100**

Unit	Topics	Details of coverage
1	**Modern Physics**	
	Introduction to Blackbody radiation spectrum	Brief explanation of distribution of energy in the black body radiation spectrum:Wien's law, Rayleigh-Jeans law(no derivation), Ultraviolet catastrophe, Planck's radiation law (no derivation)
	Photo-electric effect,	Brief introduction about the particle aspect of light may be mentioned leading to the concept of photons
	Compton effect.	Brief introduction No derivation **NO numerical question to be set from the introduction part**
	Wave particle Dualism de Broglie hypothesis :	Explanation of the concept
	de Broglie wavelength	Duality of photon, extension to particle, expression for de-Broglie wavelength
	Extension to electron particle.	deBroglie wavelength for accelerated electron
	Davisson and Germer Experiment.	Explanation, comparison of experimental result with theoretical value and conclusion
	Matter waves and their Characteristic properties.	Explanation
	Phase velocity, group velocity and Particle velocity.	Concept, explanation and equations
	Relation between phase velocity and group velocity.	Explanation and derivation
	Relation between group velocity and particle velocity.	Explanation and derivation with nonrelatevestic considerations
	Expression for deBroglie wave-length using group velocity.	Explanation and derivation

Unit	Topics	Details of coverage
2	**Quantum Mechanics**	
	Heisenberg's uncertainty principle and its physical significance .	Explanation (No derivation) usingGamma ray microscope: all three equations to be discussed. $\Delta x. \Delta p \geq h / 4\pi$. Not $h / 2\pi$
	Application of uncertainty principle	Non existence of an electron inside the nucleus
	Wave function. Properties and Physical significance of a wave function.	Complex wave function with explanation
	Probability density and Normalisation of wave function.	Explanation
	Setting up of a one dimensional time independent, Schrödinger wave equation.	Setting up on an equation using complex notation (starting from the wave function as a function of x & t)
	Eigen values and eigen function.	Explanation
	Application of Schrödinger wave equation :	
	Energy eigen values for a free particle.	Derivation of equation for free particle
	Energy eigen values of a particle in a potential well of infinite depth.	Derivation of equation for particle trapped in one dimensional potential well of infinite height. Discussion for eigen value and eigen function

Unit	Topics	Details of coverage
3	**Electrical Condutivity in Metals**	
	Free-electron concept. Classical free-electron theory Assumptions.	Brief explanation Drude-Lorentz theory
	Drift velocity. Mean collision time and mean free path.	
	Relaxation time.	Definitions
	Expression for drift velocity.	Explanation and expression
	Expression for electrical conductivity in metals.	Explanation and derivation for electrical conductivity
	Effect of impurity and temperature on electrical resistivity of metals.	Matthiessen's rule explanation with graph
	Failure of classical free-electron theory.	Explanation
	Quantum free-electron theory	Explanation assumptions.
	Fermi - Dirac Statistics.	Explanation
	Fermi-energy – Fermi factor.	Definitions and also Fermi distribution
	Density of states (with derivation).	Explanation and Expression (numericals up to this portion)
	Expression for electrical resistivity / conductivity.	Concept of effective mass and Fermi velocity. Discussion of equation and no derivation
	Temperature dependence of resistivity of metals.	Explanation with Mean free path.
	Merits of Quantum free electron theory.	Merits

4	**Dielectric and Magnetic Properties of Materials**	
	Dielectric constant and polarisation of dielectric materials.	Concept and explanation : derivation of polarisation vector
	Types of polarisation.	Detailed discussion on four types of polarizations
	Equation for internal fields in liquids and solids (one dimensional).	Solids only (one dimensional array)
	Classius – Mussoti equation.	Explanation with derivation
	Ferro and Piezo – electricity	Qualitative explanation
	Frequency dependence of dielectric constant.	Discussion and graph
	Important applications of dielectric materials.	Brief explanation
	Qualitative treatement of Langevin's and Weiss's equation for dia, para and ferro-magnetic materials.	Qualitative explanation of Langevin's theory for dia, para and Weiss's theory for ferro-magnetic materials (No derivation)
	B-H graph in ferromagnetic materials.	Explanation of Hysteris
	Soft and Hard magnetic materials.	Brief explanation and Applications.

5	**Lasers**	
	Principle and production.	Spontaneous and stimulated emission and induced absorption
	Einstein's coefficients	Expression for energy density and upto ratio of Spontaneous to stimulated emission
	Requisites of a Laser system.	Active medium and pumping system and resonant cavity
	Condition for Laser action.	Explanation
	Principle, Construction and working of He-Ne	Explanation with suitable diagrams
	semiconductor Laser.	Principle and working of any type of P-N Junction semiconducter
	Applications of Laser:	
	Laser welding, cutting and drilling. Measurement of atmospheric pollutants.	Explanation with diagrams
	Holography Principle of Recording and reconstruction of 3-D images.	Explanation with diagram
	Selected applications of holography	Hologram for storage of information Hologram as grating

6	**Superconductivity and Optical Fibers**	
	Temperature dependence of resistivity in superconducting materials.	Explanation of super conductivity
	Effect of magnetic field (Meissner effect).	Explanation with diagram
	Type I and Type II superconductors.	Explanation with diagram
	Temperature dependence of critical field.	Explanation with the help of graph
	BCS theory	Qualitative explanation
	High temperature superconductors.	Brief explanation
	Applications of super-conductors : Superconducting magnets, Maglev vehicles SQUIDS.	 Mechanism and brief explanation Principle and brief explanation Principle and brief explanation
	Propagation mechanism in optical fibers:	Explanation with diagram
	Angle of acceptance.	Expression
	Numerical aperture.	Explanation with diagram
	Types of optical fibers and modes of propagation.	Explanation with diagram
	Attenuation.	Explanation of equation (no derivation) - numericals.
	Applications: Block diagram discussion of point to point communication	 Explanation, advantages and disadvantages

7	**Crystal Structure** Space lattice Bravais lattice: unit cell primitive cell Lattice parameters	 Definitions and explanation
	Crystal systems	7 systems with 14 Bravais lattices and explanations
	Direction and planes in a crystal	Explanation
	Miller indices	Definition, steps to determine Miller Indices
	Expression for inter-planar spacing	Derivation
	Co-ordination number	Explanation
	Atomic packing factor	Derivation of expression
	Bragg's Law.	Derivation
	Determination of crystal structure by Bragg's x-ray spectrometer	Construction and working, determination of d spacing of crystal and wavelength-classification . ratio of interplaner spacing for all three Bravi's lattices to be mentioned (no derivation.)
	Crystal structures of NaCl, diamond.	Explanation with diagram

8	**Material Science**	
	Nano-materials	Brief explanation
	Molecular Manufacturing.	
	Nano-mechanical bearings.	
	Fabrication technology.	Brief explanation
	Scaling of classical mechanical systems :	Brief explanation
	Basic assumptions.	
	Mechanical scaling.	
	Scaling of electromagnetic systems:	Brief explanation
	Basic assumptions.	
	Corrections. Magnitude and scaling:	
	Steady state systems	
	Time dependent systems	
	Carbon nano-tubes	Discussion in detail with properties and applications.
	Ultrasonic non-destructive testing of materials.	Explanation with diagram
	Measurement of velocity in solids and liquids.	Explanation experimental method using ultrasonic interferometer.(no derivation)
	Determination of elastic constants in solids and liquids.	Determination- no derivation