CBCS SCHEME - Summer Semester

USN

BPHYE102/202

First/Second Semester B.E/B.Tech. Degree Examination, June/July 2025
Applied Physics for EEE Stream

Time: 3 hrs. Max. Marks:100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. VTU Formula Hand Book is permitted.

		Module – 1	M	L	C
1	a.	State and explain Heisenberg's uncertainty principle. Show that electron does not exist inside the nucleus on the basis of Heisenberg's uncertainty principle.	9	L2	CO1
	b.	Setup time independent schrodinger wave equation for free particle in one dimension.	7	L2	CO1
	c.	Calculate the momentum of an electron and the de Broglie wavelength associated with it if it's kinetic energy is 1.5 kev.	4	L3	CO1
		OR			
2	a.	What is wave function? Give it's physical significance and properties.	6	L2	CO1
	b.	Obtain the expression for Eigen value and Eigen function for a particle in a box.	10	L2	CO1
	c.	An electron has a speed of 4.8×10^5 m/s accurate to 0.012%. With what accuracy can we locate the Electron?	4	L3	CO1
		Module – 2			
3	a.	Describe Meissner's Effect and hence explain classification of superconductors into Type I and Type II superconductors.	9	L2	CO1
	b.	Derive clausius Mossotti equation.	6	L2	CO1
	c.	Calculate the probability of occupation of an energy level 0.2 eV above Fermi level at temperature 27° C	5	L3	CO1
		OR			
4	a.	Mention any three assumptions of quantum free electron theory. Discuss the dependence of Fermi factor on temperature and consequent effect on probability of occupation of energy levels.	10	L2	CO1
	b.	Explain the construction and working of MAGLEV Vehicle.	5	L2	CO1
	c.	Find the polarization produced in crystal by an electric field of strength 500 V/mm if it has a dielectric constant of 6.	5	L3	CO1
		Module – 3			
5	a.	Describe the Principle, construction and working of Carbon Dioxide Laser with energy level diagram.	8	L2	CO2
	b.	Discuss point to point optical fiber communication system. Mention two advantages and disadvantages of optical fiber system.	8	L2	CO2
	c.	A LASER source has a power output of 1 mW. Calculate the number of photons emitted per second. Given the wavelength of LASER 692.8 nm.	4	L3	CO2

		OR			
6	a.	What is numerical aperture? Obtain an expression for numerical aperture in an optical fiber.	8	L2	CO2
	b.	Obtain an expression for energy density of radiation under thermal equilibrium condition in terms of Einstein's coefficients.	8	L2	CO2
	c.	In an optical fiber, core and cladding has refractive indices 1.50 and 1.48 respectively. Calculate the numerical aperture and acceptance angle.	4	L2	CO2
		Module – 4			
7	a.	Explain the terms gradient of a scalar, divergence and curl of a rector. Derive divergence theorem.	8	L2	CO4
	b.	Derive wave equation in terms of electric field using Maxwell's equation for free space.	8	L2	CO3
	c.	Find the divergence of the vector field $\vec{A}$ given by $\vec{A} = 6x^2\hat{a}_x + 3xy^2\hat{a}_y + xyz^3\hat{a}_z$	4	L3	CO5
		OR			
8	a.	Discuss continuity equation. Derive the expression for displacement current.	9	L2	CO3
	b.	Explain the transverse nature of electromagnetic waves.	7	L2	CO3
	c.	In a diffraction grating experiment, the laser light undergoes second order diffraction for diffraction angle 1.48°. The grating constant $d = 5.05 \times 10^{-5}$m and The distance between the grating and the screen is 0.6m. Find the wavelength of laser light.	4	L3	CO5
		Module – 5			
9	a.	Establish relation between Fermi energy and energy gap for an intrinsic semiconductor. Discuss the law of mass action.	9	L2	CO4
	b.	Describe the construction and working of semiconductor laser with energy level diagram.	7	L2	CO4
	c.	The resistivity of intrinsic Germanium at 27°C is equal to 0.47 Ωm. Calculate the intrinsic carrier density. Given electron mobility = 0.38 $m^2v^{-1}s^{-1}$, hole mobility = 0.18 $m^2v^{-1}s^{-1}$.	4	L3	CO4
		OR			
10	a.	What is Hall voltage and Hall field? Obtain expression for Hassl voltage in terms of Hall coefficient.	8	L2	CO4
	b.	Explain the construction and working of photodiode. Discuss the power responsivity in a photo diode.	8	L2	CO4
	c.	The Hall co-efficient of a material is $3.68 \times 10^{-5}m^3/C$. Calculate carrier concentration.	4	L3	CO4

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