CBCS SCHEME

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 Hand Book is permitted.*

		Module – 1	M	L	C
Q.1	a.	State and explain Heisenberg's uncertainty principle show that the electron cannot exist inside the nuclear.	8	L2	CO1
	b.	Setup time independent Schrodinger wave equation for free particle in one dimension.	8	L2	CO1
	c.	Calculate the momentum of an electron and de-Broglie wavelength associated with it if its kinetic energy is 1.5 KeV.	4	L3	CO1
		OR			
Q.2	a.	What is wave function? Give its physical significance and properties.	8	L2	CO1
	b.	Assuming the time independent Schrodinger's wave equation, discuss the solution for a particle in one dimensional potential well of infinite height and hence obtain the normalized wave function.	8	L2	CO1
	c.	Calculate the energy in eV for the first two permitted excited state of an electron in an infinite potential well of width 2Å .	4	L3	CO1
		Module – 2			
Q.3	a.	What is Fermi's energy? Describe the dependence of Fermi factor on temperature and energy.	8	L2	CO2
	b.	Define internal field. Derive the Clausius – Mossotti equation.	8	L2	CO2
	c.	The Superconducting transition temperature of lead of 7.26 K. The initial field at 0 K is 64×10^3 Amp/m. Calculate the critical field at 5K.	4	L3	CO2
		OR			
Q.4	a.	What is Polarization? Describe various types of polarization mechanisms.	8	L2	CO2
	b.	What is Superconductivity? Explain the types of superconductors.	8	L2	CO2
	c.	What is the polarization produced in sodium chloride by an electric field of 600 V/mm, given that its dielectric constant is 6 ?	4	L3	CO2
		Module – 3			
Q.5	a.	Derive an expression for the radiant energy density under thermal equilibrium using Einstein's co-efficient.	8	L2	CO1
	b.	Define modes of propagation and V-number. Obtain the expression for the numerical aperture of an optical fiber.	8	L2	CO1

	c.	Find the ratio of population of the two energy states in a material that produces light of wavelength 6328 Å at 27°C .	4	L3	CO1
		OR			
Q.6	a.	Explain the construction and working of carbon dioxide laser. Mention any two applications of it.	8	L2	CO1
	b.	What is Refractive index profile? Describe three types of optical fiber with one application for each type.	8	L2	CO1
	c.	Find the attenuation in an optical fiber of length 500 m when a light signal of power 100 mW emerges out of the fiber with a power 90 mW.	4	L3	CO1
		Module – 4			
Q.7	a.	Describe the vector operator ∇ and explain the concepts of divergence, gradient and curl.	8	L2	CO3
	b.	What is displacement current? Derive an expression for displacement current.	8	L2	CO3
	c.	Determine the resonance frequency of an LCR series circuit with inductance = 0.5 henry, capacitance = 0.45, microfarad and resistance = 300Ω	4	L2	CO3
		OR			
Q.8	a.	State and prove Gauss divergence theorem. Mention four Maxwell's equations in differential form for time varying fields.	8	L2	CO3
	b.	Derive the wave equation interms of electric field using Maxwell's equation in free space.	8	L2	CO3
	c.	Find the wavelength of the semiconductor laser in diffraction grating experiment where the angle of diffraction for the first order is 0.75 degree. Given grating constant = $4.7 \times 10^{-5} m^{-1}$.	4	L3	CO5
		Module – 5			
Q.9	a.	Show that the Fermi level of an intrinsic semiconductor lies in the mid – part of the forbidden energy gap. Discuss the law of mass action.	8	L2	CO4
	b.	Derive an expression for electrical conductivity of an intrinsic semiconductor.	8	L2	CO4
	c.	The Hall co-efficient of a speciman of a dopped silicon is found to be 3.66×10^{-4} m^3/C. What is the type of charge carriers? Also calculate the carrier concentration.	4	L3	CO4
		OR			
Q.10	a.	What is Hall effect? Obtain the expression for Hall voltage and express Hall voltage interms of Hall coefficient.	8	L2	CO4
	b.	Explain construction and working of semiconductor diode laser with the help of energy Band diagram and mention any two applications of it.	8	L2	CO4
	c.	The resistivity of intrinsic germanium at 27°C is equal to 0.449 ohm-meter. Assuming electron and hole mobilites as 0.39 m^2/Volt-Sec and 0.19m^2/Volt-Sec respectively. Calculate the intrinsic carrier density.	4	L3	CO4

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