CBCS SCHEME

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BPHYE102/202

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
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
Q.1	a.	Apply Schrodinger's time independent equation to a particle in one dimensional potential well of infinite height and obtain the expressions for eigen values and eigen functions.	08	L3	CO1
	b.	State and explain Heisenberg's uncertainty principle and show that electrons does not exist inside the nucleus.	08	L2	CO1
	c.	A particle of mass 0.5 MeV/C^2 has kinetic energy 100 eV. Find its de-Broglie wavelength, where C is the velocity of light.	04	L3	CO1
		OR			
Q.2	a.	What is a Wave Function? Set up time independent Schrodinger's wave equation in one dimensional potential well of infinite height.	09	L2	CO1
	b.	Explain De-Broglie hypothesis. Derive an expression for De-Broglie wavelength by analogy method.	06	L2	CO1
	c.	A spectral line of wavelength 5461 $\mathring{A}$ has a width of 10^{-4} $\mathring{A}$. Evaluate the minimum time spent by the electron in upper energy state.	05	L3	CO1
		Module – 2			
Q.3	a.	What is Superconductivity? Explain BCS Theory.	08	L2	CO2
	b.	Define internal field and derive an expression for Clausius – Mossotti equation of dielectric materials.	08	L2	CO2
	c.	The critical temperature of Nb is 9.15 K. At zero Kelvin, the critical field is 0.196T. Calculate the critical field at 8 K.	04	L3	CO2
		OR			
Q.4	a.	Define Fermi factor and discuss the dependence of Fermi factor on temperature and energy.	08	L2	CO2
	b.	Define polarization and explain different types of polarization mechanisms with suitable diagrams.	08	L2	CO2
	c.	The dielectric constant of sulphur is 3.4. Assuming a cubic lattice for its structure, calculate the electronic polarizability of sulphur. Given : For Sulphur, density = 2.07 g/cc and atomic weight = 32.07	04	L3	CO2
		Module – 3			
Q.5	a.	Derive an expression for energy density of radiation using Einstein's coefficients.	08	L2	CO1
	b.	Obtain an expression for numerical aperture in an optical fiber and arrive at the condition for ray propagation.	08	L2	CO1

Q.5	c.	In a diffraction grating experiment the LASER light undergoes second order diffraction for diffraction angle 1.58°, the grating constant is 5.08×10^{-5}/m and the distance between grating and screen is 100 cm. Find the wavelength of LASER light.	04	L3	CO5
		OR			
Q.6	a.	What is Attenuation? Discuss Different types of attenuation in optical fibers.	08	L2	CO1
	b.	Describe the construction and working of CO_2 LASER with suitable diagrams.	08	L2	CO1
	c.	The angle of acceptance of an optical fiber is 30° when kept in air. Find the angle of acceptance when it is in a medium of refractive index 1.33.	04	L3	CO1
		Module – 4			
Q.7	a.	Explain the terms gradient of scalar, divergence and curl of a vector. Derive Gauss divergence theorem.	08	L2	CO3
	b.	What is displacement current? Derive the expression for displacement current.	08	L2	CO3
	c.	Find the divergence of the vector field $\vec{A}$ given by $\vec{A} = 6x^2\hat{a}_x + 3xy^2\hat{a}_y + xyz^3\hat{a}_z$ at a point P(1, 3, 6)	04	L2	CO3
		OR			
Q.8	a.	Derive wave equation in terms of electric field using Maxwell's equation for free space.	08	L2	CO3
	b.	Elucidate the transverse nature of EM waves through linear polarization.	08	L2	CO3
	c.	Find the inductance of an LCR series resonance circuit with resonance frequency = 2500 Hz, capacitance = 0.25 microfarad and resistance = 800 ohm.	04	L3	CO5
		Module – 5			
Q.9	a.	Describe the construction and working of semiconductor diode LASER with suitable diagrams.	08	L2	CO4
	b.	What is Hall effect? Obtain an expression for Hall voltage in terms of Hall coefficient.	08	L2	CO4
	c.	Calculate the number of donor atoms which must be added to an intrinsic semiconductor if the resistivity = 10^{-6} ohm-meter, mobility of electrons = 0.39 $m^2 V^{-1} s^{-1}$ and mobility of holes = 0.19 $m^2 V^{-1} s^{-1}$.	04	L3	CO4
		OR			
Q.10	a.	Elucidate how the resistivity of a semiconductor is determined using four probe method. Mention any two applications of four probe method.	08	L3	CO4
	b.	State law of mass action and derive the expression for electrical conductivity in intrinsic semiconductors.	08	L2	CO4
	c.	An n-type germanium sample has a donor density of 10^{21} atoms/m^3. It is arranged in a hall experiment having magnetic field of 0.5 T and the current density is 500 A/m^2. Find the hall voltage if the sample is 3 mm wide.	04	L3	CO4

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