EAST POINT COLLEGE OF ENGINEERING & TECHNOLOGY
An Autonomous Institution Affiliated to Visvesvaraya Technological University (VTU) Belagavi

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EPPHE202

Second Semester B.E. Degree Examination, July 2025
APPLIED PHYSICS FOR EEE STREAM

TIME:3 hrs. Max.Marks:100

Note: 1. Answer any FIVE full questions, choosing ONE question from each MODULE
2. Formula Hand Books Permitted
3. M: Marks, L: Bloom's level,C: Course outcomes.

		Module-1	M	L	C
Q.1	a	What is wave function? Set up time independent Schrodinger wave equation for a particle in one dimension.	8	L2	CO1
	b	Explain the distribution of energy in a black body radiation spectrum. Discuss the failure of Rayleigh-Jeans law.	8	L2	CO1
	c	The position and momentum of an electron with energy 1 keV are simultaneously determined. If the inherent uncertainty in the measurement of its position is 1 Å, compute the minimum percentage uncertainty in its momentum	4	L3	CO1
		OR			
Q.2	a	State and explain Heisenberg's uncertainty principle with its physical significance. Show that the electron doesn't exist inside the nucleus using uncertainty principle.	8	L3	CO1
	b	Obtain the expression for energy Eigen value and normalized wave function for a particle in one dimensional potential well of infinite height.	8	L2	CO1
	c	Compute the de-Broglie wavelength of neutron moving with one tenth part of the velocity of light. (Given: mass of neutron(= 1.674×10-27 kg).	4	L3	CO1
		Module–2			
Q.3	a	Mention any two assumptions of quantum free electron theory. Discuss the merits of quantum free electron theory	8	L2	CO2
	b	What are polar and Non-polar dielectrics? Derive an expression for Claussius-Mossotti equation.	8	L2	CO2
	c	The critical field for superconducting Niobium is 1×10^5 Am^{-1} at 7K and 2×10^5 Am^{-1} at 0K. Find its critical temperature.	4	L3	CO2
		OR			
Q.4	a	Discuss temperature dependence of critical field in superconductors. Differentiate between type-I and type-II superconductors.	8	L2	CO2
	b	Define Fermi energy. Illustrate the variation of Fermi factor with respect to temperature and energy.	8	L2	CO2
	c	Calculate the polarization produced in sodium chloride by an electric field of 500 Vm^{-1} given that its relative permittivity is 6.	4	L3	CO2

		Module–3			
Q.5	**a**	Describe the principle construction and working of a semiconductor laser with energy level diagram.	**8**	**L2**	**CO1**
	b	Define acceptance angle and numerical aperture of an optical fibre. Discuss different types of optical fibers with suitable diagrams.	**8**	**L2**	**CO1**
	c	The attenuation of light signal in an optical fiber is 3.6 dB/km. What fraction of its initial intensity remains after 3 km.	**4**	**L3**	**CO1**
		OR			
Q.6	**a**	Derive an expression for energy density of radiation under thermal equilibrium condition in terms of Einstein's A and B coefficients. Infer the condition $B_{12} = B_{21}$.	**8**	**L2**	**CO1**
	b	What is attenuation? Discuss point to point communication system of an optical fiber with neat block diagram.	**8**	**L2**	**CO1**
	c	In a diffraction grating experiment the laser light undergoes third order diffraction for diffraction angle 2.15°. If the grating constant is 5.08×10^{-5}m, calculate the wavelength of laser light.	**4**	**L3**	**CO5**
		Module–4			
Q.7	**a**	Derive wave equation for electromagnetic wave in vacuum in terms of electric field using Maxwell's equations.	**8**	**L2**	**CO3**
	b	State and prove Gauss divergence theorem. Explain Faraday's law of electromagnetic induction.	**8**	**L2**	**CO3**
	c	Find the divergence of $\vec{A} = 6x^2\widehat{a_x} + 3xy^2\widehat{a_y} + xyz^2\widehat{a_z}$ at a point P(1,3,6).	**4**	**L3**	**CO3**
		OR			
Q.8	**a**	Explain the terms gradient, divergence and curl with their significance. Mention Stoke's theorem in mathematical form.	**8**	**L2**	**CO3**
	b	Discuss about continuity equation. Obtain an expression for displacement current.	**8**	**L2**	**CO3**
	c	Given $\vec{A} = (3x^2 + y + az)\widehat{a_x} + (bx - 5y^3 - 2z)\widehat{a_y} + (2x + cy + 3z^2)\widehat{a_z}$ For what values of a, b and c the $\vec{A}$ is irrotational?	**4**	**L3**	**CO3**
		Module–5			
Q.9	**a**	Derive an expression for Hall voltage in terms of Hall coefficient. Mention any two applications of Hall effect.	**8**	**L2**	**CO4**
	b	State and explain Law of mass action for semiconductors. Derive an expression for electrical conductivity of an intrinsic semiconductor.	**8**	**L2**	**CO4**
	c	The electron and hole mobilities of silicon are 0.14 $m^2V^{-1}s^{-1}$ and 0.05 $m^2V^{-1}s^{-1}$ respectively at a certain temperature. If the electron concentration is 1.5×10^{16} electron/m^3, Calculate the resistivity of sample.	**4**	**L3**	**CO4**
		OR			
Q.10	**a**	Write any three differences between single crystal and polycrystalline silicon solar cells. Obtain the relation between Fermi energy and energy gap of an intrinsic semiconductor.	**8**	**L2**	**CO4**

	b	What is photoelectric effect? Explain four probe method to determine the resistivity of semiconductor.	**8**	**L2**	**CO4**
	c	The carrier concentration of a material is $1.7\times10^{23}/m^3$, then calculate the Hall coefficient of material.	**4**	**L3**	**CO4**

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