Model Question Paper-I with effect from 2022-23 (CBCS Scheme)

USN | | | | | | | | | | |

First/Second Semester B.E. Degree Examination

Subject Title APPLIED PHYSICS FOR EEE STREAM

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. Draw neat sketches where ever necessary
03. **Constants :** Speed of Light 'c' = 3×10^8 ms^{-1}, Boltzmann Constant 'k' = 1.38×10^{-23} JK^{-1}, Planck's Constant 'h' = 6.625×10^{-34} Js , Acceleration due to gravity 'g'= 9.8 ms^{-2}, Permittivity of free space 'ε_0'=8.854×10^{-12} F m^{-1}

		Module -1	*Bloom's Taxonomy Level	Marks
Q.01	a	State and explain Heisenberg's uncertainty principle. Show that an electron does not exist inside the nucleus on the basis of Heisenberg's Uncertainty Principle.	L2	09
	b	What is wave function? Give its physical significance and properties	L2	06
	c	An electron is bound in a 1-dimensional potential well of width 1A^o & of infinite height. Find its energy values in eV in the ground state & also in the first two excited states.	L3	05
		OR		
Q.02	a	Setup time independent Schrodinger wave equation for free particle in one dimension	L2	07
	b	Discuss the wave functions, probability densities and energy level for a particle in a box by considering the ground and the first two excited State	L2	09
	c	Calculate the deBroglie wavelength associated with an electron having a kinetic energy of 100 eV	L3	04
		Module-2		
Q. 03	a	Explain the dependence of resistance on temperature of a superconductor? Describe Type I and type II superconductors	L2	09
	b	Derive Clausius Mossotti equation.	L2	06
	c	Show that the sum of the probability of Occupancy of an energy state at ΔE below Fermi level and that at ΔE above Fermi level is unity.	L3	05
		OR		
Q.04	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	L2	09
	b	Explain the construction and working of MAGLEV vehicle.	L2	06
	c	The dielectric constant of helium gas at NTP is 1.0000684. Calculate the electronic polarizability of the atoms if helium gas contains 2.7 x 10^{25} atoms/ m^3.	L3	05
		Module-3		
Q. 05	a	Describe the Principle, Construction and Working of Carbon Dioxide Laser with energy level diagram.	L2	08
	b	What is numerical aperture. Obtain an expression for numerical aperture in an optical fiber.	L2	08
	c	A medium in thermal equilibrium at a temperature 300 K has two energy levels with wavelength separation of 1 μm. Find the ratio of population densities of the upper & lower levels.	L3	04

		OR		
Q. 06	a	Obtain an expression for energy density of radiation under thermal equilibrium condition in terms of Einstein's coefficients.	L2	08
	b	What is attenuation? Discuss different types of attenuation in optical fibers.	L2	07
	c	In a step index optical fiber with core diameter of 60 μm & core and cladding refractive indices as 1.50 & 1.48 respectively, when the wavelength of 850 nm is propagating through it. Calculate the numerical aperture, fractional index change, V parameter and number of modes in the fiber.	L3	05
		Module-4		
Q. 07	a	State and prove Gauss Divergence theorem	L2	07
	b	Derive wave equation in terms of electric field using Maxwell's equation for free space	L2	08
	c	Prove that $3y^4 z^2 \hat{a}_x + 4x^3 z^2 \hat{a}_y + 3x^2 y^2 \hat{a}_z$ is Solenoidal.	L3	05
		OR		
Q. 08	a	What is displacement current? Derive the expression for displacement current	L2	07
	b	Explain Faraday's Laws of Electromagnetic induction, Amperes Law and express the same in point form.	L2	08
	c	Elucidate the Transverse nature of EM Waves through Linear Polarization.	L3	05
		Module-5		
Q. 09	a	Derive an expression for Electrical conductivity in extrinsic and intrinsic semiconductors.	L2	08
	b	Explain how the resistivity of a semiconductor is determined using four probe method? Mention any two applications of four probe method.	L2	07
	c	An n- type Germanium sample as a Donor density of $10^{21}/m^3$. 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.	L3	05
		OR		
Q. 10	a	What is Hall effect? obtain an expression for the Hall coefficient	L2	08
	b	Explain the construction and working of photodiode? Discuss the power responsivity in a photodiode.	L2	08
	c	The resistivity of intrinsic Germanium at 27^0C is equal to 0.47 ohm- metre. Assuming electron and hole mobilities as 0.38 $m^2v^{-1} s^{-1}$ and 0.18 $m^2v^{-1} s^{-1}$ respectively. Calculate the intrinsic carrier density.	L3	04

*****Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.

Table showing the Bloom's Taxonomy Level, Course Outcome and Program Outcome

Question		Bloom's Taxonomy Level attached	Course Outcome	Program Outcome
Q.1	(a)	L2	1	1,2
	(b)	L2	1	1,2,12
	(c)	L3	1	1,2
Q.2	(a)	L2	1	1,2,12
	(b)	L2	1	1,2,12
	(c)	L3	1	1,2
Q.3	(a)	L2	1	1,2
	(b)	L2	1	1,2
	(c)	L3	1	1,2
Q.4	(a)	L2	1	1,2
	(b)	L2	1	1,2,12
	(c)	L3	1	1,2
Q.5	(a)	L2	2	1,2,12
	(b)	L2	2	1,2,12
	(c)	L3	2	1,2
Q.6	(a)	L2	2	1,2
	(b)	L2	2	1,2,12
	(c)	L3	2	1,2
Q.7	(a)	L2	3	1,2,12
	(b)	L2	3	1,2,12
	(c)	L3	3	1,2
Q.8	(a)	L2	3	1,2,12
	(b)	L2	3	1,2,12
	(c)	L3	3	1,2
Q.9	(a)	L3	4	1,2,12
	(b)	L2	4	1,2,12
	(c)	L3	4	1,2
Q.10	(a)	L2	4	1,2,12
	(b)	L2	4	1,2,12
	(c)	L3	4	1,2