Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–I & II EXAMINATION – WINTER 2024

Subject Code:3110018 Date:04-01-2025

Subject Name:Physics

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define: (1) Valance Band (2) Current density (3) Fermi Function	**03**
	(b)	Distinguish between Direct energy band gap semiconductor and Indirect energy band gap semiconductor with any four points.	**04**
	(c)	Explain in details about Kroning-Penney model and discuss the different cases with necessary diagrams.	**07**
Q.2	**(a)**	List out any six applications of Solar cell.	**03**
	(b)	The energy gap of two intrinsic semiconductors A and B are 0.36 eV and 0.72 eV respectively. Compare the carrier density of semiconductors A and B at temperature 300 K.	**04**
	(c)	Define density of holes in valence band and derive the necessary equation for it.	**07**
		OR	
	(c)	(1) State and prove the Law of Mass Action.	**03**
		(2)Define Luminescence and categories them with suitable illustrations.	**04**
Q.3	**(a)**	Distinguish between Spontaneous Emission and Stimulated emission with any three points.	**03**
	(b)	Define Exciton and classify them in details.	**04**
	(c)	Derive the expression for Fermi energy and carrier concentration in N-type semiconductor.	**07**
		OR	
Q.3	**(a)**	Distinguish between N-type semiconductor and P-type semiconductor with any four points.	**03**
	(b)	What are the processes known as carrier generation and recombination? Explain the Optical Generation and recombination process for charge carriers.	**04**
	(c)	Derive the relation between Einstein's coefficients and interpret the results.	**07**
Q.4	**(a)**	Define: (1) Superconductivity (2) Critical Temperature (3) Cooper pair	**03**
	(b)	The values of critical magnetic field for a superconductor are 270 T and 60 T at temperature 20 K and 90 K respectively. Calculate the values of critical temperature and zero magnetic field.	**04**
	(c)	Define density of state and derive the necessary formula for DOS.	**07**
		OR	
Q.4	**(a)**	Name the types of capacitances are associated with PN junction and briefly explain each of them.	**03**
	(b)	Explain the Hot Point Probe method to verify the type of extrinsic semiconductors.	**04**
	(c)	Explain the Four Probe method and derive the necessary formula to find the resistivity of Balk material.	**07**

Q.5	**(a)**	Distinguish between type-I superconductor and type-II superconductor.	**03**
	(b)	For a metal having density of electron is 6.5×10^{28} then find the relaxation time of conduction electrons if the metal resistivity is 1.435×10^{-8} ohm-meter	**04**
	(c)	Explain the Vander Pauw measurement method. Discuss about the measurement of Resistivity of the material by this method.	**07**

OR

Q.5	**(a)**	What is Drude Model? List out the basic assumptions of Drude Model.	**03**
	(b)	Discuss about Meissner's effect with diagrams and prove that the superconductors are perfect diamagnetic material.	**04**
	(c)	(1) What is Josephson's Junction? Explain the types of Josephson's effect.	**03**
		(2) Calculate the Critical magnetic field and Critical Current for a superconducting wire of Lead having a diameter of 1 mm at 4.2 K. Critical temperature of lead is 7.18 k and zero magnetic field is 65 kA/m.	**04**

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