GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–I&II EXAMINATION – SUMMER 2025

Subject Code:3110018   **Date:25-06-2025**

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.**

Q.1	**(a)**	State and discuss Wiedemann-Franz law.	**03**
	(b)	What is called Energy Band Gap? Draw energy band diagram for (i) Conductors, (ii) Semiconductors and (iii) Insulators.	**04**
	(c)	What is photovoltaic effect? With neat diagram discuss construction and working of solar cell.	**07**
Q.2	**(a)**	Enlist the assumptions of classical free electron theory. (Any three)	**03**
	(b)	State any four points of differences between N-type and P-type Semiconductors.	**04**
	(c)	Discuss in detail Kronig – Penney Model.	**07**

OR

	(c)	Define density of states and derive its expression.	**07**
Q.3	**(a)**	Evaluate Fermi function (or occupation probability) for energy $2k_BT$ above the Fermi energy.	**03**
	(b)	Derive formula of diffusion current density for electron as well as hole.	**04**
	(c)	Discuss forward bias and reverse bias for a PN junction diode and draw characteristics curve.	**07**

OR

Q.3	**(a)**	Write short note on: Phonon.	**03**
	(b)	Discuss Fermi golden rule for transition probability.	**04**
	(c)	Derive formula of fermi energy level for *N*-type semiconductor.	**07**
Q.4	**(a)**	State any three points of differences between spontaneous emission and stimulated emission.	**03**
	(b)	Discuss direct and indirect band gap semiconductors.	**04**
	(c)	Explain in detail experimental procedure for *DLTS*.	**07**

OR

Q.4	**(a)**	(i) What is called exciton?	**03**
		(ii) Name two metal-semiconductor junctions.	
		(iii) What is called optoelectronic device?	
	(b)	The electrical conductivity (σ) of copper at 300 K is 6.2×10^7 Ω^{-1} m^{-1}. Calculate the thermal conductivity of copper. Lorentz number is 2.44×10^{-8} W/K^2.	**04**
	(c)	Discuss in detail UV-VIS method for band gap measurement of semiconductor.	**07**

Q.5 (a) What is Meissner effect? For superconductor show that $\chi_m = -1$. **03**

(b) Write any four points of comparison of type-I and type-II superconductor. **04**

(c) (i) Calculate the critical current for a superconducting wire having radius of 0.2 mm at 5 K. Critical temperature of material of wire is 7.2 K and Hc (0) is 2.2×10^4 A/m. **07**

(ii) For a superconducting material isotopic mass is 195 amu and critical temperature is 5.2 K. Calculate isotopic mass at 6.5 K.

OR

Q.5 (a) Write a short note on: SQUID **03**

(b) What is superconductivity? Discuss any three properties of superconductor. **04**

(c) Discuss in detail four-point probe method for the measurement of resistivity. **07**

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