Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–I & II(NEW) EXAMINATION – WINTER 2022

Subject Code:3110018 Date:04-03-2023

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)**	What are the postulates for free electron theory?	**03**
	(b)	Compare Direct Band Gap semiconductors and Indirect Band Gap semiconductors	**04**
	(c)	Explain in detail how Kronig and Penney model explains the origin of band gap in semiconductors.	**07**
Q.2	**(a)**	Show that Probability of occupancy of Fermi energy level is 0.5 at T > 0 K.	**03**
	(b)	What is effective mass of electron? Derive necessary expression for it.	**04**
	(c)	(i) Consider an energy level lying 0.01 eV above Fermi level. What is the probability of this level not being occupied by an electron at 300 K. (ii) At What temperature we can expect a 20% probability the electrons in a metal can have which is lying 1% above its Fermi energy? Fermi energy of the given metal is 5.5 eV.	**07**
		OR	
	(c)	Make use of necessary assumption for intrinsic semiconductors and derive the formula for density of hole in valence band.	**07**
Q.3	**(a)**	Compare Intrinsic and Extrinsic Semiconductors.	**03**
	(b)	For a given intrinsic semiconductor with E_g = 2.0 eV, calculate the position of Fermi Level at 300 K. ($m_e^* = 0.16m_0$ and $m_h^* = 0.32m_0$, m_0 is rest mass of an Electron).	**04**
	(c)	Explain the Einstein's theory about interaction between matter and radiation in detail along with absorption and emission with necessary equation.	**07**
		OR	
Q.3	**(a)**	What is Luminescence? Discuss its types.	**03**
	(b)	Define :(i) Forbidden Gap (ii)Fermi Function, (iii) Density of states (iv) Drift Current	**04**
	(c)	(i) Find the concentration of holes and electron in (1) n-Type and (2) p-Type semiconductor having conductivity 5×10^4 ℧/m at 300 K. Mobility of electrons and holes is 1500 X 10^{-4} m^2/vSec and 500 X 10^{-4} m^2/vSec respectively and n_i = 9.5 X 10^{16} m^{-3}. (ii) A Light Emitting Diode has a band gap of 1.96 eV. Calculate the wavelength of the emitted radiation	**07**

Q.4	**(a)**	What is hot point probe method? Explain	**03**
	(b)	What are Excitons? Discuss the types of Exciton.	**04**
	(c)	Illustrate Four probe method for thin sheet and bulk sample in detail.	**07**

OR

Q.4	**(a)**	What do you mean by Photo Voltaic Effect? How it is differ from Photo Electric effect?	**03**
	(b)	Explain Optical Gain and Loss in Solar Cell.	**04**
	(c)	(i) The critical field for a superconducting sample is 10^6 Am^{-1} at 9.58 K and 2 X 10^6 Am^{-1} at 0 K. Determine the T_c value. (ii) Calculate the critical current through a long thin superconducting wire of diameter 0.5 mm. The critical field is 9.2 kA/m.	**07**

Q.5	**(a)**	Define following terms. Magnetic Levitation, Persistent Current, Isotope effect	**03**
	(b)	Compare Type-I and Type-II Superconductivity.	**04**
	(c)	Explain UV-Vis spectroscopy method for band gap measurement of semiconductors.	**07**

OR

Q.5	**(a)**	Show that superconductors are perfect diamagnet.	**03**
	(b)	Identify three important factors that defines a superconducting state in detail.	**04**
	(c)	(i) Explain how the materials are classified into conductors, semiconductors and insulators with the help of energy band diagrams. (ii) What are the applications of Hall effect measurements?	**07**

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