Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–I & II (NEW) EXAMINATION – WINTER 2020

Subject Code:3110018 Date:17/03/2021

Subject Name:Physics

Time:10:30 AM TO 12:30 PM Total Marks:56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			Marks
Q.1	**(a)**	Explain how the materials are classified into conductors, semiconductors and insulators on the basis of energy band diagram.	**03**
	(b)	Define Fermi level for intrinsic semiconductor. How it will change in p-type and n-type semiconductors. Explain with suitable diagrams.	**04**
	(c)	Explain formation and working of p-n junction diode in forward and reverse biasing by proper diagrams and its I-V characteristics.	**07**
Q.2	**(a)**	Explain absorption, spontaneous emission and stimulated emission in semiconductors with proper diagrams.	**03**
	(b)	Write down an expression for the probability of occupancy of a particular energy state of an electron in an intrinsic semiconductor. Explain it from the graph at 0^0 K and at room temperature	**04**
	(c)	Describe formation of Energy bands by using Kronig-Penney Model.	**07**
Q.3	**(a)**	Explain n-type and p-type semiconductors with suitable diagrams	**03**
	(b)	Explain direct band gap and indirect band gap semiconductors with proper E-k diagrams.	**04**
	(c)	Derive an expression for density of energy states in metals.	**07**
Q.4	**(a)**	Write down any three differences between intrinsic and extrinsic semiconductors.	**03**
	(b)	Explain construction and working of Schottky junction	**04**
	(c)	Give the names of semiconductor optoelectronic devices, their characteristics and applications.	**07**
Q.5	**(a)**	Explain law of mass action.	**03**
	(b)	Explain Photovoltaic Effect and derive an expression for photo voltage.	**04**
	(c)	Write down various properties of superconductors.	**07**
Q.6	**(a)**	Explain (i) Non-radiative transitions and (ii) Exciton .	**03**
	(b)	Explain construction and working of a solar cell by proper diagrams and I-V characteristics.	**04**
	(c)	Explain UV-VIS spectroscopy and how to find energy band gap of a material from this technique.	**07**
Q.7	**(a)**	At 0 magnetic field, a superconducting Tin has a critical temperature of 3.7 K. At 0 K, critical magnetic field is 0.306 T. Calculate the critical magnetic field at 2 K	**03**
	(b)	Write down the applications of superconductors.	**04**
	(c)	Derive a formula for carrier concentration in n-type semiconductor	**07**

Q.8 **(a)** Describe Hall Effect with a suitable diagram. **03**

(b) A semiconductor has Hall coefficient 3.75×10^{-4} m^3/C. The resistivity of the sample is 7.21×10^{-3} ohm m. Calculate the mobility and density of charge carriers. Given that the magnitude of charge on electron = 1.6×10^{-19} C. **04**

(c) Explain **07**

(a) Type I and Type II superconductors 02

(b) Low T_c and High T_c superconductors 02

(c) SQUIDS and its applications 03

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