

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 $3.75 \times 10^{-4} \text{ m}^3/\text{C}$. The resistivity of the sample is $7.21 \times 10^{-3} \text{ ohm m}$. Calculate the mobility and density of charge carriers. Given that the magnitude of charge on electron = $1.6 \times 10^{-19} \text{ C}$. **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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