

**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.

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

- 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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