

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– I & II (NEW) EXAMINATION – WINTER 2019****Subject Code: 3110018****Date: 02/01/2020****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.

		Marks	
Q.1	(a) Enlist the assumptions of free electron theory.	03	
	(b) Give the difference between Direct and Indirect band gap.	04	
	(c) Explain forward and reverse bias conditions in PN junction diode.	07	
Q.2	(a) Define Intrinsic and extrinsic semiconductor .	03	
	(b) The thermal and electrical conductivity of Cu at 20°C are $390 \text{ Wm}^{-1}\text{K}^{-1}$ and $5.87 \times 10^7 (\Omega\text{m})^{-1}$ respectively. Calculate the Lorentz number.	04	
	(c) Explain Schottky diode in detail.	07	
OR			
Q.3	(c) Explain the dependence of Fermi level on temperature	07	
	(a) Explain Drude model	03	
	(b) Fermi energy of a given substance is 7.9 eV. What is the average energy and speed of electron in this substance at 0 K?	04	
Q.3	(c) Explain photovoltaic effect. With required diagrams discuss construction and working of solar cell.	07	
	OR		
	(a) Write a short note on exciton.	03	
Q.4	(b) Consider two-dimensional square lattice of side 3.0 \AA . At what electron momentum values do the sides of first Brillouin zone appear? What is the energy of free electron with this momentum?	04	
	(c) Derive an equation of joint density of states.	07	
	(a) Define Hall effect. Give its physical significance.	03	
Q.4	(b) 2.0 cm wide and 1.0 mm thick copper strip is placed in a magnetic field 1.5 Wb/m^2 perpendicular to the strip. Suppose a current of 200 A is set up in the strip what will be the Hall potential appeared across the strip? ($n = 8.4 \times 10^{28} \text{ electrons/m}^3$).	04	
	(c) Discuss UV-VIS method for band gap measurement of semiconductor.	07	
	OR		
Q.4	(a) Discuss Fermi golden rule.	03	
	(b) The transmitted intensity is 0.4 times intensity of incident light. If this light is incident on a semiconductor having a thickness of 0.5 cm then find absorption coefficient.	04	
	(c) Explain four probe method. Derive an equation to calculate resistivity of a thin sample.	07	

- Q.5** (a) Write short note cryotron. **03**
(b) Explain London's penetration depth. **04**
(c) Give the difference between type 1 and type 2 superconductor. **07**

OR

- Q.5** (a) Write short note on SQUID. **03**
(b) Calculate the critical current for a superconducting wire of lead having a diameter of 2 mm at 2 K. Critical temperature for lead is 4 K and $H_c(0) = 6.5 \times 10^4$ A/m. **04**
(c) Explain the properties of superconductors in detail. **07**

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