

**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**

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

- 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**

\*\*\*\*\*