

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER- 1<sup>st</sup> / 2<sup>nd</sup> • EXAMINATION – SUMMER • 2014**

**Subject Code: 110011****Date: 21-06-2014****Subject Name: Physics****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. *Attempt any five questions.*
2. *Make suitable assumptions wherever necessary.*
3. *Figures to the right indicate full marks.*
4. *Each question carries equal marks.*

- Q.1 (a)** Answer the following questions. [One mark each] [07]
1. Classify the sound based on frequency.
  2. What is a primitive cell?
  3. Define: Density of packing.
  4. Define: Forbidden band.
  5. What is called a conventional radiograph and Xero-radiograph.
  6. Define: Biomaterial.
  7. What is a Kevlar?
- (b)** Obtain expression for electrical conductivity in terms of  $k_B T$ . [04]
- (c)** Calculate the critical current for a superconducting wire of lead having a diameter of 1mm at 4.2K. Critical temperature for lead is 7.18K and  $H_c(0)=6.5 \times 10^4$  A/m. [03]
- Q.2 (a)** 1. Define: Low-Temperature Superconductor, High-Temperature Superconductor, Maglev [03]  
 2. What is SQUID? Explain with diagram. [04]
- (b)** Discuss the various factors affecting the acoustics of buildings and give their remedies. [04]
- (c)** Calculate the electrical conductivity of copper. The atomic weight, density and relaxation time are  $63.5, 8.9 \times 10^3 \text{ kg/m}^3$  and  $2.48 \times 10^{-14}$  s, respectively. [03]
- Q.3 (a)** 1. Give brief account of temperature induced transformation. [03]  
 2. Discuss the types, properties and applications of metallic glasses. [04]
- (b)** Describe the principle and the method of producing of ultrasonic waves by magnetostriction method. [04]
- (c)** An optical fiber has a numerical aperture of 0.20 and a cladding refractive index of 1.55. Determine the acceptance angle for the fiber in water which has a refractive index 1.33. [03]
- Q.4 (a)** 1. What is NDT? Discuss the objectives of NDT. [02]  
 2. Explain Liquid Penetrant Method for NDT. [05]
- (b)** Define: Atomic radius. Derive atomic radius for BCC and FCC structure. [04]

- (c) A rectangular plane sheet of doped silicon has dimension of 1cm along Y-direction, and 0.5mm along Z-direction. Hall probes are attached on its two surfaces parallel to X-Z plane and a magnetic field of flux density  $0.7\text{Wb/m}^2$  is applied along Z-direction. A current of 1mA is flowing in it in X-direction. Calculate the Hall voltage measured by the probes if the Hall coefficient of the material is  $1.25 \times 10^{-3} \text{ m}^3 \text{ C}^{-1}$ . [03]

- Q.5** (a) 1. Write short note on: Laser cutting [03]  
2. Discuss the construction of Nd: YAG and  $\text{CO}_2$  Laser with proper sketch. [04]

- (b) Discuss the construction and working of (1) LED (2) Solar cell. [04]

- (c) Calculate the atomic radius of Fe which has BCC structure. Given the density of iron  $7.86\text{gm/cm}^3$  and atomic weight 55.85. [03]

- Q. 6** (a) 1. What is threshold intensity? Give its value. [01]  
2. What are ultrasonic waves? [01]  
3. Explain the term Hall Effect. Derive the relation between Hall voltage and Hall coefficient. [05]

- (b) 1. Give the Differences between stimulated and spontaneous emission. [02]

2. Define the terms: (1) Population Inversion (2) Lasing (3) Pumping (4) Metastable State [02]

- (c) An ultrasonic source of 0.09 MHz sends down a pulse towards the seabed which returns after 0.55 seconds. Assuming the velocity of sound in sea water is 1800 m/s; calculate the depth of sea and the wavelength of pulse. [03]

- Q. 7** (a) 1. The Bragg angle corresponding to the first order reflection from plane (111) in a crystal is  $30^\circ$  when X-rays of wavelength  $1.75\text{\AA}$  are used. Calculate the interatomic spacing. [03]

2. Discuss the properties of superconductors. [04]

- (b) Derive the expression for Acceptance angle and Numerical aperture of an optical fiber. [04]

- (c) The sound from a drill gives a noise level 90 dB at a point short distance from it. What is the noise level at this point if four such drills are working simultaneously at the same distance from it? [03]

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