

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**B. E. - SEMESTER –I • EXAMINATION – WINTER 2012**

**Subject code: 110011****Date: 30-01-2013****Subject Name: Physics****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt any five questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Derive an expression for rate of absorption of sound energy inside an auditorium in terms of Energy density E. 7
- (b) (1) The wavelength of light emitted from LED is  $62.11 \mu\text{m}$ . Find the value of energy band gap in eV. 2
- (2) An n-type semiconductor crystal 12 mm long, 5 mm wide and 1 mm thick has a magnetic flux density of  $0.8 \text{ Wb/m}^2$  applied parallel to its thickness. The current pass through the crystal along its length is 25 mA and the value of Hall Voltage is  $45 \mu\text{V}$ . Find the value of Hall Co-efficient. 3
- (c) Write the names of basic steps to identify the defects by Liquid Penetrate Method. 2
- Q.2** (a) What is full form of LASER? Describe construction and working system of Nd:YAG LASER with a neat energy level diagram. 6
- (b) Explain the Sol Gel Technique to synthesis Nanomaterials. Why this method is widely used? 4
- (c) In Magnetostriction method the length of rod is kept 10 mm. If the inductance of the coil is 25 mH. Find (1) The value of resonance Frequency and (2) The value of capacitance to produce an ultrasonic wave at resonance. ( $E=125 \text{ GPa}$  and  $\rho = 3568 \text{ kg/m}^3$ ) 4
- Q.3** (a) Explain the following configuration with figure: 6
- (1) Multimode Step-Index fibre
- (2) Multimode Graded-Index fibre.
- (b) Explain the types of superconductor on the bases of its behavior with applied magnetic field. 5
- (c) The Sound intensity received from a train is  $25.3 \text{ W/m}^2$  and that of from another train is  $0.9 \text{ W/m}^2$ . Find the resultant relative intensity of these two sources in decibel. 3
- Q.4** (a) Explain the construction, working, merits and demerits of Piezoelectric method to produce Ultrasonic Wave with neat circuit diagram. 6
- (b) Define the terms “Atomic Radius” and “Co-ordinate Number”. Calculate both of them for SC and BCC with figure. 6
- (c) Distinguish Loudness and Intensity. 2
- Q.5** (a) (1) Explain the energy bands in solids. 3
- (2) Write the applications of (a) Varactor Diode (b) Hall effect. 3
- (b) Define: (1) Population Inversion (2) Stimulated Emission (3) Life Time (4) Metastable State. 4

- (c) Compute the value of numerical aperture, acceptance angle and relative refractive index for an optical fibre with core refractive index 1.585 and cladding refractive index 1.515. **4**
- Q. 6** (a) Define electrical conductivity and derive an expression for it in terms of density of free electrons. **5**
- (b) (1) Write definitions of the three important factors to define a Superconducting state? **3**
- (2) The critical temperature of a superconductor is 78 K and critical field is 0.518 T at 0 K. Find the value of critical field at temperatures 25 K and 58 K. **3**
- (c) Name the types of Biomaterials and explain any one. **3**
- Q. 7** (a) (1) Give three points of differences between Destructive Testing and Non-destructive Testing. **3**
- (2) Write advantages and disadvantages of ultrasonic inspection methods. **3**
- (b) Derive the relation between inter planner spacing and cube edge for cubic system. **3**
- (c) Find the thermal conductivity of copper at 20 °C with a free electron density of  $8.48 \times 10^{28} \text{ m}^{-3}$  and thermal velocity at 20 °C is  $1.1536 \times 10^5 \text{ ms}^{-1}$ , with mean free path of 2.8138 nm. **3**

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