

GUJARAT TECHNOLOGICAL UNIVERSITY
B.E. Sem-I Examination January 2010

Subject code: 110011

Date: 01 / 01 / 2010

Subject Name: Physics

Time: 11.00 am – 1.30 pm

Total Marks: 70

Instructions:

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

- Q-1** Answer the following questions.
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|-----|---|-----------|
| i | Explain the various factors affecting the acoustics of building and give their remedies. | 04 |
| ii | Briefly explain stimulated emission. | 02 |
| iii | What is the absorption coefficient? Explain how to determine the absorption coefficient. | 03 |
| iv | A cinema hall has a volume of 7500m^3 . What should be the total absorption in the hall if the reverberation time of 1.5sec is to be maintained? | 02 |
| v | Give the properties of ultrasonic wave. | 02 |
| vi | What is a Kevlar? | 01 |
- Q-2 (a)** Answer the following questions.
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|-----|--|-----------|
| i | Describe the principle and the method of producing of ultrasonic waves by magnetostriction method. | 04 |
| ii | What is the resultant sound level when a 70dB sound is added to an 85dB sound? | 02 |
| iii | What are intrinsic semiconductors? | 01 |
- (b)** Answer the following questions.
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|----|--|-----------|
| i | Calculate the thickness of a quartz plate needed to produce ultrasonic waves of frequencies (i) 2MHz (ii) 30KHz. (Given $\rho = 2650\text{Kg/m}^3$ and Young's Modulus = $8 \times 10^{10}\text{N/m}^2$). | 02 |
| ii | What are Miller Indices? Draw the plane from given Miller Indices; (i) (1 1 0) (ii) $(\bar{1} 0 0)$ (iii) (1 1 2). | 05 |
- OR**
- (b)** Answer the following questions.
- | | | |
|----|--|-----------|
| i | What are extrinsic semiconductors? Explain the term Hall Effect. | 03 |
| ii | Explain LED (principle and application). | 04 |
- Q-3 (a)** Answer the following questions.
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|----|--|-----------|
| i | Explain (i) population inversion (ii) pumping (iii) optical resonator. | 03 |
| ii | Describe the construction and working of Nd: YAG Laser with a suitable energy level diagram. | 04 |
- (b)** State the characteristics of LASER. Explain the method of construction and reconstruction of a hologram.
- OR**
- Q-3 (a)** Describe the construction of fiber optic cable and compare the advantage of fiber optic cable over metallic cable.
- (b)** Answer the following questions.
- | | | |
|---|--|-----------|
| i | Give the conditions to be satisfied for total internal reflection for the optical fiber. | 04 |
|---|--|-----------|

- ii The Hall Coefficient (R_H) of a semiconductor is $3.22 \times 10^{-4} \text{ m}^3 \text{ C}^{-1}$. Its resistivity is $9 \times 10^{-3} \Omega\text{-m}$. Calculate the mobility and carrier concentration of the carriers. (Given $e = 1.6 \times 10^{-19} \text{ C}$). **03**
- Q-4 (a)** Answer the following questions.
- i Explain the classical free electron theory of metal. **04**
- ii An optical fiber core and its cladding have refractive indexes of 1.545 and 1.495 respectively. Calculate the critical angle θ_c , acceptance angle $\theta_{\text{in(max)}}$ and Numerical aperture. **03**
- (b)** Answer the following questions.
- i What are the success and drawbacks of classical free electron theory? **04**
- ii Compare Type-I and Type-II superconductor. **03**
- OR**
- Q-4 (a)** What is superconducting material? List the properties of superconducting materials and explain in detail. **07**
- (b)** Answer the following questions.
- i Give the application of superconductor. **04**
- ii Write the properties of metallic glasses. **03**
- Q-5 (a)** What is nano technology? Write the application of nano technology. **07**
- (b)** Answer the following questions.
- i What is biomaterial? Write the type of biomaterials. **04**
- ii Mention the name of the various NDT methods. **03**
- OR**
- Q-5 (a)** What are the objectives of NDT? Discuss about the ultrasonic inspection method-pulse echo system. **07**
- (b)** Answer the following questions.
- i Explain X-ray Radiography. **03**
- ii Draw only the material phase transformation diagrams for shape memory effect (Temp Vs Load) and pseudo-elasticity (Stress Vs Strain). **04**
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