

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-I & II (NEW) EXAMINATION – SUMMER-2019

Subject Code: 3110011

Date: 03/06/2019

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) An elastic rod having diameter of 30 mm, 10 cm long extends by 2.5 cm under tensile load of 28 kN. Find the stress, strain and the Young's modulus for the material of the rod. **03**
- (b) Match column I with column II and select the correct choice. **04**
- | I | | II | |
|---|--------------|----|--------------------|
| 1 | W. C. Sabine | A | Ruby Laser |
| 2 | T. Maiman | B | Elastic constant |
| 3 | H. K. Onnes | C | Reverberation time |
| 4 | Robert Hooke | D | Superconductors |
- (c) Explain in detail construction and working of Ruby Laser with the help of necessary schematic and energy level diagram. **07**
- Q.2**
- (a) An ultrasonic source of 150 KHz sends down a pulse towards the seabed, which returns after 0.82 s. The velocity of ultrasound in sea water is 1700 m/s. Calculate the depth of sea and wavelength of pulse. **03**
- (b) Differentiate Type – I and Type – II superconductors. (Any Four) **04**
- (c) Explain in detail Stress – Strain diagram for a bar or wire. **07**
- OR**
- (c) (1) Calculate the critical current for a superconducting wire of lead having diameter of 1 mm at 4.5 K. Critical temperature for lead is 7.2 K and critical magnetic field at 0 K is 6.5×10^4 A/m. **04**
- (2) What is Meissner effect? Prove that superconductors are perfect diamagnetic materials. **03**
- Q.3**
- (a) Find the acceleration of particle performing simple harmonic motion (SHM) when it is at 0.6 m from its mean position. The time period of SHM is 0.05 sec. Also calculate maximum velocity if the amplitude of SHM is 2 m. **03**
- (b) List various properties of superconductor. Explain in brief any three properties out of them. **04**
- (c) Define piezoelectric effect and explain in detail piezoelectric ultrasonic generator with necessary circuit diagram. Also mention its merit and demerit. **07**

OR

- Q.3** (a) Calculate length of an iron rod which can be used to produce ultrasound of frequency 22 kHz. Given that Young's Modulus and density of iron is $11.6 \times 10^{10} \text{ N/m}^2$ and $7.25 \times 10^3 \text{ kg/m}^3$, respectively. **03**
- (b) Differentiate Free and Forced oscillations. (Any Four) **04**
- (c) (1) Write short note on Reverberation and Reverberation time. **03**
- (2) Define Magnetostriction effect and draw the neat and clean circuit diagram of Magnetostriction ultrasonic generator. **03**
- (3) Classify the sound based on its frequencies. **01**
- Q.4** (a) In the acoustic grating experiment, the wavelength of light transmitted through a liquid is 650 nm. The 1st order angle of diffraction is 0.152° . Calculate the velocity of ultrasound in the liquid. The frequency of the ultrasound is 2.5 MHz. **03**
- (b) What is the full form of LASER? Give applications of Laser in various fields. **04**
- (c) (1) Differentiate Destructive and Non-destructive testing methods. (Any Four) **04**
- (2) List few applications of superconductors and explain in brief SQUID. **03**
- OR**
- Q.4** (a) Discuss elastic behavior of solid materials. **03**
- (b) A solid disc of 1 kg mass and 0.2 m diameter is suspended in a horizontal plane by a vertical wire attached to its center. The length and diameter of the wire is 1.5 m and 2 mm, respectively. Calculate modulus of rigidity of wire and the time period Torsional oscillations if Torsional rigidity $C_s = 7.8 \times 10^{-3} \text{ kg}\cdot\text{m}^2/\text{s}^2$. **04**
- (c) What is Damped and Undamped vibrations? Derive the differential equation and general solution of damped harmonic motion. **07**
- Q.5** (a) Calculate the wavelength of Laser light if the separation between metastable state and lower energy state is 1.80 eV. (consider Planck's constant is $4.14 \times 10^{-15} \text{ eV}\cdot\text{s}$) **03**
- (b) Derive the relation between Einstein's coefficients with necessary assumptions. **04**
- (c) (1) Define Following: **03**
- (a) Poisson's ratio
- (b) Weber-Fetchner law
- (c) Population inversion
- (2) List the fundamental components of the Laser and draw the block diagram of Laser consists them. **02**
- (3) What is Ultrasound? List various methods of detecting ultrasonic waves. **02**
- OR**
- Q.5** (a) Discuss various factors affecting the elasticity. **03**
- (b) Explain in brief SONAR and its application. **04**

- (c) (1) The volume of room is 800 m^3 . The wall area of the room is 230 m^2 . The floor and ceiling area is 130 m^2 . The absorption coefficient of wall, floor and ceiling is 0.05, 0.75, and 0.09, respectively. Calculate the total absorption, average absorption coefficient and the reverberation time 04
- (2) Define following: 03
- (a) Viscosity
 - (b) London penetration depth
 - (c) Metastable state

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