Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–I & II(NEW)EXAMINATION – SUMMER 2022

Subject Code:3110011   **Date:04-08-2022**
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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define ultrasonic waves. Mention two applications of Ultrasonic waves.	**03**
	(b)	An oscillator is performing SHM with an acceleration of 0.2 m/s^2 when displacement is 5 cm. Its maximum speed is 0.15 m/s. Find time period and amplitude of oscillator.	**04**
	(c)	Write applications of LASER in various field.	**07**
Q.2	**(a)**	A steel wire has 3 m length and 0.5 mm radius. When it is stretched by force of 49 N find (i) longitudinal stress, (ii) longitudinal strain and (iii) elongation produced in the wire if Young's modulus of steel is 2.1×10^{11} N/m^2. Take g = 9.8 m/s^2	**03**
	(b)	(i) Calculate the twisting couple of a solid shaft of 2 m length and 0.2 m diameter when it is twisted through an angle of 0.01 rad. The coefficient of rigidity of the material is 8×10^{10} N/m^2. (ii) Calculate the twist produced in a solid wire of 5 m length and 0.1 m radius. The twisting couple produced in the wire is 2×10^4 N m and the coefficient of rigidity of the material is 10^{11} N/m^2.	**04**
	(c)	Draw stress versus strain graph with appropriate notations. Explain elastic limit and upper yield point in detail.	**07**

OR

	(c)	Describe the Ostwald's viscometer and explain how it can be used for comparison of viscosities of two liquids.	**07**
Q.3	**(a)**	(i) Define Poisson's ratio. Write its expression.	**02**
		(ii) Define simple harmonic motion (SHM).	**01**
	(b)	What is Damped Harmonic Motion? Derive differential equation for it.	**04**
	(c)	Mention five factors affecting acoustic of building. Explain each and also mention their remedies.	**07**

OR

Q.3	**(a)**	A hall, having volume of 6000 m^3, is found to have a reverberation time of 2.2 s. If the area of sound absorbing surface is 500 m^2, calculate the absorption coefficient.	**03**

(b) The volume of a room is 1500 m^3. The wall area of the room is 240 m^2, the floor area is 130 m^2, and the ceiling area is 130 m^2. The average sound absorption coefficient (i) for wall is 0.035; (ii) for the ceiling is 0.75; and (iii) the floor is 0.05. Calculate the average sound absorption coefficient and reverberation time. **04**

(c) Describe, with appropriate diagram, principle, construction and working of Magnetostriction Generator (Oscillator). **07**

Q.4 (a) Explain the following: **03**

(i) Population inversion
(ii) Metastable State

(iii) Active medium

(b) An ultrasonic source of 0.09 MHz sends down a pulse towards the seabed which returns after 0.55 s. The velocity of sound in water is 1800 m/s. Calculate (i) the depth of the sea and (ii) wavelength of pulse. **04**

(c) What is NDT? Write down 3 advantages and 3 disadvantages of NDT. **07**

OR

Q.4 (a) What is Meissner effect? For superconductor show that $\chi_m = -1$. **03**

(b) Discuss the method to determine depth of the sea with the help of SONAR **04**

(c) What is Josephson Effect? Explain DC Josephson effect and AC Josephson effect with necessary equations. **07**

Q.5 (a) For Hg of mass number 202, the T_C value is 4.2 K. Find the T_C value for the isotope of mercury of mass number 199.5. Take, $\alpha = 0.5$. **03**

(b) The pulse arrival times from the steel bar of 30 cm thickness during the detection of possible defects using pulse echo method are 30 μs and 60 μs. Find out the distance of defect in steel bar from the entrance of ultrasonic wave. **04**

(c) (i) Calculate the penetration depth of lead at 6.2 K if the London penetration depth at 0 K is 36.5 nm. The critical temperature of lead is 7.2 K. **07**

(ii) Critical magnetic field of Lead is 6.5 x 10^3 A/m at 0 K. Calculate the temperature at which critical magnetic field of Lead drop to 3 x 10^3 A/m. The critical temperature of Lead is 7.2 K. Calculate critical current density at that temperature if radius of the wire is 0.5 mm.

OR

Q.5 (a) Write and explain any three properties of LASER. **03**

(b) Compare spontaneous emission and stimulated emission. (Mention four points of comparison) **04**

(c) Explain construction and working of Ruby LASER. **07**

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