Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–I (NEW) EXAMINATION – WINTER 2023

Subject Code:3110011 Date:12-01-2024

Subject Name:Physics

Time:02:30 PM TO 05:00 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)**	Explain the term bulk modulus, modulus of rigidity and yield point.	**03**
	(b)	Derive the formula for time period of a torsional pendulum.	**04**
	(c)	What is Cantilever? Obtain the expression for depression at free end of thin beam clamped horizontally at one end and loaded at other end.	**07**
Q.2	**(a)**	Explain sound absorption and reverberation.	**03**
	(b)	Discuss in detail the forced vibration and amplitude resonance.	**04**
	(c)	What is damping motion? Derive the differential equation and general solution of damped harmonic motion.	**07**
		OR	
	(c)	Discuss in detail the different types of elasticity. List different factors affecting elasticity.	**07**
Q.3	**(a)**	Describe any three property of ultrasonic sound.	**03**
	(b)	Calculate the length of nickel rod required to produce ultrasonic waves of frequencies of 50 kHz and 100 kHz. Consider the fundamental mode of vibrations of the rod. Given, density of nickel= 8908 kg/m^3, Young's modulus of the nickel= 2.14×10^{11} N/m^2.	**04**
	(c)	Describe production of ultrasonic waves by magnetostriction method. Give its advantages and limitations.	**07**
		OR	
Q.3	**(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)	A nickel rod having 5 cm length is vibrating at resonance. Calculate the fundamental frequency of vibration for which ultrasonic waves are generated. Given that Young's modulus of the nickel= 2.14×10^{11} N/m^2, density of nickel= 8.908×10^3 kg/m^3 .	**04**

	(c)	Explain in detail about the methods for the detection of ultrasound. Give any three applications of ultrasonic waves.	**07**
Q.4	**(a)**	Explain the Josephson's junction and state any one of its application.	**03**
	(b)	Determine the critical current for a superconducting ring of diameter 10^{-3} m at temperature 4.2 K. Given the critical temperature (T_c) for sample is 7.18 K and critical magnetic field at 0 K (Hc(0)) is 6.5×10^4 A/m.	**04**
	(c)	Explain London penetration depth. Discuss various applications of superconductors.	**07**
		OR	
Q.4	**(a)**	Explain NDT. Discuss advantages of NDT.	**03**
	(b)	A critical magnetic field of lead wire is 6.5×10^3 A/m at 0 K. At what temperature would the critical magnetic field of lead drop to 4.5×10^3 A/m if the critical temperature of lead is 7.18 K? What is the critical current density at that temperature if the diameter of the wire is 2×10^{-3} m?	**04**
	(c)	Explain in detail construction and working of Ruby LASER with necessary schematic and energy level diagrams.	**07**
Q.5	**(a)**	In He-Ne laser system, the two energy levels of Ne involved in lasing action have energy values of 20.66 eV and 18.70 eV. Population inversion occurs between these two levels. What will be the wavelength of a laser beam produced? What will be the population of the metastable energy level with respect to the upper excited level at 27 ºC?	**03**
	(b)	Discuss the properties of LASER.	**04**
	(c)	Describe the construction and working principle of He-Ne LASER with suitable diagrams.	**07**
		OR	
Q.5	**(a)**	Discuss any three important applications of LASER.	**03**
	(b)	Explain the term (i) stimulated emission, (ii) population inversion, (iii) pumping and (iv) metastable state.	**04**
	(c)	(i) What will be the resultant sound level when 70 dB sound is added to a 80 dB sound?	**04**
		(ii) A particle execute simple harmonic motion with amplitude of 0.1 m and a period of 0.5 s. Calculate its displacement, velocity and acceleration (1/12) s after it crosses the mean position.	**03**

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