GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–I&II EXAMINATION – SUMMER 2025
Subject Code:3110011   **Date:25-06-2025**
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: Stress, Strain, and Spring constant.	**03**
	(b)	A hall has a volume of 2265 m^3. Its total absorption is equivalent to 94.85 sabine·m^2. What will be the effect on reverberation time if the audience fill the hall, and thereby increasing the absorption by another 94.85 sabine·m^2?	**04**
	(c)	What is superconductor? Discuss about the Meissner effect, the effect of magnetic fields and the Isotopic effect in superconductors.	**07**
Q.2	**(a)**	State any six properties of ultrasound.	**03**
	(b)	Calculate the critical current for a superconducting wire made of lead, having a diameter of 1 mm at 4.2 K. Critical temperature (T_C) for lead is 7.18 K and $H_0 = 6.5 \times 10^4$ A/m.	**04**
	(c)	Discuss the construction and working of He-Ne laser.	**07**
		OR	
	(c)	Discuss the construction and working of Ruby laser.	**07**
Q.3	**(a)**	Find the force required to increase the length of a steel wire of 10^{-6} m^2 area of cross-section by 50% whose Young's modulus is 2×10^{11} N/m^2.	**03**
	(b)	Discuss the stress-strain curve for solid in detail.	**04**
	(c)	Derive the differential equation for damped harmonic motion. Also, derive the solution for the case where $b^2 < \omega_0^2$.	**07**
		OR	
Q.3	**(a)**	Derive the differential equation for simple harmonic motion.	**03**
	(b)	Discuss any four factors affecting acoustics of a building and their remedies.	**04**
	(c)	What is torsional pendulum? Derive the expression for the time period of vibration for torsional pendulum.	**07**
Q.4	**(a)**	Explain the working of SONAR in detail.	**03**
	(b)	Calculate the length of nickel rod required to produce ultrasonic waves with frequencies of 50 kHz and 100 kHz. Consider the fundamental mode of vibration for the rod. Given: Density of nickel = 8908 kg/m^3, Young's modulus of nickel = 2.14×10^{11} N/m^2.	**04**
	(c)	Discuss the BCS theory to explain superconductivity in materials.	**07**
		OR	
Q.4	**(a)**	State any six applications of superconductors.	**03**
	(b)	Explain the construction and working of SQUID using Josephson junctions.	**04**
	(c)	Discuss the construction and working of piezoelectric oscillator for the production of ultrasonic waves.	**07**

Q.5 **(a)** Define: Population inversion, Meta-stable state, and Pumping.   **03**
     (b) State any eight applications of lasers in various fields.   **04**
     (c) What is Non-destructive testing (NDT)? Discuss the use of ultrasound in NDT.   **07**

OR

Q.5 **(a)** Define: Simple Harmonic Motion, Forced Vibration, and Free Vibration.   **03**
     (b) Discuss about Young's modulus and bulk modulus in detail.   **04**
     (c) What is Einstein's coefficient? Derive the relation between Einstein's coefficients.   **07**

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