Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–I&II EXAMINATION – SUMMER 2025

Subject Code:BE01000021 Date:03-06-2025

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)**	Transition temperature of mercury of mass number 202 is 4.20 K. Find the transition temperature of isotope of mercury of mass number 204.	**03**
	(b)	Define: (i) Interference of light, (ii) Diffraction of light, (iii) Fresnel diffraction. Also state Huygens' principle.	**04**
	(c)(i)	Define nanomaterials and explain ball milling technique of synthesis of nanomaterials with suitable diagram.	**03**
	(c)(ii)	Write any four differences between n-type and p-type semiconductors.	**04**
Q.2	**(a)**	What is de-Broglie wave? Write the equation of de-Broglie wavelength and mention the names of each quantity involved in the equation.	**03**
	(b)	Find the force required to increase the length of a wire of 10^{-6} m^2 area of cross-section by 50 % whose Young's modulus is 2×10^{11} N/m^2.	**04**
	(c)	Explain torsional pendulum in brief with suitable diagram and derive the equation of twisting couple per unit twist of a wire.	**07**
		OR	
	(c)	Explain: (i) Elastic hysteresis, (ii) Elastic after-effect, and (iii) Elastic fatigue.	**07**
Q.3	**(a)**	Define: (i) Transverse waves, (ii) Ultrasonic waves, and (iii) Damped oscillations.	**03**
	(b)	The volume of a room is 1500 m^3. The wall area of the room is 250 m^2, the floor and the ceiling area is 150 m^2 each. The average sound absorption coefficient for the wall, floor and the ceiling are 0.25, 0.06 and 0.80, respectively. Calculate the average absorption coefficient and the reverberation time.	**04**
	(c)	Derive the differential equation of simple harmonic motion, also write its general solution and obtain the equation of velocity and acceleration of simple harmonic oscillator.	**07**
		OR	
Q.3	**(a)**	Define: (i) Reverberation, (ii) Echo, and (iii) Echelon effect.	**03**

	(b)	A particle of mass 0.50 kg executes a simple harmonic motion. If it crosses the centre of oscillation with a speed of 10 m/s, find the amplitude of the motion. (force constant k = 50 N/m)	**04**
	(c)	Explain the construction and working of piezoelectric method of ultrasonic wave production with suitable diagram.	**07**
Q.4	**(a)**	In a Young's double slit experiment, the two slits which are 0.5 mm apart are illuminated by the yellow light of wavelength 589.0 nm. Calculate the distance between two consecutive bright bands in the interference pattern observed on a screen 2 m away from the slits.	**03**
	(b)	Write Schrodinger's time independent wave equation and explain its each term. Also write Heisenberg's uncertainty principle in terms of position and momentum.	**04**
	(c)	Explain the formation of Newton's rings with suitable diagram and derive the equation of radius of bright and dark rings produced by the interference of reflected light.	**07**
		OR	
Q.4	**(a)**	Calculate de-Broglie wavelength associated with (i) A man of 50 kg mass walking with the speed of 2 m/s, and (ii) An electron moving with the speed of 3×10^5 m/s. Based on your answers obtained in above two cases, explain why the wave nature of the man can't be observed. ($h = 6.63\times10^{-34}$ J·s, electron mass = 9.11×10^{-31} kg)	**03**
	(b)	Define constructive and destructive interference with their condition in terms of path difference.	**04**
	(c)	Write a short-note on scanning tunneling microscope.	**07**
Q.5	**(a)**	In He-Ne gas laser, Ne atoms emit laser photons of wavelength 632.8 nm while electrons make transitions from E_3 state to E_2 state. Find the energy difference between these two states. ($h = 6.63\times10^{-34}$ J·s and $c = 3\times10^8$ m/s)	**03**
	(b)	Write the properties of laser and explain in brief.	**04**
	(c)	Write the full form of laser and explain (i) Absorption, (ii) Spontaneous emission, and (iii) Stimulated emission with suitable diagrams.	**07**
		OR	
Q.5	**(a)**	A ruby laser emits light of wavelength 694.3 nm. Calculate the frequency and the energy of the laser photons emitted. ($h = 6.63\times10^{-34}$ J·s and $c = 3\times10^8$ m/s)	**03**
	(b)	What is population inversion (draw suitable diagram)? Explain why it is necessary for the production of laser?	**04**
	(c)	Obtain the relation between Einstein's coefficients.	**07**

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