Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE –SEMESTER 1&2(NEW SYLLABUS)EXAMINATION- WINTER 2018

Subject Code: 3110011 Date: 04-01-2019

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)**	Define: Ductility and Plasticity.	**03**
	(b)	Draw: Stress – Strain diagram with necessary notation. Explain: Elastic Limit and Upper Yield Point in detail.	**04**
	(c)	Explain Types of Elasticity In detail. Explain Factor affecting on Elasticity.	**07**
Q.2	**(a)**	Define :Damped Harmonic Motion	**03**
	(b)	Explain Sound Absorption and Reverberation	**04**
	(c)	Illustrate various aspect associated with Acoustic of building.	**07**
		OR	
	(c)	Derive the Expression for Depression of Cantilever.	**07**
Q.3	**(a)**	Write down various advantage and disadvantage of NDT.	**03**
	(b)	Calculate the frequency to which a piezo electrical oscillator circuit should be tuned so that a piezo electrical crystal of 0.1cm thickness vibrates in its fundamental mode to generate ultrasonic waves. (Young`s modulus and density of the materials of crystal are 80GPa and 2654 Kg/m^3)	**04**
	(c)	Write a short note on Piezoelectric method for production of ultrasonic sound.	**07**
		OR	
Q.3	**(a)**	Explain Hook`s Law	**03**
	(b)	Calculate the fundamental frequency of vibration when A quartz crystal of 0.15cm thickness is vibrating at resonance. (Young's Modulus of quartz is $7.9X10^{10}$ N/m^2 and density is 2650 Kg/m^3	**04**
	(c)	Explain: Non Destructive Testing.	**07**
Q.4	**(a)**	Define: Penetration depth in the vicinity of Superconductivity.	**03**
	(b)	The Critical temperature of superconductor is 9.15K. At zero Kelvin the critical field is 0.196 Tesla. Calculate the field at 6K.	**04**
	(c)	Explain Josephson`s Junction and its applications.	**07**
		OR	
Q.4	**(a)**	Define Ultrasonic waves with necessary properties.	**03**
	(b)	Explain various applications of superconductor.	**04**
	(c)	Write short note Ruby Laser with necessary diagram.	**07**
Q.5	**(a)**	Define: Population Inversion	**03**

(b) Differentiate normal light and Laser light. **04**

(c) Explain various applications of LASER in Engineering and Medicine **07**

OR

Q.5 **(a)** Define : Simulated Emission **03**

(b) Explain Kundt`s tubes method for the detection of Ultrasonic Sound. **04**

(c) The volume of room is $800m^3$. The wall area of the room is $240m^2$, the floor area is $120m^2$ and the ceiling area is $120m^2$. The average sound absorption coefficient, (a) for the walls is 0.03 (b) for the ceiling is 0.8 (c) the floor it is 0.06 .Calculate the average sound absorption coefficient and the reverberation time. **07**

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 3110011 Date: 02/01/2020

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)**	Define: coefficient of viscosity.	**03**
	(b)	Define Reverberation time and write down the Sabine's formula of it by explaining the parameters in it.	**04**
	(c)	What is damping motion? Derive the differential equation and general solution of damped harmonic motion.	**07**
Q.2	**(a)**	Define resonance in an oscillating system.	**03**
	(b)	Draw stress- strain diagram. Explain the main points of it.	**04**
	(c)	Write down the factors affecting the acoustics of an auditorium. Give remedies.	**07**
		OR	
	(c)	Explain Young's Modulus, shear modulus, bulk modulus and Poisson's ratio.	**07**
Q.3	**(a)**	Write down various applications of ultrasonic waves.	**03**
	(b)	Calculate the natural frequency of 50 mm length of a pure iron rod. Given that Young's modulus of iron = 11.5×10^{10} N/m^2 and density of pure iron = 7.25×10^3 kg/m^3. Can you use it in a magentostriction oscillator to produce ultrasonic waves?	**04**
	(c)	Describe production of ultrasonic waves by magnetostriction method. Give its advantages and limitations.	**07**
		OR	
Q.3	**(a)**	What do you understand by NDT. Give names of few NDT methods.	**03**
	(b)	A Nikel 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 Nikel = 2.14×10^{11} N/m^2 , density of Nikel = 8.908×10^3 kg/m^3 .	**04**
	(c)	Describe acoustic diffraction method to determine the speed of sound in liquid with suitable diagram.	**07**
Q.4	**(a)**	Explain the phenomenon of superconductivity.	**03**
	(b)	The critical magnetic field of Niobium is 1×10^5 Tesla at 8 K and 2×10^5 Tesla at 0 K. Calculate the transition temperature of the element.	**04**
	(c)	Write down the applications of superconductors.	**07**
		OR	
Q.4	**(a)**	Describe BCS theory of superconductivity.	**03**
	(b)	Derive the formula for time period of a torsional pendulum.	**04**
	(c)	(i) Josephson Junction and its applications 04 (ii) What force is required to stretch a steel wire to double the length when its area of cross section is 1 cm^2. Given that Young's modulus of wire is 7×10^{10} N/m^2. 03	**07**

Q.5	**(a)**	Write down the properties of LASER light.	**03**
	(b)	What is the wavelength of light of Ruby Laser if the separation between metastable state and lower energy state is 1.79 eV. Given that Planck's constant = 6.64×10^{-34} Js.	**04**
	(c)	Describe the construction and working principle of He-Ne LASER with suitable diagrams.	**07**

OR

Q.5	**(a)**	Classify sound on the basis of frequency with suitable examples.	**03**
	(b)	Derive the relationship between Einstein Coefficients.	**04**
	(c)	Write down the various applications of LASER.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–I & II (NEW) EXAMINATION – WINTER 2020

Subject Code:3110011 Date:17/03/2021

Subject Name:Physics

Time:10:30 AM TO 12:30 PM Total Marks:56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1	**(a)**	A load of 2.6 kg produces an extension of 1 mm in a wire of 3.082 m and 1 mm in diameter. Calculate the Young's modulus of a wire.	**3**
	(b)	Define and describe Elasticity and Plasticity in detail by giving suitable examples.	**4**
	(c)	Explain the terms: (i) Young's modulus, (ii) Bulk modulus, (iii) Shear modulus and (iv) poison's ratio. Show any one relation between different moduli of elasticity.	**7**
Q.2	**(a)**	An empty assembly hall have a volume of 11260 m^3 and its total absorption is equivalent to 92 m^2 of open window. What will be the effect on reverberation time if an audience fills the assembly hall full and thereby increase the absorption by another 92 m^2 of open window?	**3**
	(b)	Define and differentiate between transverse and longitudinal waves.	**4**
	(c)	Describe Simple Harmonic motion with some examples. Differentiate Free and Forced oscillations (any four points).	**7**
Q.3	**(a)**	Describe any three applications of Ultrasonics.	**3**
	(b)	Write short note on (i) Ultrasonics and (ii) Non-Destructive Testing	**4**
	(c)	Write in detail Piezoelectric method for the production of ultrasonic sound using quartz crystal. Give suitable diagram and circuit for the same.	**7**
Q.4	**(a)**	Superconducting Gadolinium has a critical temperature of 8.6 K at magnetic field of 12.95 Tesla. Find its critical field at 4.1 K.	**3**
	(b)	What are superconductors? Explain any three properties of superconductors.	**4**
	(c)	Explain in brief (i) Josephson's junction and its applications, (ii) SQUID	**7**
Q.5	**(a)**	Describe and differentiate ordinary light and Laser light	**3**
	(b)	Write properties of Laser light.	**4**
	(c)	What is the full form of LASER? Explain in detail construction and working of Ruby Laser with the help of necessary schematic and energy level diagram.	**7**

Q.6	**(a)**	Describe population inversion with suitable diagram.	**3**
	(b)	State two advantage and disadvantages of non-destructive testing method	**4**
	(c)	Draw: Stress – Strain diagram with necessary notation. Explain: Elastic Limit and Upper Yield Point in detail.	**7**
Q.7	**(a)**	Describe role of stimulated emission in lasing action.	**3**
	(b)	Describe four methods for detection of ultrasonics.	**4**
	(c)	State the acoustic requirements of a good auditorium. Write factors affecting architectural acoustics with remedies.	**7**
Q.8	**(a)**	Describe any three property of ultrasonic sound.	**3**
	(b)	Describe ultrasonic flaw detector. How is it used in detection of flows in metals?	**4**
	(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.	**7**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–1/2 EXAMINATION – WINTER 2021

Subject Code:3110011 Date:22/03/2022

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 Hooke's law, stress and strain.	**03**
	(b)	Explain various properties of LASER beam.	**04**
	(c)	Describe Stress-Strain diagram in detail.	**07**
Q.2	**(a)**	Define wave motion. Discuss different types of waves.	**03**
	(b)	(i) A cinema hall has a volume of 9,500 m^3 . What should be the total absorption in the hall if the reverberation time of 1.7 s is to be maintained?	**02**
		(ii) An ultrasonic source of 0.075 MHz sends down a pulse towards the seabed, which returns after 0.95 s. The velocity of ultrasound in sea water is 1800 m/s. Calculate the depth of the sea and wavelength of pulse.	**02**
	(c)	Discuss in detail the different types of elasticity. List different factors affecting elasticity.	**07**
		OR	
	(c)	What are the factors affecting acoustics of the building and give their remedies.	**07**
Q.3	**(a)**	A brass bar having a cross-section of 1 cm^2 is supported on two knife-edges 1.5 m apart. A load of 2 kg at the center of the bar depresses that point by 2.75 mm. What is the Young's Modulus for brass?	**03**
	(b)	Describe viscosity. How the comparison of viscosities of two liquids can be done?	**04**
	(c)	Establish the relation between Einstein's coefficients.	**07**
		OR	
Q.3	**(a)**	In the acoustic grating experiment, the wavelength of light transmitted through a liquid is 5970 Å. The 1^{st} order angle of diffraction is 0.195°. Calculate the velocity of ultrasound in the liquid having frequency 2.7 MHz.	**03**
	(b)	Expand SQUID. How is it formed and give it's applications.	**04**
	(c)	Explain in detail the production of ultrasonic waves through piezoelectric oscillator method.	**07**
Q.4	**(a)**	Calculate the frequency to which piezoelectric oscillator circuit should be tunned so that a piezoelectric crystal of thickness 0.2 cm vibrates in it's fundamental mode to generate ultrasonic waves. Young's modulus is 80 Gpa and density of material is 2654 kg/m^3	**03**
	(b)	Define Cooper pair. Explain BCS theory for superconductors.	**04**
	(c)	What are the applications of Ultrasound? Discuss them in detail.	**07**
		OR	

Q.4	**(a)**	The critical current density equal to 1.71 x 10^8 A/m^2 is required to change a superconducting wire of radius 0.5 mm at 4.18 K. If the critical temperature of the material is 7.5 K, calculate the maximum value of the critical magnetic field.	**03**
	(b)	Explain NDT with it's objectives.	**04**
	(c)	Explain in detail construction and working of He-Ne Gas LASER with necessary schematic and energy level diagrams.	**07**
Q.5	**(a)**	A voltage of 6.7 μV is applied across a Josephson junction. What is the frequency of the radiation emitted by the junction in GHz? Planck's constant = 6.626 x 10^{-34} J.s	**03**
	(b)	Define Optical resonator, life time, metastable state and pumping mechanism for LASER.	**04**
	(c)	Define Superconductor. Discuss it's properties in detail.	**07**
		OR	
Q.5	**(a)**	A hall has a volume of 2790 m^3. It's total absorption is equivalent to 98.80 m^2 of open window. What will be the effect on reverberation time if the audience fill the hall and thereby increase the absorption by another 98.80 m^2 of open window.	**03**
	(b)	What is ultrasonic waves? Give properties and detection methods for ultrasonics.	**04**
	(c)	Give applications of LASER in various fields in detail.	**07**

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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 11.6×10^{10} N/m^2 and 7.25×10^3 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 = 7.8×10^{-3} kg·m^2/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 4.14×10^{-15} eV·s)	**03**
	(b)	Derive the relation between Einstein's coefficients with necessary assumptions.	**04**
	(c)	(1) Define Following: (a) Poisson's ratio (b) Weber-Fetchner law (c) Population inversion	**03**
		(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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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 x 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 x 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 x 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 6.5×10^3 A/m at 0 K. Calculate the temperature at which critical magnetic field of Lead drop to 3×10^3 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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