Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - V EXAMINATION - WINTER 2025

Subject Code: N115AR01 **Date: 06-12-2025**

Subject Name: NDT Techniques - II (UT)

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 the basic principle of sound propagation and briefly list the types of sounds with their frequencies.	**03**
	(b)	What is a Piezoelectric Material? State its primary role in an ultrasonic transducer.	**04**
	(c)	Differentiate between the Longitudinal wave and Transverse (Shear) wave sound propagation modes in solids, with respect to particle motion with figure. State the principle of ultrasonic testing.	**07**
Q.2	**(a)**	Mention any three advantages of Ultrasonic Testing over other NDT methods.	**03**
	(b)	Define the wavelength and frequency. Find the wavelength having the frequency 4 MHz and velocity is 6000 m/s.	**04**
	(c)	What do you mean by attenuation of sound waves? How sound waves are attenuated, and what is the impact of attenuation on ultrasonic testing?	**07**
		OR	
	(c)	A cylindrical rod is tested using immersion ultrasonic testing. Describe setup, advantages, and inspection steps.	**07**
Q.3	**(a)**	What is the basic working principle of Ultrasonic Testing?	**03**
	(b)	What is the role of the transducer in UT? What are types of transducers used in UT?	**04**
	(c)	The acoustic impedance of air is 0.004×10^5 kg/m^2 s, water is 1.5×10^5 kg/m^2 s, and steel is about 46.5×10^5 kg/m^2 s. Explain how this impedance differences affect the reflection and transmission of ultrasonic waves at the air to steel and water to steel interfaces.	**07**
		OR	
	(a)	An ultrasonic pulse takes 12 microseconds to travel to a defect and return. If sound velocity is 6000 m/s, find the depth of the defect.	**03**
	(b)	A 50 mm thick steel plate is tested for internal flaws using pulse-echo UT. Explain how reflection signals help locate defects with depth calculation.	**04**
	(c)	A welded steel plate is inspected using a shear wave transducer. Explain the full procedure for detecting side-wall cracks using angle-beam inspection.	**07**

Q.4 **(a)** Name the types of calibration clocks used in UT. **03**

(b) What is the critical angle in UT? How many critical angles are there in UT to carry inspection by oblique incident? Write angles of them. **04**

(c) Explain the pulse-echo technique to carry inspection on a steel plate having 100 mm thickness. Explain the method of calibration for normal incident on calibration block.. **07**

OR

(a) What parameters are responsible for the selection of probe frequency? **03**

(b) Match the probe frequency for particular material. **04**

Sr. No.	Frequency of Probe	Materials
1	4 - 6 MHz	Concrete
2	5 - 6 MHz	Aluminium
3	0 - 1 MHz	Martensitic Stainless Steel
4	2 MHz	Copper and Copper Alloys

(c) Show the trigonometric calculation to find the defect in the weld sample by skip distance and surface distance by angle probe inspection. **07**

Q.5 **(a)** What is the thumb rule to characterize the defect using UT? **03**

(b) Name four defects that can be characterized by UT. **04**

(c) Describe the A, B, and C scan presentation of UT. **07**

OR

(a) What is the principle of immersion testing? Write the advantages and limitation of test. **03**

(b) Discuss the principle, advantages and limitations of Acoustic Emission Testing (AET). **04**

(c) With neat sketch, describe the normal, TR and angle probe construction. **07**

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