



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. Industrial Based Non Destructive Techniques and Practices

Subject Code : BE050AR011

Subject Name: Non Destructive Testing – II

w. e. f. Academic Year:	2026-27
Semester:	5
Category of the Course:	Core Courses

<b>Prerequisite:</b>	Nil
<b>Rationale:</b>	This subject provide students with a robust foundation in advanced Non-Destructive Testing (NDT) techniques, specifically focusing on leak detection and ultrasonic evaluation. It provides the foundational knowledge required to validate the component quality that is essential for ensuring structural integrity and operational safety in industrial environments. The subject identify leak types and select appropriate detection methods—ranging from simple bubble tests to sophisticated radioactive tracers. Also, subject emphasizes and covers ultrasonic testing from science of sound to its applications in industry.

**Course Outcome:**

After Completion of the Course, Student will able to:

No	Course Outcomes
01	To learn the principles, working and applications of Leak and Ultrasonic Testing.
02	Identify defects with Leak for a given problem/component.
03	Apply Ultrasonic Testing for defects detection.

**Teaching and Examination Scheme:**

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
L	T	P	PBL*	Total no of hours per semester		Theory		Tutorial / Practical			
						ESE (E)	PA / CA (M)	PA/ CA (I)	PBL* (I)	ESE (V)	
60	0	30	60	150	05	70	0	0	30	50	150

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End Semester Examination, PA = Progressive Assessment

\* Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.



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## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	<b>Leak and pressure testing:</b> Definition of a leak and its types, Leak rate, Requirement for performing leak test, Principle, Various methods of pressure and leak testing like acoustic method, bubble testing, immersion testing, pressure system leak testing using specific gas detector, radioactive leak testing, application, and limitation.	20	34
2.	<b>Ultrasonic Testing (fundamentals):</b> Sound, Sound wave and related terminologies, Basic principles of sound propagation, types of sound waves, laws related to sound propagation, acoustic impedance, Principle of Ultrasonic Testing (UT), variables in UT, Piezoelectricity and Materials, Various types of transducers/probe, various methods of UT, their advantages and limitations, Study of A, B and C scan presentations, attenuation, couplant.	20	33
3.	<b>Ultrasonic Testing:</b> Calibration methods, use of standard blocks, inspection methods, a technique for normal beam inspection, flaw characterization technique, ultrasonic flaw detection equipment, modes of display Characterization of defects in castings, forgings, rolled and welded products by UT. Thickness determination by ultrasonic method. Immersion testing, advantage, limitations; Acoustic Emission Testing (AET): Principles of AET and techniques.	20	33
<b>Total</b>		<b>60</b>	<b>100</b>

## Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	30	30	10	0	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

## References/Suggested Learning Resources:

### (a) Books:

1. Practical Non-destructive Testing – Baldev Raj, T. Jayakumar & M. Thavasimuthu, 3rd Edition, Reprint 2019, Norosa Publishing House, New Delhi.
2. Treaties on Non-destructive Testing, Vol. 1,2 & 3 Edited by Dr. E.G. Krishnadas Nair, NDT Centre, HAL, Bangalore



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3. Non-destructive test and evaluation of materials Jayamangal Prasad; C G Krishnadas Nair 2nd Edition, 2011, : Tata McGraw-Hill, New Delhi
4. Non-destructive testing, R. Halmshaw 2nd Edition, 1991, Butterworth-Heinemann Ltd.
5. Non Destructive Testing, Louis Cartz, 1995, ASM International, USA
6. Non-destructive testing, Warren J. McGonnagle, Gordon Breach, Science Publishers Ltd.
7. ASNT Level-II Study Guide

## (b) Open source software and website:

1. <http://nptel.iitm.ac.in/>
2. <https://www.nde-ed.org/>

## Suggested Course Practical List:

1. To study leak testing and methods.
2. To study about principle and applications of UT.
3. To study UT machines and its functions.
4. To study and demonstrate different UT probes.
5. To study different calibration blocks used for UT.
6. To study and calibrate the UT machine for a given specimen using normal or TR probes.
7. To study and calibrate the UT machine for a given specimen using angle probe.
8. To study about principle and applications of AET.
9. Numerical and MCQ based on LT and UT.
10. Report on expert lecture.
11. Report on Industrial Visit / Research Lab Visit -1

## List of Laboratory/Learning Resources Required:

UT machine, UT probes, UT calibration blocks, testing samples.

## List of suggested activities for Problem Based Learning:

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
2.	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
3.	Assignment writing. Numericals based assignment is preferable.	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.
4.	Expert Lecture/session	Lecture = 2 hr Report = 1 hr Total = 03 h	Based on report submitted. Report should contain observation and learning.



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5.	Self learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of course. Based on the certificate produced.
6.	Complex problem solving	Maximum 2 problem. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
7	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
8	Discussion on research paper based on relevant subject	5 research paper = 20 h	Summarize research paper and evaluation critical parameters
9.	Poster/chart/power point preparation on technical topics	Duration = 6 h	Based on poster/chart preparation and presentation skills
10	Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation
11	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/any other issue	Duration = 15 h for industrial exposure  Problem identification and tentative solution = 10 h Total = 20 h	Based on evaluation of critical problems and solutions
12	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.
13.	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.

**Note:**

1. All the suggested activity should be related to the subject.
2. The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
3. Rubrics for the evaluation can be prepared by the faculty.

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