



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Metallurgy Engineering

Subject Code : DI04021071

Subject Name : Non Destructive Testing

w. e. f. Academic Year:	2025-26
Semester:	4 th
Category of the Course:	Professional Elective - II

Prerequisite:	The prerequisites for this course include a basic knowledge of waves, magnetism, and ultrasonic, which are essential to understand ultrasonic, magnetic particle, and radiographic testing methods. A fundamental understanding of materials science, including the structure and mechanical properties of metals and alloys, will help in relating defects to material performance. Familiarity with chemistry, especially surface interactions, assists in comprehending liquid penetrant testing.
Rationale:	This course provides a comprehensive introduction to Non-Destructive Testing techniques, which are critical for evaluating the integrity of materials and components without causing damage. The primary goal is to develop an understanding of the principles, procedures, applications, and limitations of major NDT methods such as visual inspection, liquid penetrant testing, magnetic particle testing, ultrasonic testing, and radiographic testing. Students will learn how these methods are applied to detect surface and subsurface flaws, measure thickness, and ensure product quality.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Understand the fundamentals of destructive and non-destructive testing.	R
02	Apply liquid penetrant and magnetic particle testing methods to detect and evaluate surface and subsurface flaws in materials.	A
03	Explain the use of eddy current testing methods for defect detection.	U
04	Acquire knowledge of the ultrasonic testing techniques used for measure flaw characterization.	U
05	Acquire knowledge of the Radiographic testing techniques used for interpret radiographs and identify defects.	U

*Revised Bloom's Taxonomy (RBT)



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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE (V)	
2	0	4	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction: 1.1 Fundamentals of destructive and non-destructive testing. 1.2 Applications and limitations of NDT, 1.3 Visual examination methods, 1.4 Different optical aids used for visual examination.	4	14
2.	Liquid penetrant Testing and Magnetic Particle Testing: 2.1 Principle of Testing, 2.2 Properties for testing materials. 2.3 Procedure used for Testing 2.4 Sensitivity of test. 2.5 Application and Limitations of Testing.	8	25
3.	Eddy Current Testing: 3.1 Principle of Eddy Current Testing. 3.2 Techniques used for Eddy Current Testing. 3.3 Sensitivity of test. 3.4 Application and Limitations of Eddy Current Testing.	5	18
4.	Ultrasonic Testing: 4.1 Basic properties of sound beam, types of sound waves. 4.2 Ultrasonic Transducer 4.3 Inspection methods used for Ultrasonic test. 4.4 Techniques for normal beam and angle beam inspection. 4.4 Flaw characterization technique. 4.5 Thickness determination by ultrasonic method, Study of A, B, and C scan presentations. 4.6 Advantages and Limitations of ultrasonic testing.	7	23
5.	Radiographic testing: 5.1 X-ray and Gamma-Ray radiography, 5.2 Principles of Radiographic testing. 5.3 Types of films, screens and penetrometer.	6	20



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5.4 Techniques used for Radiographic testing. 5.5 Applications and limitation Radiographic testing.		
Total	30	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
20	50	30	-	-	-

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:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Practical Non-destructive Testing	Baldev Raj, T. Jayakumar & M. Thavasimuthu	Woodhead publishing limited ISBN: 1-85573-600-4 ISBN: 1-84265-081-5
2	Non-Destructive Testing Techniques	Ravi Prakash	New age international publishers, ISBN-13: 978-8122425888 ISBN-10: 8122425887
3	Non-destructive test and evaluation of materials	Jayamangal Prasad; C G Krishnadas Nair	2nd Edition, 2011,; Tata McGraw-Hill, New Delhi

(b) Open source software and website:

1. https://onlinecourses.nptel.ac.in/noc23_mm05/preview
2. <https://www.nationalboard.org/index.aspx?pageID=164&ID=374>
3. <https://www.asnt.org/what-is-nondestructive-testing/methods/magnetic-particle-testing>
4. <https://www.youtube.com/watch?v=UM6XKvXWVFA>
5. https://www.youtube.com/watch?v=7oR_l8nXdmo



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Suggested Course Practical List:

Sr. No.	Practical Title	Unit No.	Approx. Hrs. Required
1	To study about need of Destructive testing and Nondestructive testing.	I	06
2	Perform visual test for given metallic sample using optical visual aid.	I	06
3	Perform Liquid Penetration Test for given sample with visible dye.	II	06
4	Perform Liquid Penetration Test for given sample with fluorescent dye.	II	06
5	Perform Magnetic Particle test using different methods of magnetization.	II	06
6	To study Eddy Current Test for conductivity and crack detection.	III	06
7	To study Ultrasonic Test on given weld sample.	IV	06
8	To measure thickness using UT machine for given sample.	IV	06
9	To study Radiographic Testing for given sample.	V	06
10.	To study safety in Industrial Radiographic.	V	06
	Total		60

List of Laboratory/Learning Resources Required:

- Magnifying glasses
- Penetrant materials (visible dye penetrant, fluorescent penetrant)
- Developer sprays
- Magnetic yokes
- Magnetic powders

Suggested Project List:

- Create Comprehensive Charts Summarizing Ultrasonic Thickness Measurement Setup.
- Visit a Non destruct testing laboratory and make a report.
- Explore and identify the Inspection of welded Joints using different Non-destructive testing.

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