



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3172102

Semester – VII

Subject Name: Non-Destructive Testing

Type of course: Science & Engineering

Prerequisite: Knowledge of Metallurgical Processes and its defects

Rationale: Defects are the reason for any rejection of products for metallurgy engineers. Any foundry, heat treatment, or fabrication process may create defects. Also, defects may be generated during the service of the product. So it is essential for an engineer to know the defect and detect it. This course is offered to inculcate fundamentals, methodology, and skills to use various Non-Destructive techniques for defect detection and estimation to ensure desired properties and long product service life. The course covers basic need of NDT Level II certificate.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	4	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hours
1	Fundamental of destructive and non-destructive testing. Scope and limitations of NDT, Visual examination methods, Different visual examination aids. Leak and pressure testing: Definition of a leak and its types, Principle, Various methods of pressure and leak testing, application, and limitation.	6
2	Dye penetrant Testing/ liquid penetrant testing: Principle, Procedure, characteristics of penetrant, types of penetrants, penetrant testing materials, fluorescent penetrant testing method– sensitivity, application, and limitations. Magnetic Particle Testing: Principle, magnetizing technique, procedure, equipment, magnetic particle testing methods, sensitivity, application, and limitations.	6
3	Basic principles of sound propagation, types of sound waves, Principle of UT, methods of UT, their advantages and limitations, Piezoelectric Material, Various types of transducers/probe, Calibration methods, use of standard blocks, a technique for normal beam inspection, flaw characterization technique, defects in welded products by UT, Thickness determination by ultrasonic method, Study of A, B, and C scan presentations, advantage, limitations acoustic emission testing – principles of AET and techniques	6
4	Radiographic testing: X-ray and Gamma-Ray radiography, Their principles, methods of generation, Industrial radiography techniques, inspection techniques, applications, limitations, Types of films, screens, and penetrameters. Interpretation of radiographs, Safety in industrial radiography.	6

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5	Eddy current testing: Principle, instrument, techniques, sensitivity, application, limitation, Thermal methods of NDT	4
Total		28

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	30	35	10	05	00

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

Reference Books:

1. Practical Non-destructive Testing – Baldev Raj, T. Jayakumar & M. Thavasimuthu, 3rd Edition, Reprint 2019, Norosa Publishing House, New Delhi.
2. Treatise on Non-destructive Testing, Vol. 1,2 & 3 Edited by Dr. E.G. Krishnadas Nair, NDT Centre, HAL, Bangalore
3. Non-destructive test and evaluation of materials Jayamangal Prasad; C G Krishnadas Nair 2nd Edition, 2011,; Tata McGraw-Hill, New Delhi
3. Ultrasonic Testing of Materials, J. Krautkramer & Herbert Krautkramer, 2nd Edition, 1990, Springer.
4. Non-destructive testing, R. Halmshaw 2nd Edition, 1991, Butterworth-Heinemann Ltd.
5. Non Destructive Testing Louis Cartz, 1995, ASM International, USA
6. ASNT Level-II Study Guide

Course Outcomes:

Sr. No.	CO statement	Marks % Weightage
CO-1	Select an appropriate non-destructive technique as per requirement.	35
CO-2	Apply non-destructive testing methods for a given problem or application.	50
CO-3	Interpret the defects.	15

List of Experiments:

1. To study the need for Nondestructive testing (NDT).
2. To perform a visual test for a given sample using a visual aid.
3. To perform Dye/Liquid Penetration Test for a given sample with a visible and fluorescent dye.
4. To study and perform Magnetic Particle Test using different methods of magnetization.
5. To study and perform Ultrasonic Test for weld samples.



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6. To measure thickness using an Ultrasonic Flaw Detector for a given sample.
7. To interpret radiographic film.
8. To study and perform Leak Testing.
9. To study of Eddy Current Test.
10. To study acoustic emission testing and thermography.

Major Equipment:

1. Prod type Magnetic Particle testing machine
2. Yoke type Magnetic Particle testing machine
3. Digital Ultrasonic Flaw Detector
4. Model of Radiography for demonstration of RT

List of Open Source Software/learning website:

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