

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Metallurgy
SUBJECT NAME: Non Destructive Testing
SUBJECT CODE: 2172102
B.E. 7th SEMESTER

Type of course: Core

Prerequisite: NIL

Rationale: Defects are the reason for any rejection of product for metallurgy engineers. Any foundry, heat treatment or fabrication process may create defects. Also defects may be generated during service of product. So it is essential for engineer to know the defect and detect it. This course is offered to inculcate fundamentals, methodology and skill to use various techniques for defect detection and estimation so as to ensure desired properties and long product service life.

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)	
4	0	2	6	70	PA	ALA	ESE	OEP	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Fundamentals of and introduction to destructive and non-destructive testing. Scope and limitations of NDT, Visual examination methods, Different visual examination aids.	4	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	8	12
3	Magnetic Particle Testing: Important terminologies related to magnetic properties of material, principle, magnetizing technique, procedure, equipment, fluorescent magnetic particle testing method, sensitivity, application and limitations	8	12
4	Ultrasonic Testing: 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, technique for normal beam inspection, flaw	14	25

	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		
5	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.	14	25
6	Leak and pressure testing: Definition of leak and types, Principle, Various methods of pressure and leak testing, Application and limitation	6	10
7	Eddy current testing: Principle, instrument , techniques, sensitivity, application, limitation Thermal methods of NDT s	6	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	25	30	10	05

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 above table.

Reference Books:

1. Practical Non-destructive Testing – Baldev Raj, T. Jayakumar & M. Thavasimuthu, 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
3. Non-destructive testing, Warren J. McGonnagle, Gordon Breach, Science Publishers Ltd.
4. Ultrasonic Testing of Materials, J. Krautkramer & Herbert Krautkramer, Narosa Publishing House, New Delhi.
5. Non-destructive testing, R. Hatmshaw.
6. Ultrasonic Methods of Testing Materials, Leszek Filipezynski, Zdzislaw Pawlowski & Jerzywehr, Butterworths, London.

Course Outcome:

After learning the course the students should be able to:

1. Classify various nondestructive testing.
2. Check different metals and alloys by visual inspection method.
3. Explain and perform non-destructive tests like: Liquid penetrant test, Magnetic particle test, Ultrasonic test, X-ray and Gamma ray radiography, Leak Test, Eddy current test.

4. Identify defects by using relevant NDT methods.

List of Experiments:

1. To study about need of Nondestructive testing (NDT).
2. To perform visual test for given sample using visual aid.
3. To perform Dye/Liquid Penetration Test for given sample with 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 sample.
6. To measure thickness using UT machine for given sample.
7. To study Radiographic Testing.
8. To study and perform Leak Testing.
9. To study of Eddy Current Test.
10. To study acoustic emission testing and thermography.

Design based Problems (DP)/Open Ended Problem:

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:

www.nptel.ac.in

www.nde-ed.org

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.