

## NON-DESTRUCTIVE TESTING

<b>Course Code</b>	22MEMD2T6A	<b>Year</b>	I	<b>Semester</b>	II
<b>Course Category</b>	Programme Elective	<b>Branch</b>	ME	<b>Course Type</b>	Theory
<b>Credits</b>	4	<b>L-T-P</b>	4-0-0	<b>Prerequisites</b>	Nil
<b>Continuous Internal Evaluation:</b>	40	<b>Semester End Evaluation:</b>	60	<b>Total Marks:</b>	100

**Course outcomes:** At the end of the course, the student will be able to:

CO	Statement	BTL	Units
CO1	Explain the fundamentals of non-destructive testing and Liquid Penetration testing	L2	1
CO2	Demonstrate Magnetic Particle Testing and Ultrasonic testing methods	L2	2
CO3	Describe Acoustic Emission Testing, Thermography, and Codes, Standards, Specification and Procedures used for NDT	L2	3
CO4	Enumerate the procedures to detect different flaws in composite materials	L2	4

**Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High:3, Medium: 2, Low:1)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2		1	2	1			2			1	3	1
CO 2	3	2		1	2	1			2			1	3	1
CO 3	3	2		1	1	1			2			1	3	1
CO 4	3	2		1	2	1			2			1	3	1

Syllabus		
Unit	Contents	Mapped CO
1	INTRODUCTION: Various methods, advantages, disadvantages and applications. Visual Examination: Basic principle, the eye- defects which can be detected by unaided, visual inspection, optical aids used for visual inspection- microscope, bore scope, endoscope, telescope, holography; applications. LIQUID PENETRANT TESTING: Physical principles, Procedure for Penetrant testingcleaning, penetrant application, removal of excess penetrant, application of developer, inspection and evaluation; Penetrant testing materials: penetrants, cleaners and emulsifiers, developers,	CO1

	special requirements, test blocks; penetrant testing methods: water washable method, post-emulsifiable method, solvent removal method; sensitivity, applications & limitations	
2	MAGNETIC PARTICLE TESTING: Principle of MPT, Magnetizing techniques- magnetization using a magnet, magnetization using an electro magnet, constant current flow method. Procedure used for testing a component: Equipment used for MPT-simple equipment, large portable equipment, stationary magnetizing equipment; sensitivity, limitations. ULTRASONIC TESTING: Basic properties of sound beam- sound waves, velocity of ultrasonic waves, acoustic impedance, behaviour of ultrasonic waves. Inspection methods: Normal incident pulse-echo inspection, normal incident through-transmission testing, angle beam pulse-echo testing, criteria for probe selection, flaw sensitivity, beam divergence, penetration and resolution.	CO2
3	ACOUSTIC EMISSION TESTING: Principle of AET, technique, instrumentation, sensitivity, applications. THERMOGRAPHY: Basic principles, detectors and equipment, techniques, applications. CODES, STANDARDS, SPECIFICATION AND PROCEDURES: Code, standards-international and national standards, industry standards, government and military standards, industry practices, standards; specification, procedures, Indian National standards for NDT, International standards for NDT- ISO standards for quality systems.	CO3
4	LIQUID CRYSTALS FOR FLAW DETECTION IN COMPOSITES: Equipment, specimen preparation procedure, results, passive tests, discussion and conclusions. DETECTION OF DAMAGE IN COMPOSITE MATERIALS BY VIBROTHERMOGRAPHY: Experimental technique, results and discussion. APPLICATION OF X-RAY TOMOGRAPHY TO THE NON-DESTRUCTIVE TESTING OF HIGH PERFORMANCE POLYMER COMPOSITES: Introduction, presentation of basic method on the medical scanner, absorption of x-rays, x-ray tomography, terminology, results achieved with the CGR – ND 8000 Scanner, conclusions.	CO4

#### Learning Resources

##### Text Book(s):

1. Practical Non-Destructive Testing, (2nd Edition) by Baldev Raj, T. Jayakumar, M. Thavasimuthu, Wood head Publishing Limited.
2. Non-Destructive Testing of Fibre-Reinforced Plastics Composites by J. Summerscales, Springer.
3. Damage Detection in Composite Materials by Masters JE, ASTM STP 1128.
4. Non-destructive evaluation and flaw criticality for composite materials by R. Byron Pipes, ASTM International, 197

Course coordinator:

HOD