

## NON-DESTRUCTIVE EVALUATION

### Professional Elective – I

<b>Course Code</b>	23ME4501D	<b>Year</b>	III	<b>Semester</b>	I
<b>Course Category</b>	Professional Elective- I	<b>Branch</b>	ME	<b>Course Type</b>	Theory
<b>Credits</b>	3	<b>L-T-P</b>	3-0-0	<b>Pre-requisites</b>	Nil
<b>Continuous Internal Evaluation</b>	30	<b>Semester End Evaluation</b>	70	<b>Total Marks</b>	100

Course Outcomes		
Upon successful completion of the course, the student will be able-to		<b>Blooms Level</b>
<b>CO1</b>	Discuss the applications of NDE, principles and procedure of radiography techniques.	<b>L2</b>
<b>CO2</b>	Interpret the principles and procedure of ultrasonic testing	<b>L2</b>
<b>CO3</b>	Understand the principles and procedure of Liquid penetration and eddy current testing	<b>L2</b>
<b>CO4</b>	Illustrate the principles and procedure of Magnetic particle testing	<b>L2</b>
<b>CO5</b>	Interpret the principles and procedure of infrared testing and thermal testing	<b>L2</b>

Contribution of Course outcomes towards the achievement of program outcomes &Strength of correlations (High:3,Medium:2, Low:1)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	2		1	2	1			2		1	3	1
<b>CO2</b>	3	2		1	2	1			2		1	3	1
<b>CO3</b>	3	2		1	2	1			2		1	3	1
<b>CO4</b>	3	2		1	2	1			2		1	3	1
<b>CO5</b>	3	2		1	2	1			2		1	3	1

SYLLABUS		
UNIT	Contents	Mapped CO
<b>I</b>	<b>INTRODUCTION TO NON-DESTRUCTIVE TESTING AND INDUSTRIAL APPLICATIONS OF NDE:</b> Span of NDE Activities, Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions. <b>Radiographic test:</b> Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography, neutron ray radiography.	<b>CO1</b>
<b>II</b>	<b>ULTRASONIC TEST:</b> Principle of Wave Propagation, Reflection, Refraction,	<b>CO2</b>

	Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect, Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.	
III	<b>LIQUID PENETRANT TEST:</b> Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness, DPI, FPI, Limitations of Liquid Penetrant Testing. <b>Eddy Current Test:</b> Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current Testing, Effectiveness of Eddy Current Testing	CO3
IV	<b>MAGNETIC PARTICLE TEST:</b> Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test	CO4
V	<b>INFRARED AND THERMAL TESTING:</b> Introduction and fundamentals to infrared and thermal testing—Heat transfer—Active and passive techniques—Lock in and pulse thermography, tomography—Contact and non-contact thermal inspection methods—Heat sensitive paints—Heat sensitive papers—thermally quenched phosphors liquid crystals—techniques for applying liquid crystals—other temperature sensitive coatings—Inspection methods—Infrared radiation and infrared detectors—thermo mechanical behaviour of materials—IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures—Case studies.	CO5
<b>Learning Resource</b>		
<b>Text Books:</b>		
1. Nondestructive test and evaluation of Materials/J Prasad, GCK Nair/TMH Publishers 2. Ultrasonic testing of materials/ H KrautKramer/Springer 3. Nondestructive testing/Warren, J Mc Gonnagle / Godan and Breach Science publishers 4. Nondestructive evaluation of materials by infrared thermography / X. P. V. Maldague, Springer-Verlag, 1 <sup>st</sup> edition, (1993)		
<b>References:</b>		
1. Ultrasonic inspection training for NDT/E.A.Gingel/Prometheus Press, 2. ASTM Standards, Vol 3.01, Metals and alloys 3. Non-destructive Evaluation, Hand Book – R. Ham Chand		
<b>E- Resources &amp; other digital material</b>		
1. <a href="https://nptel.ac.in/courses/113/106/113106070/">https://nptel.ac.in/courses/113/106/113106070/</a> 2. <a href="https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm07/">https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm07/</a>		