

<b>BMEE313E</b>	<b>Non- destructive Testing</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>
<b>Pre-requisite</b>	<b>BMEE209L , BMEE209P</b>	<b>Syllabus version</b>			
		1.0			
<b>Course Objectives</b>					
<ol style="list-style-type: none"> <li>To provide a basic understanding with case studies on different NDT &amp; E techniques.</li> <li>Impart knowledge on inspecting materials with industry specifications and standards.</li> <li>To get knowledge about the advanced NDT techniques.</li> </ol>					
<b>Course Outcome</b>					
At the end of the course, the student will be able to					
<ol style="list-style-type: none"> <li>Infer the knowledge of various NDT techniques.</li> <li>Apply the NDT techniques to identify surface defects of engineering components.</li> <li>Use the subsurface NDT techniques to identify the defects.</li> <li>Examine and quantify closed discontinuities to assess the structural integrity of engineering components.</li> <li>Analyse the outputs of the acquired data from NDT techniques.</li> <li>Evaluate the output results in the different modality.</li> </ol>					
<b>Module:1   Introduction NDT</b>		<b>6 hours</b>			
Fundamentals of characterisation studies, Codes, Standards and Specifications, Defects in Materials due to various processing, Visual Testing – vision certification, lighting, material attributes, environmental factors, visual perception, direct and indirect methods – mirrors, magnifiers, boroscopes and fibrosopes– light sources and special lighting–calibration.					
<b>Module:2   Surface inspection Techniques</b>		<b>5 hours</b>			
Dye penetrant testing – visible, fluorescent method, Selection of penetrant method - Theory of magnetism and Principle of Magnetic Particle Testing - Wet Magnetic Particle Testing (WMPT) and Dry Magnetic Particle Testing (DMPT).					
<b>Module:3   Ultrasonic Testing</b>		<b>8 hours</b>			
Introduction, Elastic wave propagation in solids, Bulk waves, Particle motion and Wave fronts, Reflection and refraction at interfaces, Attenuation and scattering, Ultrasonic transducers, Inspection techniques, Flaw characterization, Material properties characterization, Immersion testing, Applications.					
<b>Module:4   Acoustic emission testing</b>		<b>4 hours</b>			
AE sources, Wave propagation in metals and alloys, AE signal intensity in attenuation media, AE equipments, Signal features, Data collection and analysis, source location, Applications.					
<b>Module:5   Eddy current testing</b>		<b>7 hours</b>			
Generation of eddy currents – effect of change of impedance on instrumentation – properties of eddy currents – eddy current sensing elements, probes, type of coil arrangement – absolute, differential, lift off, operation–Through encircling coils, type of arrangements – absolute, differential fill factor, operation - Factors affecting sensing elements and coil impedance - test part and test system– Applicable codes and standards.					
<b>Module:6   Radiography Testing</b>		<b>7 hours</b>			
Introduction to Radiography – radiography sources - Film Radiography - Film handling and storage - Effect of film processing on film characteristics - Radiographic Image Quality and Radiographic Techniques - Special Radiographic Techniques and Interpretation of radiographs - Radiation hazards evaluation and control - Applicable codes and standards of Radiography techniques.					
<b>Module:7   Advanced NDT</b>		<b>6 hours</b>			
Leak testing, Hydro testing, Holography, Thermography, Magnetic Barkhausen Effect, and In-situ metallography. Industrial applications of flaw detection probability, Wave propagation in guided wave modes in isotropic and composite plate structures, Mode conversion, diffraction and scattering of ultrasonic waves in isotropic and anisotropic media, Pulsed eddy					

current NDT, Electromagnetic acoustic technique (EMAT). Scanning Acoustic Microscopy (SAM) and Scanning Laser Acoustic Microscopy.			
<b>Module:8</b>	<b>Contemporary ISSues</b>		<b>2 hours</b>
<b>Total Lecture hours:</b>			<b>45 hours</b>
<b>Text Book(s)</b>			
1.	Wong B. Stephen, Non-Destructive Testing - Theory, Practice and Industrial Applications, 2015, 1 <sup>st</sup> edition, Lambert Academic Publishing, USA.		
<b>Reference Books</b>			
1.	Prasad, J C. G. Krishnadas Nair, Non-Destructive Test and Evaluation of Materials, 2017, 2 <sup>nd</sup> edition, McGraw Hill Education (India) Private Limited.		
2.	Raviprakash, Non-Destructive Testing Techniques, 2010, 1st edition, New Age International Private Limited Published.		
3.	Baldev Raj, M. Thavasimuthu, and Jayakumar T, Practical Non-Destructive Testing, 2009, 3 <sup>rd</sup> edition, Narosa publications.		
Mode of Evaluation: CAT / written assignment / Quiz / FAT			
<b>Indicative Experiments</b>			
1.	Inspection of welds/samples using solvent removable visible dye penetrant		
2.	Inspection of welds using solvent removable fluorescent dye penetrant.		
3.	Inspection of welds/samples by Magnetic Particle Testing – Dry method		
4.	Inspection of welds/samples by Magnetic Particle Testing – Wet method		
5.	Detection of surface flaws in non- ferrous material using eddy current testing.		
6.	Non- conductive coating dimensional variations measurement using eddy current testing.		
7.	Calibration and detection of sub / deep surface flaws using Ultrasonic testing.		
8.	Evaluate the location of sub / deep surface flaws using Ultrasonic testing.		
9.	Detection of sub / deep surface flaws using Ultrasonic testing.		
10.	Evaluate the location of sub / deep surface flaws using Ultrasonic testing.		
Hours		Total Laboratory	<b>30 hours</b>
<b>Text Book</b>			
Lab manual prepared by the faculty member.			
Mode of assessment: Continuous assessment, FAT, Oral examination			
Recommended by Board of Studies		09-03-2022	
Approved by Academic Council		No. 65	Date 17-03-2022