GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. Industrial Based Non Destructive Techniques and Practices

Course / Subject Code : BE040AR011

Course / Subject Name: Non Destructive Testing – I

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	Core Courses

Prerequisite:	**Nil**
Rationale:	This subject provides students with a foundational understanding of non-destructive testing (NDT) methods, which are essential for quality control and safety in manufacturing and maintenance. The course focuses on three primary techniques: Visual Inspection, Liquid Penetrant Testing, and Magnetic Particle Testing. The content is structured to build knowledge progressively, starting with the types and causes of defects, followed by a detailed exploration of each NDT method's principles, procedures, applications, and limitations. This practical approach, supported by specific course outcomes, ensures students cannot only comprehend the theoretical aspects but also apply these methods to identify defects in real-world engineering materials like castings, forgings, and welds. The inclusion of core reference books and learning websites also supports deeper self-study.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Identify various defects in manufacturing products with their causes and remedies and evaluate product quality using visual inspection (VI).
02	Demonstrate the principles, procedures, and materials used in dye/liquid penetrant testing (DPT/LPT).
03	Apply knowledge of magnetic properties and magnetization techniques to perform magnetic particle testing (MPT).

Teaching and Examination Scheme:

Teaching / Learning Scheme (in Hours per semester)					Total Credits	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	Total no of hours per semester		ESE (E)	PA / CA (M)	PA/ CA (I)	PBL* (I)	ESE (V)	
60	0	30	60	150	05	70	0	0	30	50	150

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End Semester Examination, PA = Progressive Assessment

*** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause**

9.4 of NBA manual.

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Module 1:** Defects in casting, forging, heat-treated and other products namely rolled/machined, welded products etc., Causes of defects, Defects: reason for rejection of product. Testing: Need of Testing, Fundamental of destructive and nondestructive testing. Scope and limitations of NDT. Visual inspection methods, Different visual inspection aids.	**20**	34
2.	**Module 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.	**20**	33
3.	**Module 3:** Magnetic Particle Testing: Important terminologies related to magnetic properties of material, Principle, magnetizing technique, procedure, and equipment, fluorescent magnetic particle testing methods, sensitivity, application, and limitations.	**20**	33
	Total	**60**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	**30**	**30**	**10**	**0**	**0**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Practical Non-destructive Testing – Baldev Raj, T. Jayakumar & M. Thavasimuthu, 3rd Edition, Reprint 2019, 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 test and evaluation of materials Jayamangal Prasad; C G Krishnadas Nair 2nd Edition, 2011,: Tata McGraw-Hill, New Delhi

4. Non-destructive testing, R. Halmshaw 2nd Edition, 1991, Butterworth-Heinemann Ltd.
5. Non Destructive Testing, Louis Cartz, 1995, ASM International, USA
6. Non-destructive testing, Warren J. McGonnagle, Gordon Breach, Science Publishers Ltd.
7. ASNT Level-II Study Guide

(b) Open source software and website:

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

Suggested Course Practical List:

1. To study manufacturing defects.
2. To study scope of NDT techniques.
3. To study visual inspection and visual aids.
4. To study and demonstrate LPT for given sample.
5. To study and demonstrate MPT for given sample.
6. Numerical/MCQ based on VI.
7. Numerical/MCQ based on LPT.
8. Numerical/MCQ based on MPT.
9. Report on expert lecture.
10. Report on Industrial Visit / Research Lab Visit -1

List of Laboratory/Learning Resources Required:

Microscope, Borescope, LPT Kit, MPT Kit – Yoke type.

List of suggested activities for Problem Based Learning:

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
2.	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
3.	Assignment writing. Numericals based assignment is preferable.	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.
4.	Expert Lecture/session	Lecture = 2 hr Report = 1 hr Total = 03 h	Based on report submitted. Report should contain observation and learning.
5.	Self learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of

			course. Based on the certificate produced.
6.	Complex problem solving	Maximum 2 problem. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
7	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
8	Discussion on research paper based on relevant subject	5 research paper = 20 h	Summarize research paper and evaluation critical parameters
9.	Poster/chart/power point preparation on technical topics	Duration = 6 h	Based on poster/chart preparation and presentation skills
10	Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation
11	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/any other issue	Duration = 15 h for industrial exposure Problem identification and tentative solution = 10 h Total = 20 h	Based on evaluation of critical problems and solutions
12	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.
13.	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.

Note:

1. All the suggested activity should be related to the subject.
2. The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
3. Rubrics for the evaluation can be prepared by the faculty.

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