



DEPARTMENT OF PHYSICS

COURSE PLAN – PART I			
Name of the programme and specialization	M.Tech NDT Semester I, July 2020		
Course Title	SURFACE NDE TECHNIQUES		
Course Code	PH601	No. of Credits	3
Course Code of Pre-requisite subject(s)	NIL	NIL	
Session	July 2020	Section (if, applicable)	NIL
Name of Faculty	DR. SOMNATH MUKHOPADHYAY	Department	PHYSICS
Official Email	somnath@nitt.edu	Telephone No.	
Name of Course Coordinator(s) (if, applicable)	DR. SOMNATH MUKHOPADHYAY		
Official E-mail	somnath@nitt.edu	Telephone No.	
Course Type	Core course		
Syllabus (approved in BoS)			
<p>1. Visual Testing</p> <p>Fundamentals of Visual Testing –vision, lighting, material attributes, environmental factors, visual perception, direct and indirect methods –mirrors, magnifiers, boroscopes and fibrosopes–light sources and special lighting–calibration–computer enhanced system –Employer defined applications, metallic materials including raw materials and welds –Inspection objectives, inspection checkpoints, sampling plan, inspection pattern etc–classification of indications for acceptance criteria -Codes, Standards and Specifications (ASME,ASTM,AWS etc.)</p> <p>2. Liquid Penetrant Testing</p> <p>Principles –types and properties of liquid penetrants –developers –advantages and limitations of various methods -Preparation of test materials –Application of penetrants to parts, removal of excess penetrants, post cleaning –Control and measurement of penetrant process variables –selection of penetrant method –solvent removable, water washable, post emulsifiable –Units and lighting for penetrant testing –calibration-Interpretation and evaluation of test results -dye penetrant process-applicable codes and standards.</p>			



3. Magnetic Particle Testing

Theory of magnetism –ferromagnetic, paramagnetic materials –characteristics of magnetic fields –magnetic hysteresis–magnetization by means of direct and alternating current – surface strength characteristics –Depth of penetration factors–Circular and longitudinal magnetization techniques, current calculation –field produced by a current in a coil, shape and size of coils, field strength, Magnetic Barkhausen Noise Analysis (MBN)– advantages and limitations

4. Magnetic Particle Testing Equipment

Selecting the method of magnetization, inspection materials, wet and dry particles –portable, mobile and stationary equipment –calibration–capabilities of equipment–magnetic particle inspection of castings and welding –Dry continuous method, wet residual method – Interpretation and evaluation of test indications –Principles and methods of demagnetization – Residual magnetism –applicable codes and standards.

5. Eddy Current Testing

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, applications, advantages, limitations –Through encircling coils, type of arrangements –absolute, differential fill factor, operation, application, advantages, limitations –Factors affecting sensing elements and coil impedance – test part and test system –Signal to noise ratio –equipment's, reference samples, calibration, inspection of tubes, cylinders, steelbars, welded tubing, plates and pipes, Remote Field Sensing -Interpretation/Evaluation –Applicable codes and standards.

Text Books:

1. Non-Destructive Examination and Quality Control, ASM International, Vol.17, 9th edition (1989).
2. J.Prasad and C. G. K. Nair, Non-Destructive Test and Evaluation of Materials, Tata McGraw-Hill Education, 2nd edition (2011).
3. B.Raj, T. Jayakumar and M. Thavasimuthu, Practical Non Destructive Testing, Alpha Science International Limited, 3rd edition (2007).
4. T. Rangachari, J. Prasad and B.N.S. Murthy, Treatise on Non-destructive Testing and Evaluation, Navbharath Enterprises, Vol.3, (1983).
5. Ed. Peter.J. Shull, Nondestructive Evaluation : Theory, Techniques, and Applications, Marcel Dekker (2002).

Reference Books:

1. C. Hellier, Handbook of Non-Destructive Evaluation, McGraw-Hill Professional, 1st edition (2001).



2. J. Thomas Schmidt, K. Skeie and P. MacIntire, ASNT Non Destructive Testing Handbook: Magnetic Particle Testing, American Society for Nondestructive Testing, American Society for Metals, 2nd edition (1989).
3. V. S. Cecco, G. V. Drunen and F.L. Sharp, Eddy current Manual: Test method, Vol. 1, Chalk River Nuclear Laboratories (1983).
4. B.P.C. Rao, Practical Eddy Current Testing, Alpha Science International Limited (2006).
5. N. A. Tracy, P. O. Moore, Non-Destructive Testing Handbook: Liquid Penetrant Testing, Vol. 2, American Society for Nondestructive Testing, 3rd edition (1999).
6. Don E. Bray and Roderic K. Stanley, Nondestructive Evaluation: A Tool in Design, Manufacturing and Service, CRC Press (1996).

COURSE OBJECTIVES

To provide a basic understanding with case studies on different surface NDE techniques and apply them for inspecting materials in accordance with industry specifications and standards.

MAPPING OF COs with POs

Course Outcomes	Programme Outcomes (PO) (Enter Numbers only)
1. Have a basic knowledge of surface NDE techniques which enables to carry out various inspection in accordance with the established procedures.	PO1, PO3, PO5, PO6, PO7, PO9, PO10, PO11
2. Calibrate the instrument and inspect for in-service damage in the components.	PO1, PO2, PO3, PO5, PO6, PO7, PO8, PO9, PO11
3. Differentiate various defect types and select the appropriate NDT methods for better evaluation.	PO1, PO2, PO3, PO6, PO9, PO10, PO11
4. Communicate their conclusions clearly to specialist and non-specialist audiences.	PO1, PO2, PO3, PO6, PO7, PO8, PO9, PO10, PO11
5. Document the testing and evaluation of the results for further analysis.	PO1, PO2, PO3, PO6, PO7, PO8, PO9, PO10, PO11

COURSE PLAN – PART II

COURSE OVERVIEW

PH601 course deals with the introduction and importance of Non-Destructive Testing as a measure of safety, reliability, cost-effectiveness and quality control in various industrial and manufacturing fields. The course also includes the basics of Surface NDE methods which are – visual testing, liquid penetrant testing, magnetic particle testing and eddy current testing.

COURSE TEACHING AND LEARNING ACTIVITIES

(Add more rows)

S.No.	Week/Contact Hours	Topic	Mode of Delivery
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1.	3 rd week of September 2020	Basics of NDT, Importance and Applications, Visual Testing	PPT and Board work online through MS Teams
2.	4 th week of September 2020 and 1 st week of October 2020	Liquid Penetrant Testing	PPT and Board work online through MS Teams
3.	2 nd , 3 rd and 4 th weeks of October 2020	Magnetic Particle Testing ; Magnetic Particle Testing Equipment	PPT and Board work online through MS Teams
4.	1 st , 2 nd and 3 rd weeks of November 2020	Eddy Current Testing	PPT and Board work online through MS Teams

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assignment 1	2 nd week of October	--	20%
2	Assignment 2	2 nd week of November	--	20%
3	Cycle Test 1	4 th week of November	2 hours	30%
4				
CPA	Compensation Assessment*	1 st week of December		
5				
6	Final Assessment *	End of Semester	2 hours	30%

*mandatory; refer to guidelines on page 4

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback from students at the end of the semester regarding knowledge gained, content of the course, teaching effectiveness through questionnaire.

COURSE POLICY (including compensation assessment to be specified)

The lecture videos, PPT slides, board work and other lecture notes shall be made available in the Class Materials folder in MS Teams to the students.

Compensation assessment shall be conducted only for those students who were absent in any



regular assessment. The reasons for absenteeism shall be based on genuine grounds only.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

FOR APPROVAL

Somnath Mukhopadhyay
19/10/2020
Course Faculty

Somnath Mukhopadhyay
19/10/2020
CC- Chairperson

M. Ashu
HOD



Guidelines

- a) The number of assessments for any theory course shall range from 4 to 6.
- b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.
- c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.
- d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

- e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.
- f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.
- g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.