

I YEAR M. TECH (MACHINE DESIGN) SECOND SEMESTER

17MEMD2T6A

NON-DESTRUCTIVE TESTING

Credits 4

Lecture: 4 periods/week

Internal assessment: 40 marks

Tutorial: - -

Semester end examination: 60 marks

COURSE OBJECTIVES:

- Familiarize with the fundamentals of non-destructive testing and Liquid Penetration testing.
- Describe Magnetic Particle Testing and Ultrasonic testing methods.
- Gain knowledge about Acoustic Emission Testing, Thermography, and Codes, Standards, Specification and Procedures used for NDT.
- Acquire knowledge to detect different flaws in composite materials

COURSE OUTCOMES:

Upon completion of this course the student will be able to:

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

UNIT-I

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 testing- cleaning, penetrant application, removal of excess penetrant, application of developer, inspection and evaluation; Penetrant testing materials: penetrants, cleaners and emulsifiers, developers, special requirements, test blocks; penetrant testing methods: water washable method, post-emulsifiable method, solvent removal method; sensitivity, applications & limitations.

UNIT-II

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.

UNIT-III

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.

UNIT-IV

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.

Learning Resources

Text Books:

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, 1979