ADVANCED NON-DESTRUCTIVE TESTING TECHNIQUES
(Elective - II)

Subject Code: 13ME2121 **L P C**
4 0 3

Pre requisites: Metrology

Course Educational Objectives:

Understanding the basic principles of various NDT methods, fundamentals, discontinuities in different product forms, importance of NDT, applications, limitations of NDT methods and techniques and codes, standards and specifications related to non-destructive testing technology.

Course Outcomes:

The student will be able to

1. Identify various surface and sub- surface flaws and inclusions by using different NDT techniques .
2. apply magnetic particle inspection, ultrasound inspection, x-ray inspection for flaw detection
3. interpret radiographs and sonographs

UNIT- I

Liquid penetrant tests: characteristics of liquid penetrants – different washable systems – developers – applications

Magnetic particle tests: methods of production of magnetic fields- principles of operation of magnetic particle test- applications-advantages and limitations

UNIT-II

Radiography: Sources of ray X-ray production-properties of γ and X-rays – film characteristics – exposure charts – contrasts – operational characteristics of X- ray equipment – applications

Industrial Computed Tomography (CT): Computed Tomography, X-Ray Detectors - CT image reconstruction algorithm - Capabilities, comparison to other NDT methods - industrial CT applications, CT System design and equipment.

Ultrasonic techniques: Production of ultrasonic waves – different types of waves - general characteristics of waves – pulse echo method – A, B, C scans

UNIT- III

Acoustic emission techniques: Principles of acoustic emission techniques – advantages and limitations - instrumentation – applications

Acoustical Holography: Liquid Surface Acoustical Holography - Optical System, Object size and shape, sensitivity and resolution, commercial liquid surface equipment – Scanning Acoustical Holography - Reconstruction, Object size, Sensitivity and resolution, Commercial Scanning equipment - Comparison of liquid surface and scanning systems – Read out methods, calibration, Interpretation of results - Applications - Inspection of welds in thick materials.

UNIT –IV

Principles of Thermography: Contact and non contact inspection methods - Heat sensitive paints - Heat sensitive papers - thermally quenched phosphors liquid crystals - techniques for applying liquid crystals - calibration and sensitivity - other temperature sensitive coatings - non contact thermographic inspection - Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications.

UNIT –V

Optical Holography and Speckle Metrology: Laser fundamentals – coherence – types of lasers – holography, recording and reconstruction – holographic interferometry – real-time, double-exposure & time-averaged techniques – holographic NDT – methods of stressing andfringe analysis – typical applications – requirements – advantages and disadvantages – laser speckle metrology basics – electronic speckle pattern interferometry (ESPI) – shearography –applications.

TEXT BOOKS:

1. Barry Hulland Vernon John, "*Non-destructive Testing*",MacMilan, 1988.

REFERENCES:

1. Miller, Ronnie; and Paul Mclntire, "*Non-Destructive Testing Handbook; Acoustic Emission Testing*", VoL-5, 2e, Columbus, OH: American Society for Non-Destructive Testing, 1987.
2. Spanner, J.C. "*Acoustic Emission Techniques and Applications*, Evanston, I, L.: latex Publishing Co., 1974.
3. American Metals Society. Non-Destructive Examination and QualityControl:MetalsHandBook,Vol-17,9th Ed,Metals Park, 1989.
4. Dewit, D.P., "*Theory and Practice of Radiation Thermometry*", Wiley-lnterscience, John Wiley & Sons, Inc, 1989.
5. Non - Destructive Evaluation and Quality control, ASM Hand book, Vol. 17.