ADVANCED NON-DESTRUCTIVE TESTING TECHNIQUES

(Elective - II)

Course Code: 15ME2119

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Course Outcomes: At the end of the course, the student will be able to

CO1: Identify various surface flaws by using liquid penetrants and magnetic particles tests

CO2: Apply the systematic understanding of knowledge on radiography and ultrasonic techniques

CO3: Demonstrate a comprehensive understanding of acoustic emission techniques

CO4: Recognize a conceptual understanding of principles of thermograph

CO5: Summarize the various techniques of optical holography and speckle metrology

UNIT- I (10-Lectures)

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 (10-Lectures)

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 (10-Lectures)

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 (10-Lectures)

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 (10-Lectures)

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 and fringe analysis – typical applications – requirements – advantages and disadvantages – laser speckle metrology basics – electronic speckle pattern interferometry (ESPI) – shearography –applications.

TEXT BOOK:

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 Quality Control: Metals HandBook, 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.