UNIVERSIDAD PONTIFICIA ICAI ICADE COMILLAS MADRID

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA

DIM-GITI-443 Nondestructive Testing

SEMESTER: Spring

CREDITS: 3 ECTS (2 hrs. per week. 18h Theory + 12h Lab)

LANGUAGE: Spanish

DEGREES: GITI

Course overview

Nondestructive Testing (NDT) plays an extremely important role in quality control, flaw detection and structural health monitoring covering a wide range of industries. There are varieties of NDT techniques in use. This course will first cover the fundamental science behind the commonly used NDT methods to build the basic understanding on the underlying principles. It will then go on to cover the process details of each of these NDT methods.

Prerequisites

Basic knowledge of physics, materials science and manufacturing processes.

Course contents

Theory:

1. Introduction to non-destructive testing.

2. Liquid penetrant inspection. Purpose of liquid penetrant testing. Physical principles, wetting ability and contact angle, surface tension, capillary action, viscosity. Types of dye: Type I (Fluorescent) and Type II (Visible).Methods of removal of excess penetrant including water washable, emulsifiers and solvent removable. Interpretation of test results.

3. Magnetic particle testing. Fundamentals of magnetism. Types of magnetic materials. magnetic permeability, magnetisation of ferromagnetic materials. Techniques and equipments: Portable yoke, coil shot and cable wrap techniques. Quality control and validation.

4. Eddy current testing. Basic principles of eddy current inspection. Effect of material conductivity and frequency. Standard depth of penetration, sensitivity to subsurface defects, standard phase lag. Coil design and selection. Quality control and validation.

5. Ultrasonic testing. Wave modes. Ultrasonic transducer and sound field. US equipment. Single and dual transducers. Resolution in flaw detection: frequency and damping.Transducer selection: frequency and diameter. Reflection and refraction at interfaces. Snell's Law. Mode conversion to shear waves at interfaces. Straight beam and angle beam inspection. Phase array. Quality control and validation.

6. Radiographic testing. Types of Radiation X-Ray and Gamma Rays. Properties of Radiation. Attenuation of electromagnetic radiation. Radiographic techniques. Exposure charts. Image quality. Geometric unsharpness and definition. radiographic sensitivity, radiographic density, radiographic contrast. Film radiography, film speed, selection of film, radiographic screens. IQI Selection and placement

8. Failure analysis.

Laboratory:

Each unit described previously has at least one associated lab practice (2 hours/week)

P1. Penetrant liquid testing
P2. Magnetic particles
P3. Industrial radiology
P4. Ultrasonic nondestructive testing I (US).
P5. Ultrasonic nondestructive testing II (US).
P6. Eddy-current testing (CI).

Textbook

- Charles J. Hellier, Handbook of Nondestructive Evaluation, Second Edition. McGraw-Hill Education, 2012.
- Paul E. Mix. Introduction to Nondestructive Testing: A Training Guide. Secong Edition, Wiley Interscience. (2005)
- ASME Code Section V: Nondestructive Examination
- UNE EN Standards
- ASTM Standards

Grading

The following conditions must be accomplished to pass the course:

- A minimum overall grade of at least 5 over 10.
- A minimum grade in the final exam of 4 over 10.

The overall grade is obtained as follows:

- Final exam 70%.
- Other exams 15%. Typically 1 short exams (1-hour long).
- Performance during the lab sessions 15%.

Additional evaluation during July (Retake): Regular assessments and laboratory marks will be preserved.

- 75% July exam
- 25 % Laboratory