Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(AUE)/SEM-8/AUE-816/2012

2012

NON-DESTRUCTIVE TESTING METHODS

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : 10 × 1 = 10

i) Which type of testing is selected to detect creep in engineering material ?

a) Ultrasonic testing (U.T.)

b) Acoustic emission tesing (A.E.T.)

c) Thermography testing (T.T.)

d) Magnetic particle testing (M.P.T.)

ii) Coating thickness can be detected with the help

a) Eddy current tesing (E.C.T.)

b) Liquid penetrant testing (L.P.T.)

c) Visual testing (V.T.)

d) Radiographic testing (R.T.).

iii) NDT methods are used to inspect in-service operation of product damage like

a) Rolling b) Heat treatment

c) Welding d) Corrosion.

iv) Latent cracks may be detected by which technique ?

a) Ultrasonic

b) Eddy current

c) AE testing

d) Liquid penetrant inspection.

v) Which method is the best recommended method in Intergranular corrosion ?

a) LPT b) MPT

c) ECT d) RT

e) UT.

vi) The minimum detectable crack size for UT, RT and ECT methods is about

a) 0·5 mm b) 1 mm

c) 2 mm d) 0·05 mm

e) 3 mm.

vii) XRD (*X*-ray diffraction) (RT method) is used to find out

a) chemical composition and crystal structure of material

b) Fatigue detection

c) Fracture detection

d) Creep

e) Corrosion.

viii) Black light source is used for

a) X-ray methods

b) Fluorescent penetrant method

c) Thermography

d) None of these.

ix) For ultrasonic testing of a thin metallic sheet, which method would you opt ?

a) Through transmission

b) Pulse echo

c) Either of these

d) Neither of these.

x) For circumferential crack along length of a steel pipe what would you opt for ?

a) Longitudinal magnetization

b) Circular magnetization

c) Either of these

d) Neither of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Compare destructive testing with non-destructive testing.

3. Briefly describe the benefits of non-destructive testing. Also, enlist the nature of flaws. Finally describe the use of NDT techniques for applications other than flaw detection.

4. Explain different types of ultrasonic waves. Explain different types of transducers used in ultrasonic inspection.

5. Explain with sketches the following terms in ultrasonic testing :

   i) *A*-scan system

   ii) *B*-scan system

   iii) *C*-scan system

   iv) *P*-scan system

   v) *S*-scan system

   vi) *Z*-scan system.

6. With the neat sketch explain steps involved in liquid penetrant testing. What are the advantages and disadvantages of this method ?

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) If there is a need to locate a surface crack running along the length of the shaft, for a detection of a radial crack in a steel shaft, which type of magnetization would you opt for ? Also which type of magnetization, would you recommend ? Show with the help of suitable figures as to how you would obtain the above mentioned magnetization(s).

b) How will you detect flaw in a short workpiece using prod type magnetic crack detector.

c) What is the need for demagnetization ? Explain, in brief, the various techniques that can be employed for the demagnetization of component after doing MPI.

5 + 5 + 5

8. a) Write down the principle of Eddy current testing (E.C.T.).

b) Give the advantage and disadvantage of Eddy current testing (E.C.T.).

c) Explain how the following components are inspected using Eddy current inspection.

i) Tubes and solid cylinder

ii) Welds in welded tubing and pipe

iii) Aircraft structural part and engine components.

5 + 5 + 5

9. a) Write down the principle of Ultra-sonic testing (U.T.).

b) Give the advantage and disadvantage of Ultra-sonic testing (U.T).

c) Give the applications with sketches of ultrasonic inspection of products like :

i) Casting

ii) Extrusion

iii) Rolled products

iv) Weld set

v) Corrosion monitoring

vi) Stress measurement. 5 + 5 + 5

10. a) How is the depth of penetration related to the frequency of test in case of eddy current circuit. Write down the relationship expression between these two parameters.

b) Compute the depth of penetration in mm for eddy current testing using the following data :

Electrical conductivity = 50 mhos/m

Magnetic permeability = 4×10^{-7} henry/m

Frequency (f) = 1 MHz.

c) What is the principle involved in eddy current inspection ? Explain how eddy current can be used to analyse the remaining life of a part of corrosive pipeline. 5 + 5 + 5

11. a) Explain briefly the various defects developed during manufacturing process.

b) What are the objectives of leak testing ? Explain any one of the methods to detect flaws using this technique.

c) With sketches explain how the following components are inspected using MPI :

i) Casting and forgings

ii) Hollow cylinder. 5 + 5 + 5

12. a) Give the advantage and disadvantage of acoustic emission testing (A.E.T.)

b) Give the advantage and disadvantage of thermography testing (T.T.).

c) Give the applications of T.T. and A.E.T. 5 + 5 + 5