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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B.Tech MSENT	**Semester – V**
Subject (Course): Quality Inspection and NDT Techniques	**Max. Marks : 100**
Course Code: MTEG353	**Duration : 3 Hrs**
No. of page/s: 3	

Instructions: 1) Internal choice in Q-5 and Q-10. Do not over-attempt.

Section-A (4x5 marks=20marks)

1. Which type of current is used in eddy current testing (AC or DC) and why?

2. Define 'standard depth of penetration' in eddy current testing and how it is measured.

3. Define 'acoustic impedance' and its physical significance in ultrasonic inspection.

4. In the context of radiographic testing, briefly describe the difference between 'contrast' and 'definition.'

Section-B (4x10 marks=40 marks)

5. Answer **any 2** of the following in the context of radiographic inspection: (5+5)

a) Define Radiographic density, and calculate the radiographic density of a film with 1% transmittance. Also list one advantage and one disadvantage of high radiographic density.

b) How is exposure measured? Draw a typical film characteristic curve and discuss how it is used to adjust exposure.

c) Define geometric unsharpness. Calculate the geometric unsharpness when the focal spot size of X-ray source is 100 microns, sample thickness is 100 mm, and distance between source and sample surface is 50 mm. Radiographic film has been kept adjacent to the sample.

6. a) Describe the construction of radiographic film used in radiographic inspection. Explain why regions with high transmittance appear dark and those with low transmittance appear bright in the developed film. (5)

b) Discuss the difference between 'absolute probes', 'differential probes', and 'reflection probes' used in eddy current testing. (5)

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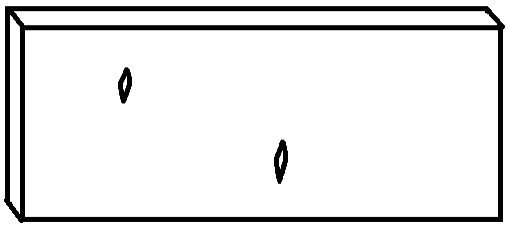
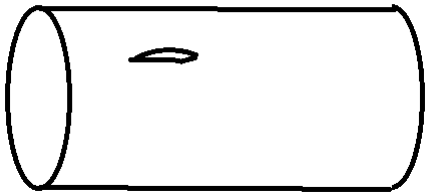
7. a) Draw the relative lift-off curves for following materials that have been arranged in the order of their electrical conductivity: bronze < steel < Aluminium < Copper (5)

b) Draw a schematic hysteresis loop for a ferromagnetic material showing the value of remanence and coercivity. (5)

8. a) In the context of liquid penetrant inspection method, discuss the effect of crack size, dye density, and contact angle on the ease of dye penetration. (5)

b) In the context of magnetic particle inspection method, and with the help of schematics, discuss one appropriate method for the magnetization of each of the following parts: (5)

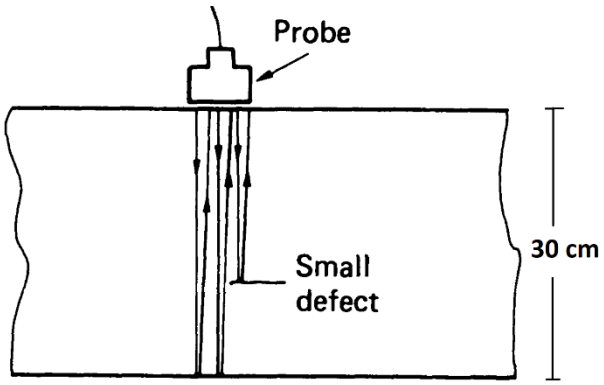


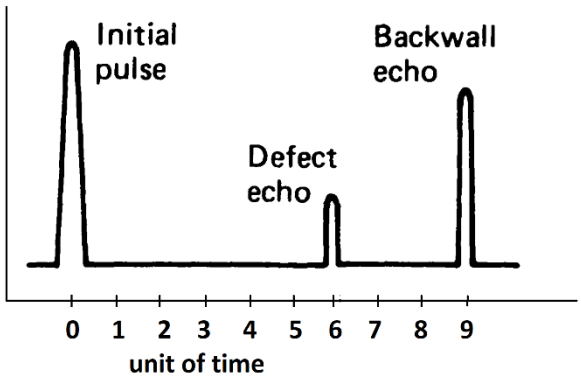


Section-C (2x20 marks=40 marks)

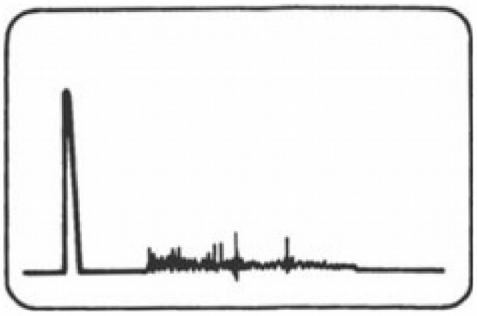
9. Answer the following in the context of ultrasonic inspection:

a) Below figure shows the setup used for ultrasonic testing of a metallic test piece and the pulse measurement. From the given information, calculate the depth at which defect is present. (5)





b) Using the same type of setup as shown in above image, ultrasonic inspection of a casting was carried out. Below figure shows the output screen display obtained. What kind of defects/flaws present in the casting could be responsible for it? (5)



c) Define 'dead zone' and discuss different measures that can be taken to reduce or remove the dead zone. (5)

d) What is the relation between frequency and resolution in ultrasonic inspection? Name any two piezoelectric materials used for the construction of probes used in ultrasonic inspection. (5)

10. X-Ray Fluorescence (XRF) and Optical Emission Spectroscopy (OES) are frequently used for chemical analysis of metals & alloys. **Answer <u>any four</u> of the following**:

a) How are characteristic X-rays generated in XRF and how are they used for determining chemical composition? (5)

b) Name two factors that determine the energy of an electron, and state any two applications and two limitations of XRF? (5)

c) Describe the difference between Energy Dispersive Spectroscopy (EDS) and Wavelength Dispersive Spectroscopy (WDS), along with one advantage and one disadvantage of WDS as compared to EDS. (5)

d) Describe the working of Si(Li) detectors used for EDS with emphasis on how the input photon energy is converted into the output 'Intensity vs Energy' curve. (5)

e) Describe the working of Proportional Counters used for EDS with emphasis on how the input photon energy is converted into the output 'Intensity vs Energy' curve. (5)

f) Draw a properly labeled schematic of OES clearly indicating all the components involved in generation and analysis of signals/spectrum. (5)

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