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Question Paper Code: U7502

B.E. / B.Tech. DEGREE EXAMINATION, APRIL/MAY 2025

Professional Elective

Mechanical Engineering

21MEV502 FAILURE ANALYSIS AND NDT TECHNIQUES

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which of the following is a fundamental source of failure? CO1- U
a) Use of high-quality materials b) Regular maintenance
c) Deficient design d) Proper testing procedures
2. What is a common consequence of improper assembly in manufacturing? CO1- U
a) Increased product lifespan b) Reduced risk of failure
c) Premature component failure d) Improved product performance
3. Which of the following is an optical aid used for visual inspection? CO1- U
a) Ultrasonic sensor b) X-ray machine c) Magnifying glass d) Eddy current probe
4. Which method of penetrant testing uses ultraviolet light to detect defects? CO1- U
a) Water wash method b) Fluorescent penetrant method
c) Oil-based method d) Visible dye method
5. What factor affects the sensitivity of Magnetic Particle Testing? CO1- U
a) The wavelength of the induced electromagnetic field
b) The type of fluorescent dye used
c) The strength and uniformity of the magnetic field applied
d) The thickness of the material being tested

6. Which equipment is essential for conducting Magnetic Particle Testing? CO1- U
 a) Magnetic yoke or coil b) Fluorescent light source
 c) Acoustic emission sensor d) High-frequency signal generator
7. Which of the following is a common source of electromagnetic radiation used in industrial radiography? CO1- U
 a) Laser b) X-ray tube c) Ultrasonic transducer d) Infrared camera
8. Which of the following is a limitation of radiographic inspection? CO1- U
 a) It cannot detect surface defects b) It is not suitable for thick materials
 c) It requires direct contact with the specimen d) It cannot be used for metallic materials
9. Which of the following is NOT an application of Acoustic Emission Testing? CO1- U
 a) Structural health monitoring b) Welding defect detection
 c) Determining material composition d) Pressure vessel inspection
10. Which type of detector is commonly used in Thermo graphic testing? CO1- U
 a) Piezoelectric sensor b) Photodiode detector
 c) Bolometer d) Hall-effect sensor

PART – B (5 x 2= 10 Marks)

11. Summarize the fundamental sources of failures in engineering. CO1- U
12. Illustrate the physical principles behind Liquid Penetrant Testing CO1- U
13. Classify the types of equipment used for Magnetic Particle Testing. CO1- U
14. Explain the basic principle of radiographic testing. CO1- U
15. Classify different applications of Acoustic Emission Testing in industries. CO1- U

PART – C (5 x 16= 80 Marks)

16. (a) Illustrate how improper manufacturing and assembly contribute to product failures with real-world cases. CO1- U (16)
 Or
 (b) Compare failure due to design deficiencies and failure due to material defects with case studies. CO1- U (16)
17. (a) Apply the basic principles of visual examination to identify potential flaws in a material or component used in a critical structural application CO2-App (16)

Or

- (b) Apply the physical principles of Liquid Penetrant Testing to detect surface cracks in a metal component used in aerospace applications and propose a suitable testing method. CO2-App (16)
18. (a) Apply the basic principles of magnetism to design a magnetic particle testing procedure for detecting surface cracks in a steel component. CO2-App (16)
- Or
- (b) Solve a real-world problem in which an eddy current test failed to identify a defect and propose changes to the testing procedure, including adjustments in equipment and technique. CO2-App (16)
19. (a) Apply the principles of electromagnetic radiation to develop an effective radiographic inspection method for detecting internal defects in pressure vessels. CO3-App (16)
- Or
- (b) Solve the issue of poor radiographic imaging due to improper exposure settings by recommending modifications in source selection and technique. CO3-App (16)
20. (a) Apply the principles of Acoustic Emission Testing to monitor structural integrity in bridges and suggest methods to enhance defect detection. CO4-App (16)
- Or
- (b) Apply the principles of Infrared Thermography to detect insulation failures in electrical panels and recommend corrective actions. CO4-App (16)

