



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 8 Examination in Engineering: September 2023

Module Number: ME8212

Module Name: Non-Destructive Testing
Applications

[Three Hours]

[Answer all questions]

Question paper consists of two parts. Part I: Essay and Part II: MCQ.

Part I: Essay Questions

Answer all questions. Each question carries 12.0 marks.

- Q1. a) Liquid penetrant testing is based on the principle of capillary action. How does it work? Explain with neat sketches where appropriate. [3.0 Marks]
- b) How is the size of a liquid penetrant indication usually related to the discontinuity it represents. Explain with neat sketches where appropriate. [3.0 Marks]
- c) List and describe four basic safety rules to be followed when conducting a liquid penetrant test. [3.0 Marks]
- d) Fatigue cracks could typically be found with a liquid penetrant test. Explain why? [3.0 Marks]
- Q2. a) What are the factors affecting the choice of Non-Destructive Testing (NDT) method? [3.0 Marks]
- b) What is *6 dB drop method* used in ultrasound testing (UT)? [3.0 Marks]
- c) Write the step-by-step procedure of detecting of defect size by *6 dB drop method*. [3.0 Marks]
- d) What is the block used for normal probe and shear probe calibration? When they are used? Explain using examples. [3.0 Marks]
- Q3. The weld shown in Figure Q3-A is to be tested by ultrasonic testing by pulse echo method. The test has been performed using a 60° angle probe with a screen calibration 200 mm. The echo pattern obtained at the probe position shown is given in Figure Q3-B.
- a) Determine the full skip beam path length and full skip distance. [2.0 Marks]

- b) Do you agree with the given calibration? Explain? [2.0 Marks]
- c) Describe the correct process of screen calibration to 200 mm. [3.0 Marks]
- d) Find the location of the crack. [3.0 Marks]
- e) Identify the type of the defect. Provide evidences for your answer. [2.0 Marks]

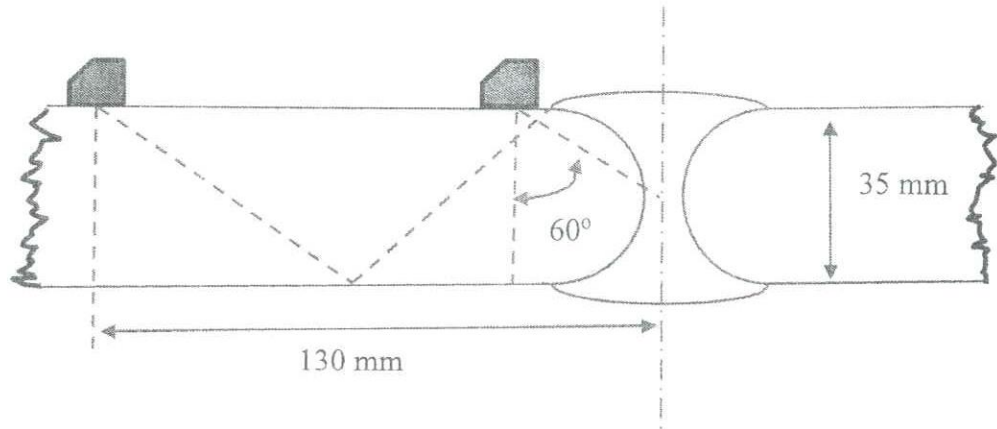


Figure Q3-A

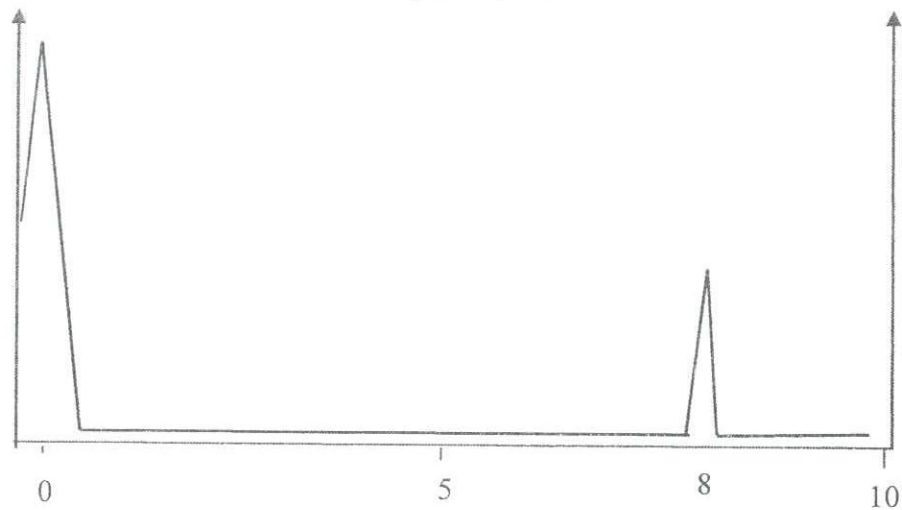


Figure Q3-B

Part II: Multiple Choice Questions (MCQ)

Instructions for candidates

- This Part II contains 24 multiple choice questions.
- Answer all questions. Each question has only one answer.
- Mark your answer on the **answer-sheet** provided in **page number 7**.
- **For each question, put an X mark on the letter a), b), c), or d) which corresponds to the correct answer, by using a black or blue pen.**
- Each correct answer carries **1 mark**.

- 1) Dye penetrant method is generally used to locate
 - a) core defects
 - b) surface defects
 - c) superficial defects
 - d) temporary defects
- 2) What is used as the source of rays for radiography?
 - a) Uranium-235
 - b) Tellurium
 - c) Cobalt-60
 - d) Manganese dioxide
- 3) Defects in which material can't be tested by Magnetic Particle Test (MT)?
 - a) Co
 - b) Fe
 - c) Ni
 - d) Mg
- 4) What is the disadvantage of liquid penetrant test?
 - a) Expensive
 - b) Slow
 - c) Not reliable
 - d) Depth restriction
- 5) Which principle define eddy current inspection?
 - a) Lenz law
 - b) Biot severt law
 - c) Electromagnetic induction principle
 - d) Faraday's law
- 6) In which type of test the capillary action principle is used?
 - a) Probe test
 - b) Bend liquid test
 - c) Dye penetrant test
 - d) None of the above

- 14) A wire brush should be used for pre-cleaning:
- a) when grease and oil must be removed.
 - b) only as a last resort.
 - c) when rust is to be removed.
 - d) when grinding burrs must be removed.
- 15) Which of the following is a reason to post clean a part after a liquid penetrant test?
- a) The part might be further processed
 - b) If repairs are necessary
 - c) Developers absorb moisture and may result in part being corroded
 - d) All of the reasons are correct
- 16) Flaw sizing by the **6 dB drop technique** is applicable to:
- a) large flaws relative to the sound beam.
 - b) small flaws relative to the sound beam.
 - c) any flaws.
 - d) None of the above
- 17) The 100 mm radius in an IIW (International Institute of Welding) block is used to:
- a) calibrate sensitivity level.
 - b) check resolution.
 - c) calibrate angle beam distance.
 - d) check beam angle.
- 18) An ultrasonic technique in which two transducers are used, in a constant position relative to each other, is:
- a) through transmission.
 - b) contact testing.
 - c) pulse echo.
 - d) continuous wave.
- 19) Most commercial ultrasonic testing is performed at frequencies:
- a) 1 MHz and 10 MHz.
 - b) 1 MHz and 100 MHz.
 - c) 10 MHz and 50 MHz.
 - d) more than 25 MHz.
- 20) The particle motion for compression waves is:
- a) parallel to wave propagation.
 - b) transverse to wave propagation.
 - c) elliptical.
 - d) circular.

- 21) As ultrasonic frequency increases:
- a) wavelength increases.
 - b) wavelength decreases.
 - c) sound velocity increases.
 - d) sound velocity decreases.
- 22) Magnetic particle is a non-destructive examination method used for:
- a) locating surface discontinuities.
 - b) near surface discontinuities.
 - c) both a and b.
 - d) material separation.
- 23) The strength of a magnetic field within a coil is determined by:
- a) the current in the coil.
 - b) the number of turns in the coil.
 - c) the diameter of the coil.
 - d) all of the above factors.
- 24) An electric current through a copper wire:
- a) creates a magnetic field around the wire.
 - b) creates magnetic poles in the wire.
 - c) magnetises the wire.
 - d) does not create a magnetic field.

Question	Answer			
	a)	b)	c)	d)
1)	a)	b)	c)	d)
2)	a)	b)	c)	d)
3)	a)	b)	c)	d)
4)	a)	b)	c)	d)
5)	a)	b)	c)	d)
6)	a)	b)	c)	d)
7)	a)	b)	c)	d)
8)	a)	b)	c)	d)
9)	a)	b)	c)	d)
10)	a)	b)	c)	d)
11)	a)	b)	c)	d)
12)	a)	b)	c)	d)

Question	Answer			
	a)	b)	c)	d)
13)	a)	b)	c)	d)
14)	a)	b)	c)	d)
15)	a)	b)	c)	d)
16)	a)	b)	c)	d)
17)	a)	b)	c)	d)
18)	a)	b)	c)	d)
19)	a)	b)	c)	d)
20)	a)	b)	c)	d)
21)	a)	b)	c)	d)
22)	a)	b)	c)	d)
23)	a)	b)	c)	d)
24)	a)	b)	c)	d)