UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 8 Examination in Engineering: July 2022

Module Number: ME8212 **Module Name: Non Destructive Testing Applications**

[Three Hours]

[Answer **all questions**, each question carries **12** marks]

(State the assumptions where necessary and do the calculations stating the units)

Q1. Select the correct answer for following questions and write the number relevant to the correct answer in your answer book.

a) Liquid penetrant testing is based on the principle of:
   i) Polarized sound waves in a liquid
   ii) Magnetic domains
   iii) Absorption of X rays
   iv) Capillary action

b) How is the size of a liquid penetrant indication usually related to the discontinuity it represents:
   i) Larger than
   ii) Smaller than
   iii) Equal to
   iv) Not related to

c) Which of the following discontinuity type could typically be found with a liquid penetrant test?
   i) Internal slag in a weld
   ii) Internal slag in a casting
   iii) Sensitization in austenitic stainless steel
   iv) Fatigue cracks

d) A wire brush should be used for pre-cleaning:
   i) When grease and oil are to be removed
   ii) Only as a last resort
   iii) When rust is to be removed
   iv) When grinding burrs is to be removed

e) Which of the following is not an advantage of magnetic particles testing?
   i) Fast and simple to perform
   ii) Can detect discontinuities filled with foreign materials
   iii) Most reliable for finding surface cracks in all types of materials
   iv) Works well through a thin coat of paint

f) Which of the following are ferromagnetic materials?
   i) Aluminium, iron, copper
   ii) Iron, copper, nickel
   iii) Copper, aluminium, silver
   iv) Iron, cobalt, nickel

g) A common use of ultrasonic testing is:
   i) Cleaning
   ii) Detecting of sub-surface indications
   iii) Determination of the test piece ductility
   iv) Communications

h) Loss of the test piece back wall echo during scanning may be caused by:
   i) An abnormally homogeneous material structure
   ii) A smooth entry surface on the test piece
   iii) A discontinuity which is not parallel to the entry surface
   iv) An opposite surface which is parallel to the entry surface

[12.0 Marks]

Q2. a) What is the deference between Destructive Testing (DT) and Non-Destructive Testing (NDT)? Explain.

[2.0 Marks]

b) What is the different between defect and discontinuity?

[2.0 Marks]

c) For detection of surface weld defects or discontinuities what are the NDT methods commonly used?

[2.0 Marks]

d) Explain three (03) duties and responsibilities of a NDT technician?

[3.0 Marks]

e) What are the factors affecting the choice of NDT method?

[3.0 Marks]

Q3. a) Name and describe the six basic steps in the correct sequence of how to conduct a typical liquid penetrant test.

[4.0 Marks]

b) Describe two important functions of a developer.

[4.0 Marks]

c) List and describe four basic safety rules to be followed when conducting a liquid penetrant test.

[4.0 Marks]

Q4. The weld shown in Figure Q4 is to be tested by ultrasonic testing following pulse echo method. The test has been performed using a 70° angle probe with a screen calibration 175 mm. The echo pattern obtained at the probe position shown is given in Figure Q4-B

a) Write the step-by-step procedure of inspection of a weld (V or double V grove) by ultrasound testing method.

[2.0 Marks]

b) Determine the full skip beam path length and full skip distance.

[2.0 Marks]

c) Do you agree with the given calibration? Why?

[2.0 Marks]

d) Describe the process of screen calibration to 175 mm.

[2.0 Marks]

e) Find the location of the crack.

[2.0 Marks]

f) Identify the type of the defect. Provide evidences for your answer.

[2.0 Marks]

Q5. a) What is *6 dB drop method* used in ultrasound testing (UT)?

[2.0 Marks]

b) Write the step-by-step procedure of detecting of defect size by 6 dB drop method.

[3.0 Marks]

c) What are the different calibration blocks available in UT? When they are used? Explain using examples.

[3.0 Marks]

d) What is the penumbra effect observed in X-ray testing of materials?

[2.0 Marks]

e) Provide a suggestion to minimize the penumbra effect.

[2.0 Marks]

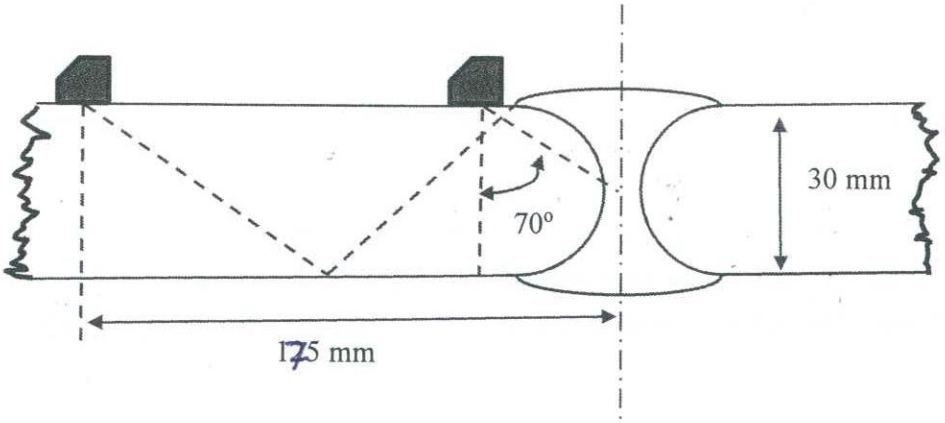

Figure Q4-A

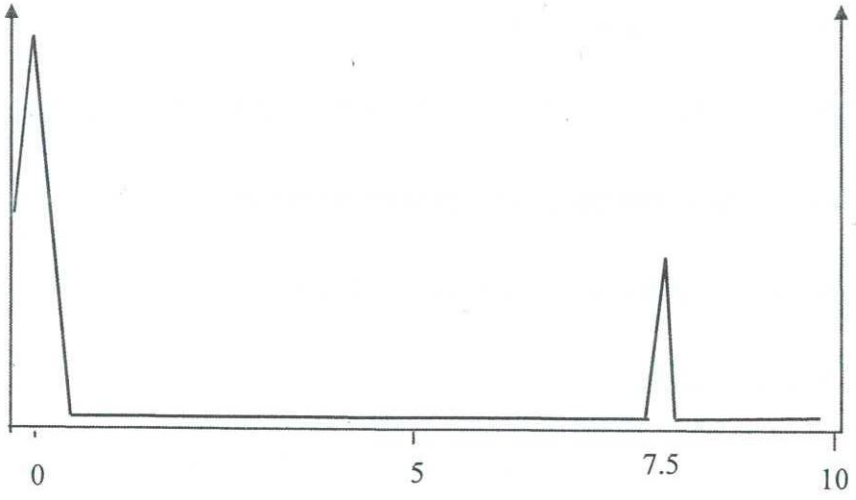

Figure Q4-B