



UTHM

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION SEMESTER II SESSION 2022/2023

- COURSE NAME : APPLIED NON-DESTRUCTIVE TESTING
- COURSE CODE : BDC 41203
- PROGRAMME CODE : BDD
- EXAMINATION DATE : JULY/AUGUST 2023
- DURATION : 3 HOURS
- INSTRUCTION : (1) PART A: ANSWER ALL QUESTION
(2) PART B: ANSWER **THREE (3)** QUESTIONS **ONLY**
(3) THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**
(4) STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

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PART A: ANSWER ALL QUESTIONS.

Q1 (a) Danamin (M) Sdn. Bhd., one of the biggest NDT service provider companies in Malaysia plans to replace their analog UT flaw detector unit to a digital unit. As an NDT engineer, you are asked to compare both analog and digital UT flaw detector units in term of their control function and limitation in detecting the discontinuities to the company for top management decision. You may use an appropriate block diagram to support your explanation.

(8 marks)

(b) **Figure Q1(b)** shows the reflection and refraction angle as stated in Snell's Law. Based on your understanding regarding this phenomenon;

(i) Prove that the air is worse than water to be used as the transmission medium for the non-contact UT technique. Use the percentage energy reflected calculation as evidence to support your explanation. The acoustic impedances for steel, water and air are given as $Z_{\text{steel}} = 46.7$, $Z_{\text{water}} = 1.48$, $Z_{\text{air}} = 0.0004$, respectively.

(6 marks)

(ii) Why does the refraction angle of the compression wave is higher than the shear wave? Justify your answer with Snell's Law equation.

(6 marks)

PART B: ANSWER THREE (3) QUESTIONS ONLY.

Q2 Visual Inspection (VI) is the most commonly used NDT method across all industries. It is assumed to be the early detection of any indication visible to the naked eyes. By referring to **Figure Q2**, evaluate each of the indication/flaw for the surface defects that normally occur in pipe metallic. You may create a report practice by industries in presenting your findings to the clients/main contractors.

(20 marks)

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Q3 (a) **Figure Q3(a)** shows one of the Magnetic Particle Testing (MPT) known as the Central Conductor Technique. Differentiate **FOUR (4)** techniques that can be used to inspect parts using the Central Conductor Technique with an appropriate element of consideration.

(10 marks)

(b) You are inspecting 1.5 inches diameter round bar with a total length of 9 inches using a five-turn coil with an internal diameter (ID) of 12 inches.

(i) Determine whether the coil is a low fill factor by comparing area ratios.

(2 marks)

(ii) Based on the **Q4(b)(i)**, evaluate the Ampere to be used if the part is positioned in both sides and centrally in coil?

(8 marks)

Q4 (a) Liquid Penetrant Testing (LPT) is a surface and near-surface inspection that commonly used in industries due to its benefit over other surface methods. Involving simple procedures while implementing it where the inspector usually using red dye to spot any indication if ever existed on the surface. What phenomenon that makes LPT work? Also gives 2 natural examples surrounds you which inspired by this phenomenon.

(15 marks)

(b) LPT can inspect to almost on all types of material. However, there are several components/materials that cannot be inspected by this method. Explaining in brief the reasons that LPT cannot be applied at certain circumstances.

(5 marks)

Q5 (a) It is common for Non-Destructive Testing (NDT) to practice 3 stages of inspection. Evaluate each stage with detail explanation includes the processes involve and examples.

(12 marks)

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(b) As one of the well-known NDT companies in Malaysia, Xpert Solution (M) Sdn. Bhd. have to comply with rules set by worldwide standard. It is their responsibility to ensure that they are hiring NDT personnel that posses high credibility and integrity. In gaining trust from industries that required their service for NDT inspection, each NDT personnel hired by the company is compulsory for proper training and certified by registered and established standard which recognized around the globe. Explain in brief what standard and certification available in Malaysia and which accredited body that offer it.

(8 marks)

Q6 (a) **Figure Q6(a)** shows three NDT personals were conducting the Radiography Testing (RT) in a working area. Based on the radiation safety, discuss the element to comply during conducting RT. Then, identify any obligation that occurs as referred to **Figure Q6(a)**. Your answer may include exposure control, radiation protection and shielding elements.

(12 marks)

(b) **Figure Q6(b)** shows the RT image of welded steel material. Interpret all the defects and discuss the defects criteria and root cause.

(8 marks)

– END OF QUESTION –

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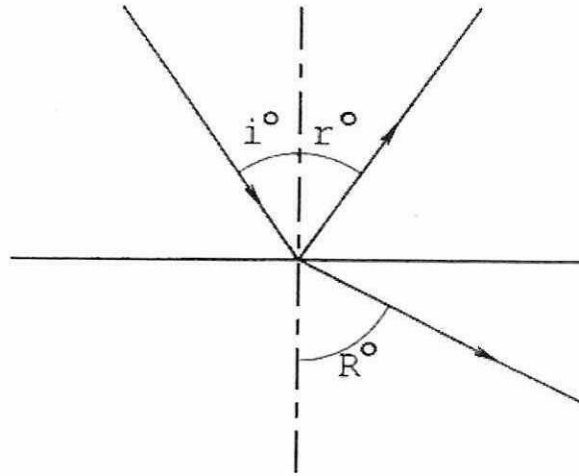


Figure Q1(b)

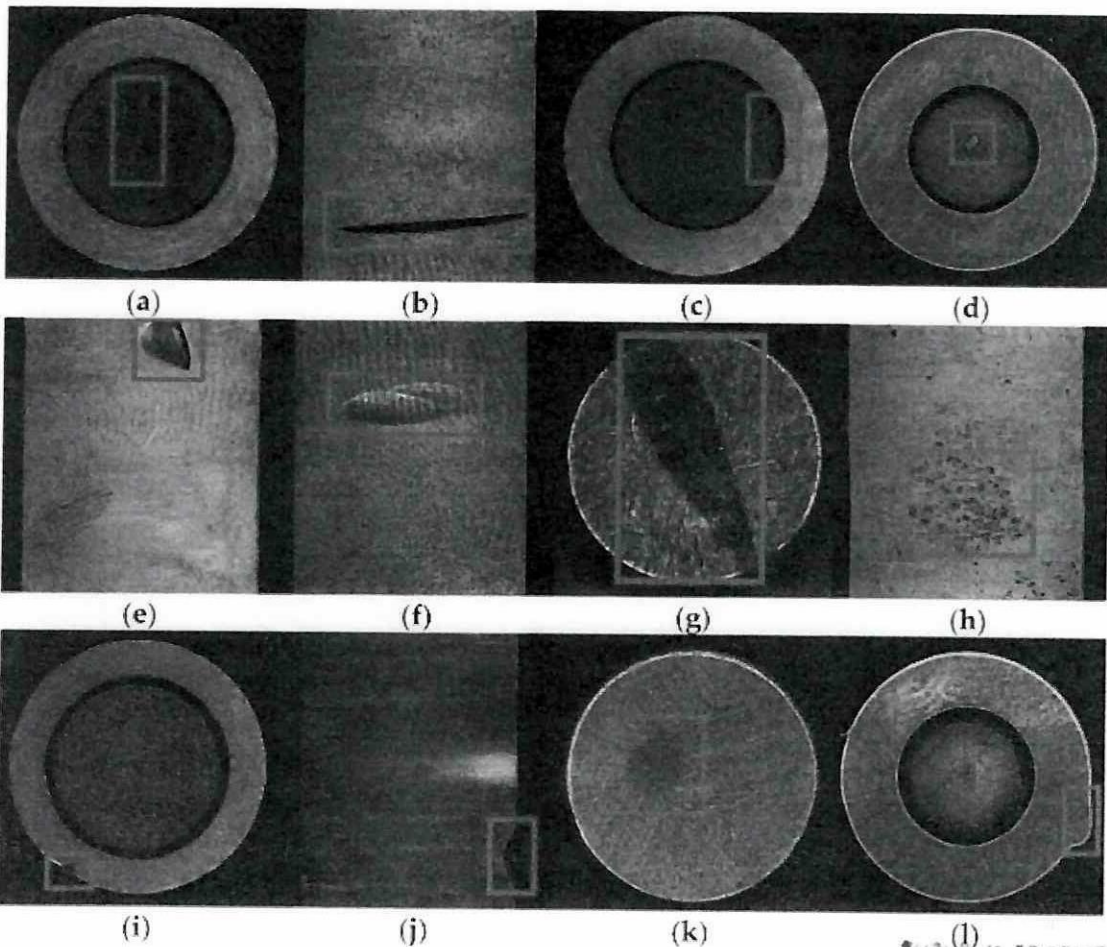


Figure Q2

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DESTRUCTIVE TESTING

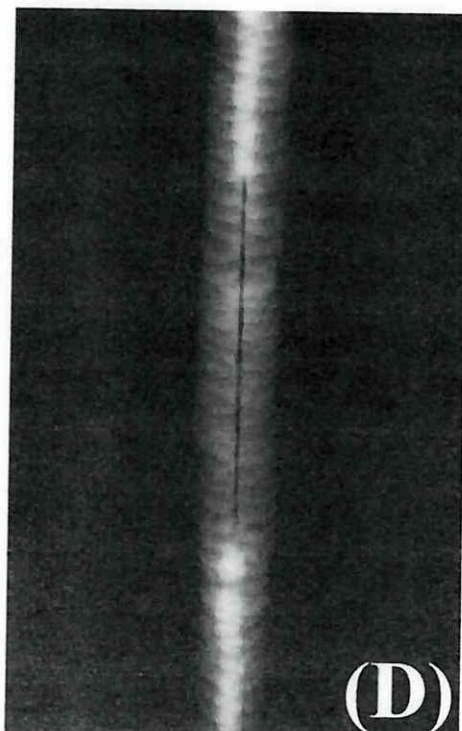
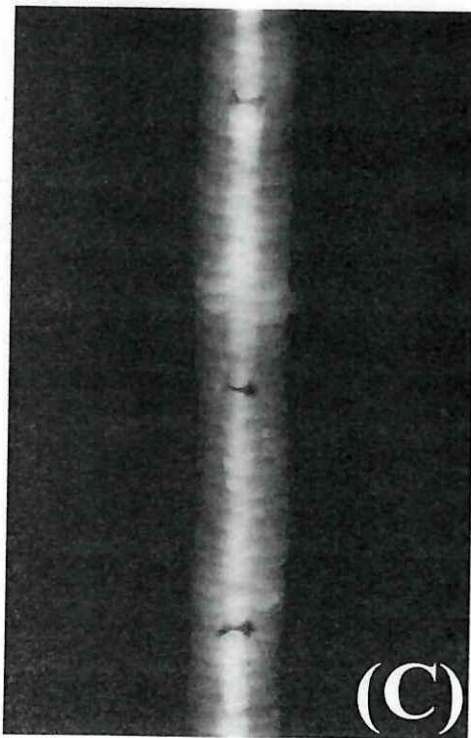
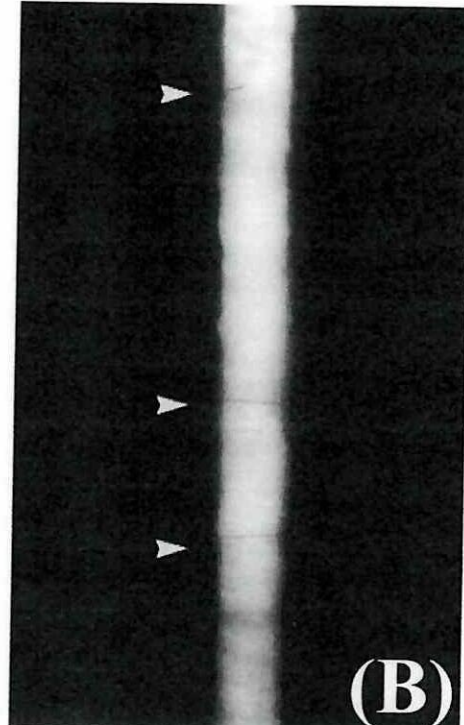
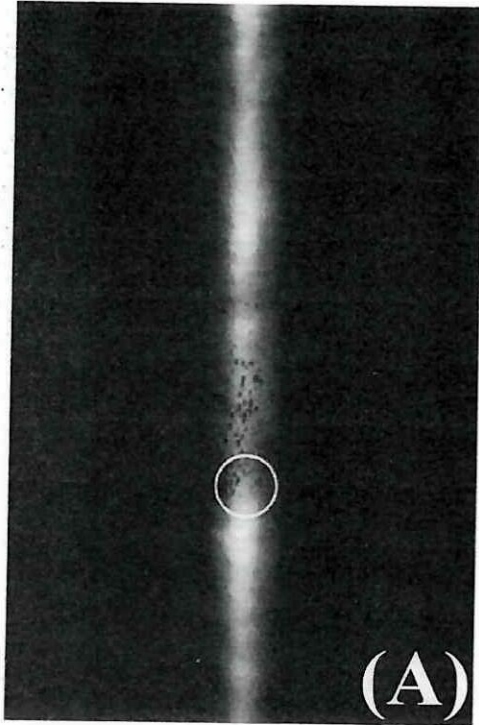


Figure Q6(b)