



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2022/2023**

COURSE NAME	:	MATERIALS TESTING
COURSE CODE	:	BDB 40203
PROGRAMME	:	BDD
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER <b>FIVE (5)</b> QUESTIONS <b>ONLY</b> 2. THIS FINAL EXAMINATION IS CONDUCTED VIA <b>CLOSED BOOK</b> . 3. STUDENTS ARE <b>PROHIBITED</b> TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

- Q1** (a) Explain why compression testing suitable for brittle materials. (4 marks)
- (b) Sketch the typical engineering stress-strain for brittle (ceramic), ductile (metal) and plastic (polymer). (4 marks)
- (c) Fatigue failures occur under dynamic or fluctuating stresses. Differentiate TWO (2) of the possible stress versus time curves that can occur in fatigue test. (5 marks)
- (d) Select THREE (3) indenters and their method that commonly used in the laboratory. (7 marks)
- Q2** (a) Identify FOUR (4) Non Destructive Testing (NDT) for surface inspection. (4 marks)
- (b) Sketch the steps of liquid penetrant inspection. (4 marks)
- (c) Differentiate the principle between magnetic particle and Eddy Current testing. (5 marks)
- (d) Select THREE (3) functions of ultrasonic in NDT and their operation procedure. (7 marks)
- Q3** (a) List the abrasives materials for polishing. (2 marks)
- (b) Identify TWO (2) purposes of sectioning. (2 marks)
- (c) Write the steps of hot mounting process for metal specimens. (5 marks)
- (d) Compare the process of sectioning of metal to ceramic. (4 marks)
- (e) Select the information obtained from light optical microscope for metallurgy microstructure. (7 marks)

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- Q4** (a) Explain the information after Transmission Electron Microscope (TEM) characterisation. (4 marks)
- (b) Sketch the interaction of electron-solid in Scanning Electron Microscope (SEM). (4 marks)
- (c) Distinguish between secondary electron and backscattered electron. (5 marks)
- (d) Evaluate two SEM images (sample of  $\text{Al}_2\text{O}_3/\text{Ni}$  composite) as shown in **Figure Q4(d)** in term of signal and function (7 marks)
- Q5** (a) Explain the functions of X-Ray Diffraction (XRD) in the characterisation of materials. (4 marks)
- (b) Interpret the XRD result as shown in **Figure Q5(b)**. (4 marks)
- (c) Differentiate the applications between X-Ray Fluorescence (XRF) and XRD in materials science and engineering. (6 marks)
- (d) Evaluate the type of vibration for FTIR in **Figure Q5(d)**. (6 marks)
- Q6** (a) Explain the applications of thermogravimetric analysis (TGA) in Materials Engineering. (4 marks)
- (b) Write TWO (2) applications of dynamic mechanical analysis (DMA). (4 marks)
- (c) Examine SIX (6) of typical weight loss profile of TGA as shown in **Figure Q6(c)**. (6 marks)
- (d) Evaluate the normal plot for thermal analysis of Differential Scanning Calorimeter (DSC) in polymer sample as shown in **Figure Q6(d)**. (6 marks)

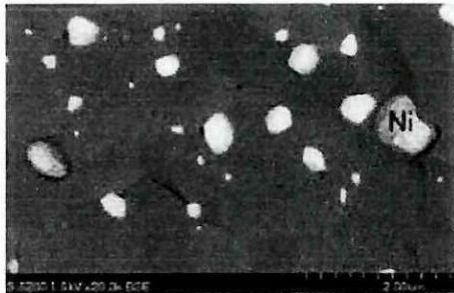
- END OF QUESTION -

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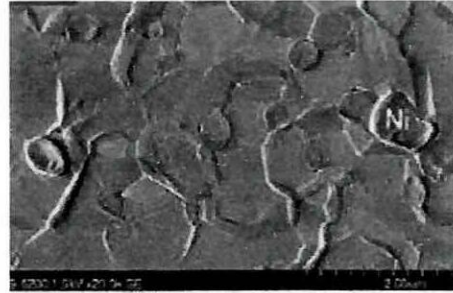
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(i)



(ii)

Figure Q4(d)

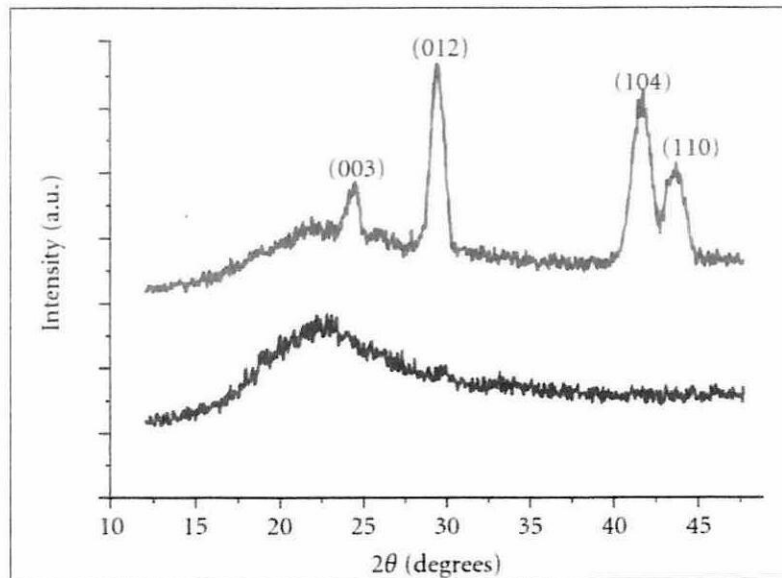


Figure Q5(b)

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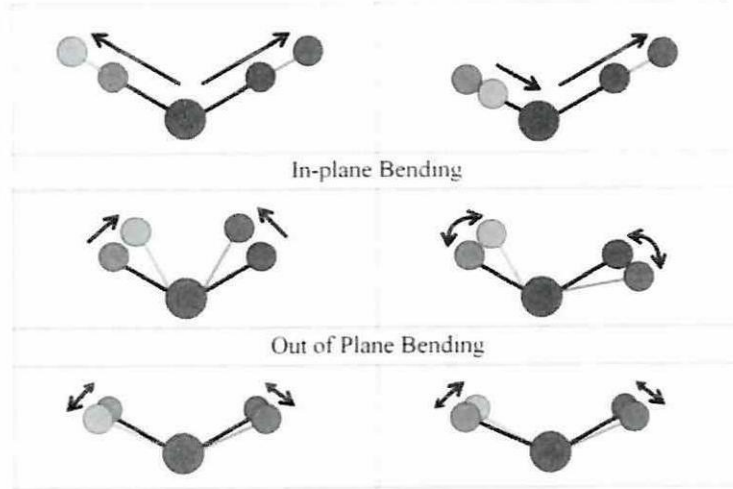


Figure Q5(d)

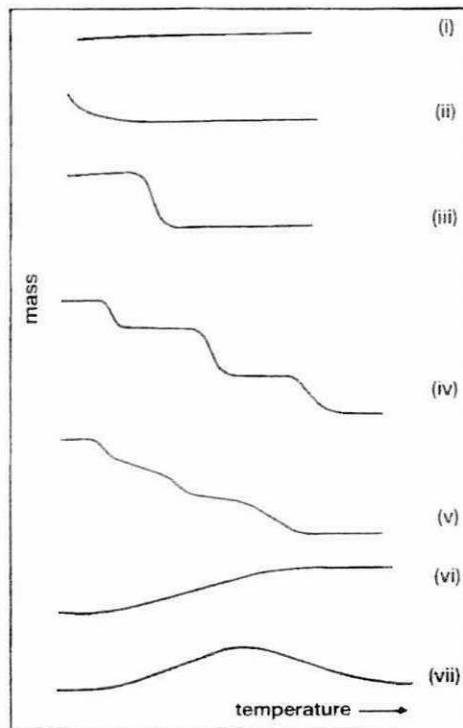


Figure Q6(c)

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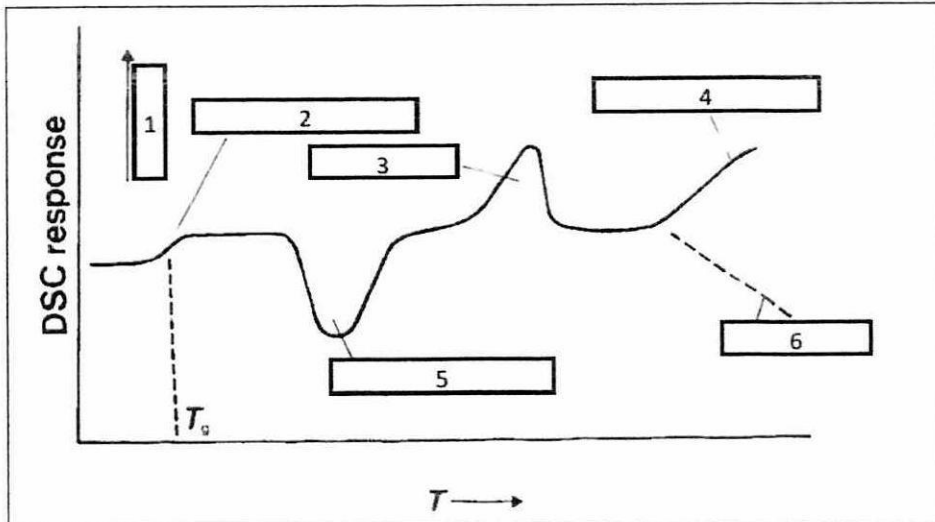


Figure Q6(d)

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