Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	ADVANCED MATERIALS
COURSE CODE	:	BDB 40803
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	JULY 2024
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ Closed book 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **THREE (3)** PAGES

Q1 Shape memory alloys (SMAs) and batteries are two examples of smart and functional materials widely used in various industries, including aerospace, automotive, medical, and energy.

(a) Determine FOUR (4) applications of shape memory alloys.

(8 marks)

(b) Explain the mechanism of pseudoelasticity in shape memory alloy.

(6 marks)

(c) Differentiate between primary and secondary batteries. Support your answer by providing ONE (1) example of each type.

(6 marks)

Q2 Aluminum foam has a cellular structure. Its lightweight and unique physical and mechanical properties have made this metal foam widely used in structural and functional applications.

(a) Classify THREE (3) types of pores in Aluminum cellular metal foam applications and provide ONE (1) example in each type.

(6 marks)

(b) Identify THREE (3) advantages of metal foam applied in Aluminum foam sandwich panels (ASP) over dense metal.

(6 marks)

(c) An oil and gas company must develop an open pores structure of Aluminum metal foam. Suggest ONE (1) method to produce the metal foam and explain the method in detail. What criteria need to be considered to make the heat exchanger more effective?

(8 marks)

Q3 One patient has to undergo surgery for knee implant replacement due to a car accident. However, after three months of surgery, the patient needs to undergo a second surgery due to the failure of the knee implant replacement.

(a) Investigate and explain briefly the possible causes of the failure of the knee implant replacement.

(6 marks)

(b) What would you suggest the suitable biomaterial for knee implant replacement and justify your answer?

(6 marks)

(c) What are the requirements that you used to select the suitable material for knee implant replacement?

(8 marks)

Q4 Nanotechnology is rapidly transforming the smartphone industry, enabling novel functionalities and pushing performance boundaries.

(a) Define nanomaterials and explain TWO (2) characteristic that differentiates them from bulk materials.

(6 marks)

(b) Propose a potential future application of nanomaterials in smartphone batteries, explaining the underlying mechanism and its benefits.

(6 marks)

(c) The integration of nanomaterials in smartphones offers enhanced functionalities but raises sustainability concerns. Comment on TWO (2) potential environmental challenges associated with the use of nanomaterials in smartphones and propose solutions to address them.

(8 marks)

Q5 A company is developing a new generation of high-performance solar panels. They need to choose the most suitable thin film coating material and deposition technique to optimize solar cell efficiency.

(a) Define the term "thin film" and briefly explain the concept of thin film deposition.

(4 marks)

(b) Analyse THREE (3) key characteristics of thin films crucial for their effectiveness in solar cell applications, detailing their impact on solar cell performance.

(6 marks)

(c) Suggest a thin film coating and deposition technique to improve the new solar panels' performance, considering various processing methods and material properties. Justify your recommendation by explaining its specific advantages for this application.

(10 marks)

- END OF QUESTIONS -