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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2016/2017**

**TERBUKA**

COURSE NAME : ADVANCED MATERIALS  
COURSE CODE : BDB 40803  
PROGRAMME CODE : 4 BDD  
EXAMINATION DATE : DECEMBER 2016/JANUARY 2017  
DURATION : 3 HOUR  
INSTRUCTION : ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

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- Q1**
- (a) Define Shape Memory Alloy (SMA). Give THREE (3) types of SMA Materials. (5 marks)
  - (b) Discuss battery materials. Sketch a diagram of battery classification and include ONE (1) example for each type of battery cell. (10 marks)
  - (c) Explain nanomaterials as according to their classification accordingly. (5 marks)
- Q2**
- (a) Metallic foam can be produced using liquid state technique. One of the techniques is direct foaming by gas injection. Explain this method with the assistance of appropriate illustrations. (8 marks)
  - (b) List TWO (2) production methods of cellular metals. Give ONE (1) example of each method. (4 marks)
  - (c) Compare the differences between top down approach and bottom up approach in synthesis of nanopowders? (8 marks)
- Q3**
- (a) Describe the relationship between shape memory effect (SME) and Pseudo-Elasticity (PE) with an assistance of stress-strain curve. (10 marks)
  - (b) Nickel-Cadmium battery is one example of secondary cell. Discuss the disadvantages of using Nickel-Cadmium battery. (4 Marks)
  - (c) The applications for cellular metals depended on its physical properties. Select the appropriate porosity and explain briefly the mechanism for sound-proof room application. (6 marks)

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- Q4** (a) Cobalt-chromium and titanium alloys are specific examples of the ceramic and metal materials, commonly used in hip implants. Why ceramics and metals are good materials for coating and structural components? Support your answer in term of the application of Cobalt/Chromium and Titanium (Co/Cr and Ti) for this application and concepts. (10 marks)
- (b) Alloys are increasingly applied as compared to pure metals for biomedical applications. What are two major advantages these materials impart? Describe how the difference in atomic makeup of pure metals versus alloys contributes to these advantages. (10 marks)
- Q5** (a) Thin film technology is pervasive in many applications, including micro-electronics, optics, magnetic, hard resistant coatings and micro-mechanics. Characterisation of thin films plays an important role to determine the structure, composition and electronic structure. Select and propose ONE (1) of the composition characterization method for thin films. Support your argument with concepts and diagram. (10 marks)
- (b) Surface cleaning is one of the steps of preparing surface for coating to ensure a homogenous final surface. Select and explain the suitable specific cleaning method used for soda-lime-silicate glass. (5 marks)
- (c) As an engineer of company ABC Sdn. Bhd., you are given a task to design a coating-substrate system to be used in gas turbine application. Suggest the suitable coating process for this application with the coating thickness of 100 to 1000  $\mu\text{m}$  range. (5 marks)
- Q6** (a) Thin powder coatings may not be advisable or feasible for certain requirement or specifications. Thin-film powder coating is considered for some applications, condition or environment. Explain with the aid of diagram, why thin powder coating are not suitable for low-temperature cure condition. (10 marks)

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(b) In your opinion, write THREE (3) challenges of biomaterials product usage. (6 marks)

(c) Write TWO (2) requirements for biomaterials product in term of mechanical properties and performance. (4 marks)

- END OF QUESTIONS -

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