



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022**

COURSE NAME : APPLIED METALLURGY
COURSE CODE : BDB 40503
PROGRAMME CODE : BDD
EXAMINATION DATE : JULY 2022
DURATION : 3 HOURS
INSTRUCTION : 1) ANSWER **FIVE (5)** FROM SIX (6) QUESTIONS
2) THIS FINAL EXAMINATION IS CONDUCTED VIA **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

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- Q1** (a) Sketch a typical ceramic mold (Shaw process) for casting steel die that is used in hot forging
(4 marks)
- (b) Distinguish between the reverberatory furnace and tower (shaft) furnace (The cupola) that is being used for melting the metal used in the casting process.
(6 marks)
- (c) An engineer is planning to produce a new product using casting methods. The product will be used zinc alloy as the material. Suggest a suitable mould that can be used excellently for this product.
(10 marks)
- Q2** (a) The production line had produced several new casting products. Analyse the product in terms of ONE (1) of these characteristics: dimensional accuracy, mechanical behaviour or chemical composition.
(4 marks)
- (b) Distinguish between the characteristic of sand casting and die casting methods.
(6 marks)
- (c) An aluminium-based products are to be cast for fulfilling the customer's need. The product will incorporate fiber as reinforcement. If the chosen metal has a low fluidity, suggest a suitable casting method with explanation and illustration.
(10 marks)
- Q3** (a) Illustrate the steps in the solidification process with the explanation.
(4 marks)
- (b) Compare homogeneous and heterogeneous nucleation.
(6 marks)
- (c) Evaluate the maximum hydrogen partial pressure required to eliminate gas porosity in aluminium casting if given that concentration of hydrogen in liquid aluminium is $3.27 \text{ cm}^3/100\text{g Al}$ and the concentration of hydrogen in solid aluminium is $1.56 \text{ cm}^3/100\text{g Al}$.
(10 marks)

- Q4** (a) Illustrate FOUR (4) different ideal particle shapes that can be found in powder metallurgy. (4 marks)
- (b) Analyse the powder characteristics by its porosity. (6 marks)
- (c) There are few commercial methods for manufacturing powder used in powder metallurgy such as atomization, milling/crushing, mechanical alloying, chemical and electrolytic. Evaluate the powder production by atomization. (10 marks)
- Q5** (a) Sketch the hot iso-static pressing (HIP). (4 marks)
- (b) Analyse the effect of compacting pressure on the materials' properties with a suitable graph. (6 marks)
- (c) Three main stages in powder metallurgy involve mixing, compacting and sintering. Recommends the basic approach of the consolidation of powder. (10 marks)
- Q6** (a) Analyse the possible defects that may occur during the die pressing of powder. (4 marks)
- (b) Differentiate between mechanical and physical properties of the powder metallurgy product. (6 marks)
- (c) Evaluate the effects of porosity on the mechanical properties of powder metallurgy materials. (10 marks)

~ END OF QUESTIONS ~

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