Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2022/2023

COURSE NAME	:	APPLIED METALLURGY
COURSE CODE	:	BDB 40503
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	FEBRUARY 2023
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **5 (FIVE)** QUESTIONS **ONLY** 2. THIS FINAL EXAMINATION IS CONDUCTED PHYSICALLY AND CONDUCTED **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 (a) Sketch a typical ceramic mold (Shaw process) for casting steel dies used in hot forging method.

(4 marks)

(b) There are a few methods for melting the metal in casting process. Crucible and induction melting are two examples of batch melting. Differentiate these two methods by using suitable sketch.

(6 marks)

(c) Evaluate the methods of producing good casting product by avoiding the liquid front damage and shrinkage damage.

(10 marks)

Q2 (a) The standards, quality, accuracy, production cost and automation of metal castings may influence the selection of casting methods. Select TWO (2) casting methods based on the product quantity.

(4 marks)

(b) Distinguish between the characteristic of true centrifugal casting and die-casting methods.

(6 marks)

(c) A magnesium-based products are to be cast for fulfilling the customer's need. The product requires maximum density with low porosity. The method needs to be run during the transition between solid to liquid phase. Suggest a suitable casting method that fulfilled the requirement with explanations and illustrations.

(10 marks)

Q3 (a) Illustrate and explain the steps involved in the solidification process.

(4 marks)

(b) Distinguish between the cooling curve for pure metal and alloys with a suitable sketch.

(6 marks)

(c) Shrinkage is an unavoidable problem in casting methods. However, the shrinkage could be minimised by directional solidification. Suggest a suitable way for directional solidification by using chill with and aid of diagram.

(10 marks)

Q4 (a) Illustrate TWO (2) possible particle generations mechanisms associated with water atomization.

(4 marks)

(b) Analyse the mixing parameters effect to the homogeneity of the metal powder method.

(6 marks)

(c) Porosity is a unique and inherent characteristic of powder metallurgy technology. It can be exploited to create special products by filling the available pore space with oils, polymers, or metals. Suggest the methods of porosity formation via impregnation.

(10 marks)

Q5 (a) Sketch the sintering sequence on a microscopic scale of particle.

(4 marks)

(b) Distinguish between Vickers and Rockwell hardness testing.

(6 marks)

(c) A new powder metallurgy product is designed to be used in fluctuation applied stress with a large number of cycles. Suggest the suitable testing that the product needs to undergo to ensure it follows the requirement with explanation on the testing.

(10 marks)

Q6 (a) Demonstrate the possible secondary processing in powder metallurgy method.

(4 marks)

(b) Distinguish between mechanical and physical properties of the powder metallurgy product.

(6 marks)

(c) Evaluate the effects of porosity to the mechanical properties of powder metallurgy materials.

(10 marks)

~ END OF QUESTIONS ~