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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	APPLIED METALLURGY
COURSE CODE	:	BDB40503
PROGRAMMECODE	:	BDD
EXAMINATION DATE	:	JUNE 2017
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **FIVE (5)**QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1   (a)   Cylinder head in internal combustion engine is fabricated via permanent mould casting, often referred to as gravity die casting. Illustrate by using appropriate figure to show the flow of this casting process.

(6 marks)

(b)   Compare the characteristics of greensand mould and dry sand mould.

(5 marks)

(c)   Suggest THREE (3) rules to obtain reliable and good castings.

(9 marks)

Q2   (a)   Explain the term 'shake out' and 'shot blasting' in the sand casting process.

(4 marks)

(b)   Shrinkage and crack are defects that can be occurred during sand casting process. Select TWO (2) steps in the sand casting process where the preventative measures can be done to avoid those defects.

(4 marks)

(c)   Mr. Faiz needs to castmedium size cylindrical components from high-alloy steel metal. Proposea suitable casting method to fabricate the required component.

(6marks)

(d)   Solidification time is important in casting because it affects production rate and the resulting microstructure. Calculate the solidification time for a sand cast magnesium part with a dimension of 10 cm x 10 cm x 25 cm if the metal is poured at its melting point (T_m) is 650 °C. The environment temperature is 25°C.

Other parameters are;
   density of magnesium = 1700 kg/m^3,
   density of sand = 1500 kg/m^3,
   specific heat of sand = 1.16 kJ/kg.K,
   thermal conductivity of sand = 0.6 x 10^{-3} kW/mK
   latent heat of solidification = 384 kJ/kg.

(6 marks)

Q3   (a)   Differentiate between the homogeneous and heterogeneous nucleation in metal solidification

(6 marks)

(b)   Alloy and cooling conditions are factors that influence the grain structure of the casting from the nucleation process. Predict the types of grain structure and illustrate the microstructuresthat will be obtained for the following conditions. Which is the desired grain structure in the casting.

(i)   no nucleation within melt

(ii)   nucleation both on walls and within melt

(iii)   no nucleation on walls

(8 marks)

(c)   You have to carry out a process selection for casting. Decide THREE (3) attributes that need to be considered in your selection.

(6 marks)

Q4   (a)   Details FOUR (4) important characteristics for metal powders used for the manufacture of powder metallurgy products.

(8 marks)

(b)   A one PSM student wants to prepare a composite sample for his research project using powder metallurgy technique. First, he mixed the powders and compacted using hydraulic press. While compacting the samples, he noticed a cracks and chipping of the edge in the green body of the samples and some samples are broken. In your opinion, what is the most probable cause of the problem and propose the ways to solve it.

(12 marks)

Q5   (a)   List advantages and disadvantages of powder metallurgy.

(5 marks)

(b)   What is the technical difference between mixing and blending in powder metallurgy?

(4marks)

(c)   A steel part can be made by powder metallurgy or by machining from a solid block. Which part is expected to have the higher toughness? Justify your answer.

(8 marks)

(d)   Differentiate between Hot Isostatic Pressing and Cold Isostatic Pressing.

(3 marks)

Q6   (a)   What are some approaches to obtain full density during powder consolidation?

(7 marks)

(b)   How sintering atmosphere affects the properties of the powder metallurgy product?

(3 marks)

(c)   How is tensile property related to density?

(7 marks)

(d)   Why the ratio between particle sizes of two different powders need to be closer to 1?

(3 marks)

-END OF QUESTION-