UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	METAL CASTING PROCESS
COURSE CODE	:	BDD 40603
PROGRAMME CODE	:	BDD
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **FIVE (5)** QUESTIONS **ONLY**

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

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Q1   (a)   Differentiate between open mold and close mold with illustrate figure.

(6 marks)

(b)   Compare the advantages of sand cast and die casting process.

(4 marks)

(c)   Preparation of molding sand is a key process, determining the final quality of casting products. Special requirements are imposed at stabilising and optimising the parameters of the molding sand so that it should maintain its properties required for molding. Justify FIVE (5) measurement in sand quality to prepare and control the high quality casting.

(10 marks)

Q2   (a)   Describe your observation of nucleation and growth stage during solidification of cast structure.

(6 marks)

(b)   Analyse the temperature and density that you observed for solidification of pure aluminum alloys with illustrate figure.

(6 marks)

(c)   After molten metal is poured into a mold, cooling rate plays important aspect for determine the final casting product during solidification process. Propose the correlation between cooling rate and final properties of a casting.

(8 marks)

Q3   (a)   Demonstrate the operation of sand casting process with illustrate figure.

(8 marks)

(b)   Compare THREE (3) types of molds for sand casting.

(6 marks)

(c)   The forming of holes, internal cavities and other internal surface of casting depends on cores. Therefore core can be defined as that portion of mold which form the hallow interior of casting or hole through the casting. Mostly sodium silicate materials and several requirement of core are needed to fulfill the sand cast quality. Justify SIX (6) requirements of core in the sand cast to produce a high quality cast product.

(6 marks)

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Q4   (a)   Describe the fluidity and it measurement method.

(5 marks)

(b)   Sketch a casting defect called misrun and explain the possible causes for them to form.

(5 marks)

(c)   Evaluate the defect which can form in sand castings if the pouring temperature is too high and fluidity is too great.

(5 marks)

(d)   Explain the significant to design the geometry of the gating system to control the rate of metal flow as it travels from the pouring cup into the mold cavity.

(5 marks)

Q5   During pouring into a sand mold, the molten metal can be poured into the downsprue at a constant flow rate during the time it takes to fill the mold. At the end of pouring the sprue is filled and there is negligible metal in the pouring cup. The downsprue is 6.0 in long. Its cross sectional area at the top = 0.8 in^2 and at the base = 0.6 in^2. The cross sectional area of the runner leading from the sprue also = 0.6 in^2, and it is 8.0 in long before leading into the mold cavity, whose volume = 65 in^3. The volume of the riser located along the runner near the mold cavity = 25 in^3. It takes a total of 3.0 sec to fill the entire mold (including cavity, riser, runner, and sprue. This is more than the theoretical time required, indicating a loss of velocity due to friction in the sprue and runner. Evaluate the following items:

(a)   The theoretical velocity and flow rate at the base of the downsprue.

(5 marks)

(b)   The total volume of the mold.

(5 marks)

(c)   The actual velocity and flow rate at the base of the sprue.

(5 marks)

(d)   The loss of head in the gating system due to friction.

(5 marks)

Q6 (a) Justify the significant to provide a means of venting gases from the mold cavity.

(5 marks)

(b) Formulate the relationship between casting volume and surface area as they relate to the total solidification time according to the Chvorinov's rule.

(5 marks)

(c) Justify THREE (3) possible effect of sand selection to the mold or casting product quality.

(6 marks)

(d) Formulate TWO (2) possible approaches that can be taken to prevent the formation of gas porosity in a metal casting.

(4 Marks)

– END OF QUESTIONS –

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