Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	METAL CASTING PROCESS
COURSE CODE	:	BDD 40603
PROGRAMME	:	4 BDD
EXAMINATION DATE	:	JUNE 2016/JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** FROM **SIX (6)** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Classify **THREE (3)** capabilities of metal casting over other manufacturing process

(3 marks)

(b) Differentiate between the hot chamber and cold chamber machine in metal casting process with the aid of figure.

(7 marks)

(c) You are a production manager that received a drawing as shown in **FIGURE Q1**. From this drawing, defend your judgments which type of metal casting process to produce these casting component.

(10 marks)

Q2 (a) Describe the terminology of metal casting

(i) Nucleus
(ii) Nucleation
(iii) Homogeneous
(iv) Heterogeneous

(4 marks)

(b) Differentiate between the solidification of pure metals and metal alloys

(6 marks)

(c) When a molten metal poured into a square mold, a sequence of stages takes place during the solidification and cooling of the metal to ambient temperature. Evaluate each stage in the cooling curve of metal casting process with the aid of figure and cast structure of metal solidified by terminology casting such as latent heat, solidus, nucleation, chill zone, columnar grain, equiaxed structure.

(10 marks)

Q3 (a) Sketch **FOUR (4)** type of patterns in sand casting

(4 marks)

(b) Sand castings are often required to have holes, recesses, etc. for various sizes and shapes through making the core in the casting process. You are a casting engineer that is required to employ the core making process to produce the hole for the sand casting components as shown in **FIGURE Q3**.

(6 marks)

(c) A large variety of molding materials is used that in sand casting process for manufacturing molds and cores. You are a tooling manager has a responsible task to produce the high quality casting by your sand mold materials selected. Defend your judgments to have a high quality sand mold materials.

(10 marks)

Q4 (a) Differentiate between the permanent mold and not permanent mold casting with **TWO (2)** examples

(3 marks)

(b) Distinguish between the sand casting and die casting in the metal casting process

(7 marks)

(c) As an engineer in production engineering department, you are required to select the suitable casting process to produce the high quantity of hard disc casing casting component in daily (10,000 components). Support your selection for this casting process with the strong reasons

(10 marks)

Q5 (a) Explain the features which affect the life of a permanent mold?

(5 marks)

(b) If you need only **FIVE (5)** units of casting, which process would you use? Explain your reason

(5 marks)

(c) What is fluidity and how can it be measured?

(5 marks)

(d) Why is it desirable to make the pattern allowances as small as possible?

(5 marks)

Q6 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

(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)

- END OF QUESTION –

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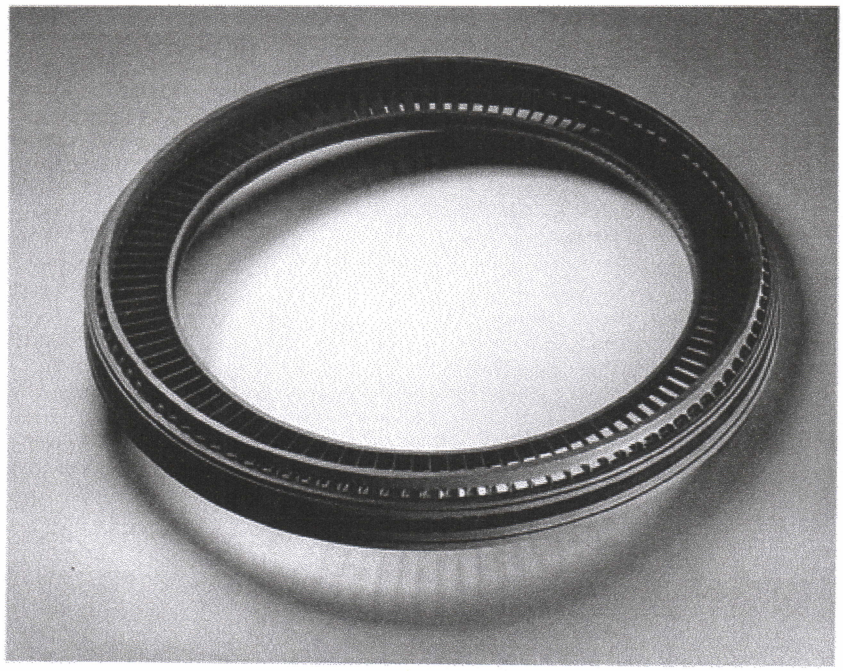

FIGURES Q1 : A one-piece compressor stator with 108 separate airfoils

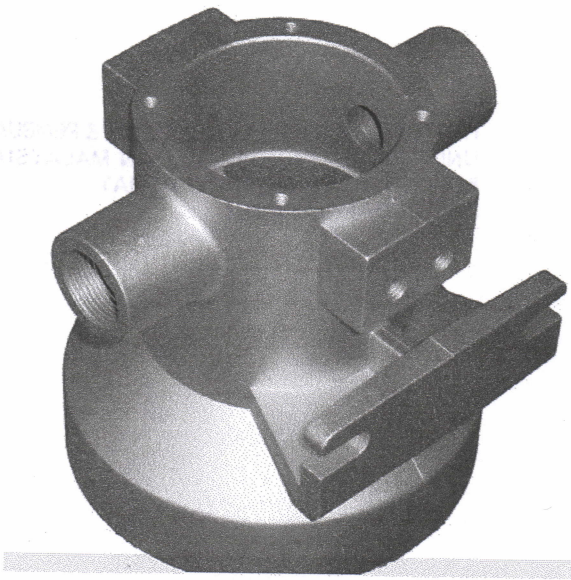

FIGURE Q3 : Automotive valve body by aluminum sand casting