

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF INDUSTRIAL TECHNOLOGY
DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING
MANUFACTURING PROCESSES I - TIE 3113
SUPPLEMENTARY EXAMINATION
OCTOBER 2009

Instructions

1. Examination length is **3hrs**.
2. Each question carries twenty (**20**) marks and there are six (**6**) questions in total.
3. Attempt the whole of Section A and any other three questions from Section B.

Section A

Question 1

A steel plate casting 3 cm x 5 cm x 20 cm is poured in 10 seconds, the effective sprue height is 10 cm, and the gating ratio is 1:2:3. The density of steel is 7.86 g/cm^3 and the casting yield is 60%. The cylindrical tapered sprue is connected to two square runners, and each runner is connected to two gates that have a width three times the height. The dynamic viscosity of steel is 0.06 g/cm.sec. Determine the following:

- | | | |
|----|---|-----|
| a) | The amount of metal poured (g and cm^3) | [3] |
| b) | The pouring rate (g/s and cm^3/s) | [3] |
| c) | The choke velocity (cm/s) | [2] |
| d) | The choke area and the location of the choke | [4] |
| e) | The dimensions of the sprue base, each runner, and each gate (cm) | [6] |
| f) | The maximum Reynolds number | [2] |

Question 2

In a meeting you are asked to describe, very briefly, the essential features of the four principal die-casting processes. There are no facilities to make sketches and you are expected to clarify the method of filling the cavity. [20]

Section B

Question 3

- | | | |
|-------|--|-----|
| a) | Make simple sketches showing the principal distinguishing features of | |
| (i) | Centrifugal casting | [4] |
| (ii) | Semi centrifugal casting | [4] |
| (iii) | Centrifuging | [4] |
| b) | What are the two principal advantages of dry sand over green sand moulds? | [2] |
| c) | Determine the optimum size of a riser using the Modulus method. The riser must have a height to diameter ratio of 2. | [6] |

Question 4

- a) Is it possible to obtain a sound casting of a solid bar by centrifugal casting? Support your answer with reasons. [8]
- b) Outline the investment casting process and give its typical applications. [12]

Question 5

- a) Name any two metal pouring defects and explain their formation. [4]
- b) Describe the pattern colour code normally used in foundries. [6]
- c) Name the main control area in a gating system that regulates the metal flow into the mould cavity so that the mould is filled within the calculated time. [2]
- d) Discuss safety in foundries. [8]

Question 6

Discuss the steps that have been made in improving the quality of castings at the melting and pouring stage. [20]

End