Ex/Met/PC/B/T/311/2022

BACHELOR OF ENGINEERING IN METALLURGICAL AND MATERIAL ENGINEERING EXAMINATION, 2022

(3rd Year, 2nd Semester)

FOUNDRY METALLURGY

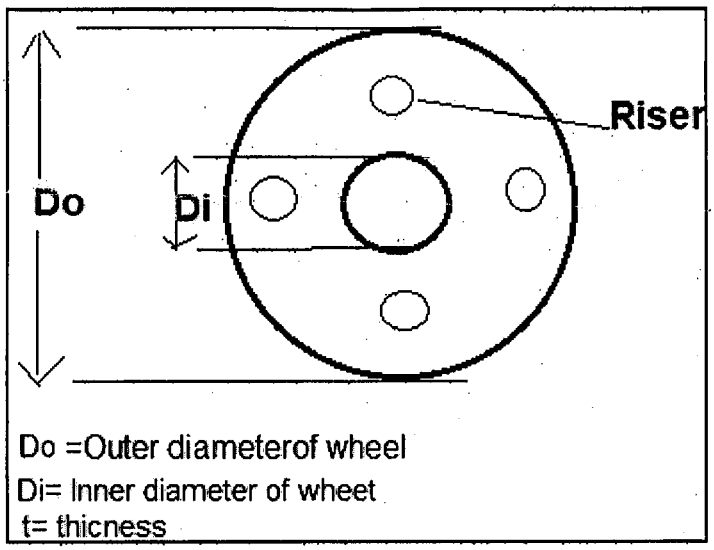
Time : Three hours | Full Marks : 100

Use Separate Answer scripts For each Part

PART I (30 Marks)

Answer any two questions, each question is of 15 marks

1.Draw a typical diagram to explain directional solidification of metal casting. What is modulus of casting ? How it Is related with modulus of riser. Design risering for the following steel wheel casting



Determine the number of riser and dimension of each riser, considering D_o= 90 cm, D_i= 25 cm, t=15 cm. Each riser can feed up to 2t distance on either side 4+3+8

2. What is carbon equivalent (CE) ? Explain how CE and section thickness (cooling rate) influence the formation of grey cast iron. What are the effects of chiller for thick section and exothermic power for thick section of casting. What are charges in cupola for grey cast iron production and what are the output 2+3+3+7

3. Explain the sequences of operation in Electric Arc Furnace for melting of steel for casting. How do control Phosphorus and Sulphur level here . Steel casting needs good fluidity to fill up narrow channel in the mould. How do you maintain good fluidity 5+6+4

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Subject : Foundry Metallurgy

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Metallurgical & Material Engineering Department

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PART II (35 Marks)

Answer to the following questions.	Marks
1. Explain Foundry with an example	5
2. Write short notes on any three items of the following	10 X 3

- Different Casting Defects
- Sand Testing Procedures in Sand Casting
- Types of Melting Furnaces in Foundry
- Mould and their types

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B.E Metallurgical and Material Engineering

Third Year, Second Semester Eamination – 2022

Subject: Foundry Metallurgy

Time: 3 hours **Full marks: 100**

PART III (35 Marks)

(USE SEPARATE ANSWER PAPERS; ANSWER SHOULD BE SPECIFIC)

Answer any five from the following: **7 x 5 = 35**

(1) Show that the critical size of the nucleus for solidification depends on degree of undercooling. 7

(2) A steel casting has a cylindrical geometry with 4.0 in diameter and weighs 20 lb. This casting takes 6.0 min to completely solidify. Another cylindrical shaped casting with the same diameter-to-length ratio weighs 12 lb. This casting is made of the same steel, and the same conditions of mould and pouring were used. Determine: (a) the mould constant in Chvorinov's rule, (b) the dimensions, and (c) the total solidification time of the lighter casting. The density of steel = 490 lb/ft^3. 7

(3) What is "ADI?" What are the phases present in "ADI?" Discuss the mechanism for development of ADI microstructure. 2+ 1 + 4 = 7

(4) What is 'coring?" In which types of alloy there will be no "coring?" and why? Name one such alloy. What difficulties are faced in mechanical working of an alloy with heavily cored structure and why? what is the practice to overcome the difficulties? 2 + 1 + 1 + 3 = 7

(5) Discuss "constitutional supercooling" phenomenon and its effect on solidification process. In which case there will be no such constitutional copercooling? Why is it called "constitutional" supercooling? 5 + 2 = 7

(6) What is cast iron and on what basis is it classified? Which property of "Gray Cast Iron" is used to advantage and what is the reason behind this? When do we encounter with different varieties of Gray Cast Iron out of single liquid composition and why? 2 + 2 + 3 = 7

(7) Why Al-Si casting alloys are considered very important? What is the microstructure of hypereutectic Al-Si alloy? What is the need for modifying Al-Si alloy and with reference to Al-Si phase diagram discuss the mechanism for modification of a hypereutectic Al-Si alloy? 2 + 2 + 3 =7

(8) What is the microstructure of White Cast Iron? Discuss the heattreatment process applied to "White Cast Iron" and the microstructure developed thereof. 2 + 5 = 7