Ref. No. : Ex/Met/PC/B/T/321/2023(S)

B.E. METALLURGICAL AND MATERIAL ENGINEERING THIRD YEAR SECOND SEMESTER SUPPLEMENTARY EXAM - 2023

Subject: FOUNDRY METALLURGY **Time: 3hr.** **Full Marks: 100**

Group / Part - I

Instructions: Use Separate Answer scripts for each Group

(Answer question number 1 and any four questions from the rest of the group I)

1. i) _____ is a process of preparing a casting.
   a) Founding
   b) Forging
   c) Melting
   d) Pouring
   ii) Which of the following is prepared using pattern is foundry?
   a) Mould
   b) Sand
   c) Core
   d) Mould, Sand and Core
   iii) To form castings, always virgin metal is used in foundries.
   a) True
   b) False
   iii) The foundry uses _____ process to relieve stresses produced in castings.
   a) Reforming
   b) Heat treatment
   c) Water treatment
   d) Cooling
   iv) The product of the foundry process is _____
   a) Binders
   b) Pattern
   c) Casting
   d) Metal
   v) In order the get a smooth casting, the size of the sand particles should be _____
   a) Coarse
   b) Fine
   c) Moderate
   d) Large
   vi) Which of the following is not used for the formation of the moulding sand?
   a) Silica Sand
   b) Binders
   c) Additives
   d) Coal

vii) The _____ is responsible for the impact strength in the molding sand.
a) Aggregates

b) Refractoriness
c) Impurities
d) Permeability
viii) The _____ property ensures the removal of excess sand in the mould box.
a) Adhesiveness
b) Cohesiveness
c) Green strength
d) Compressive strength
ix) The _____ is responsible for cavities in castings in the foundry.
a) Patterns
b) Sand
c) Cores
d) Riser
x) _____ cores cannot make long narrow features.
a) Green Sand
b) Dry-Sand
c) Metallic
d) Lost

2. What are the different types of sand molding processes? What are the basic steps in the green sand molding process? What are the differences between green sand molding and dry sand molding? 2+5+3=10

3. A mold dimension of 60 cm X 30cm X 14cm is to be fed by liquid metal using the top pouring method. The liquid metal height above the top surface of the mold is 14cm and the area of the gate is. Find the time taken to fill up the mold. Explain the investment casting process. 5+5=10

4. What is the application of loose patterns in the casting process? Why distortion allowance is important in casting? What is the importance of introducing the choke area to the sprue? How we can calculate the choke area? 2.5+2.5+3+2=10

5. What are the different types of patterns used in foundries? Explain match-plate patterns. Why pattern allowances is important for the casting process? Explain any one type of allowance. 2+5+1+2=10

6. What are the different types of testing procedures for molding sand in the industry? How AFS clay content can be determined in molding sand? How green compression test of molding sand can be performed? 2+5+3=10

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Subject: **FOUNDRY METALLURGY**

Time: 3hrs. Full Marks: 100

Part- II (50)

Instructions: Use Separate Answer scripts for each Part

(Attempt each Group (A, B &C) is compulsory

Group-A: *Answer any four questions with two liner explanations.* $4x2^1/_2= 10$

i) Bulls eye of S.G. iron. ii) Silicon in C.I, iii) Melting atmosphere, iv Blast in Cupola. v) Foundry Refractories, vi) Reverberatory Furnace.

Group-B: *Answer any one question.* 1x10

1. Describe microstructures of different cast irons, with the associated relations of mechanical properties due to Sulfur, Carbon, Silicon and Magnesium. How will you design a suitable grain refiner for Al-Si Alloy? 7+3

2. a) Differentiate between white and gray cast iron with respect to its microstructure, properties and applications.

Group-C: *Answer any two questions.* 2x15=30

3. "Most of the metallic glasses which have been identified to date required rapid solidification processing". What do you mean by metallic glass? Why rapid solid application is required for its formation? 7+8

4. In case of pure metal solidification deduce from first the principle the critical nucleus size and volume free energy relations with under cooling. Explain- why heterogeneous nucleation is common. 10+5

5. a) Discuss different features of Cupola design and operation.

   b) 'Suppose you are a Foundry expert of Raja Foundry in Lilua, Howrah and current job is Tubewell casting. The company has been facing regarding Rat Tails and Cold Shut.'- What will be your suggestion? 9+6

6. Discuss the following terms: *Answer any two questions* 6+6
   i. Super cooling and eutectic structures.
   ii. Grain refinement.
   iii. Directional solidification.