

This question paper contains 4 printed pages.

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Your Roll No.

MEM

J

Paper— ME.507

FOUNDRY TECHNOLOGY

Time : 3 hours

Maximum Marks : 100

*(Write your Roll No. on the top immediately
on receipt of this question paper.)*

Attempt any five questions.

All questions carry equal marks.

1. (a) What are inert moulds? What are their advantages and disadvantages? Differentiate inert moulds and aggregate moulds. 10
- (b) Explain various transformation zones in a green mould; assuming that it is full of molten metal which is solidifying. What defects in castings do normally occur due to expansion of silica sand? 10
2. (a) How does the 'silo' act to prevent sand segregation? Why is rubbing an essential part of any sand reclamation system? Explain a reclamation system you expect to see in a large Grey cast iron foundry doing green sand moulding. 10

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- (b) Explain foundry automation with a foundry layout doing aluminium die casting / gravity die casting. What is continuous casting process? Can it be adopted for aluminium? Why do we prefer all killed steel in casting by continuous casting process? 10
3. (a) What is ASTM grain size number? Under a metallurgical microscope the 5 cm diameter circular field of view reveals that there are 24 whole grains plus another 20 grains cut by the circumference.
- (i) If the magnification were 100X, what would be the ASTM grain size?
- (ii) What would be the ASTM grain size if the magnification were 500X? 10
- (b) What is an effective and efficient gating system? What types of gating systems are used for casting GCI? Discuss the difficulties in the design of gating system. 10
4. Draw Fe-C equilibrium phase diagram. A 10 gm ball bearing sphere is made of steel containing 1.1 wt% C. Suppose the ball is austenitized and slowly cooled to room temperature.
- (i) What is the weight of pearlite and total weight of ferrite present?

- (ii) What is the total weight of cementite present?
- (iii) What is the weight of cementite present in the pearlite?
- (iv) What is the weight of cementite present as proeutectoid phase? 20
5. (a) Explain why the length of 'Mushy Zone' in a solidifying casting is important. What variables affect this length? 8
- (b) Differentiate Homogeneous and Heterogeneous nucleation. A spherical nucleus forms during a solid state transformation and it is determined that surface energy (γ) = 0.2 J/m^2 and free energy difference (ΔG_v) = $-6.5 \times 10^6 \text{ J/m}^3$. Assume homogeneous nucleation.
- (i) What is the radius of the nucleus of critical size?
- (ii) What is the magnitude of nucleation energy barrier? 12
6. (a) Discuss the inoculation of GCI. Why do we generally add ferro-silicon for inoculation of GCI? Discuss the effects of following alloying elements in GCI:—
- (i) Chromium
- (ii) Silicon

- (iii) Magnesium. 10
- (b) What factors determine riser adequacy and riser economy? Compare critically the solidification of risers treated with insulating and with exothermic materials. 10
7. (a) How will you eliminate slag and dross from castings? What is core shift? Describe the measures that you would take to reduce core shifting in sand casting. 8
- (b) Briefly explain the casting defects that occur due to pouring rate too high or low. 6
- (c) What is interdendritic shrinkage? How can it be prevented? 6