

R2

INSTRUCTIONS: USE TWO ANSWER SCRIPTS (ONE for PART-A, ONE for PART-B)

N.B: Assume any data which is required, but not mentioned. Clearly mention in the respective answer script (s).

PART-A : (CASTING: 33 Marks & FORMING: 33 Marks)

Casting

A1. (a) What are the various differences between continuous and ingot casting processes? (b) What is constitutional under cooling? [6+5=11]

A2. Show the temperature distribution from liquid metal to sand mould during solidification. Derive

Chvorinov's Rule, $t_s \propto \left(\frac{V}{A}\right)^2$, where, t_s = time for solidification of liquid metal inside the sand mould,

V and A are the volume and surface area of the casting, respectively. [11]

A3. (a) A metal with melting temperature of 700°C is poured into the sand mould that is initially at 30°C . How thick must a mould be to be considered semi-infinite for times of 1 min and 15 min after pouring the metal? (Properties of sand mould given are: specific heat= $1.16\text{ J/g}^{\circ}\text{C}$, thermal conductivity= $0.6\text{ W/m}^{\circ}\text{C}$ and density= 1.5 g/cm^3).

(b) What are various factors influencing progressive solidification? [8+3]

Forming

A4. (a) Draw the Fe-Fe₃C phase equilibrium diagram and show the three main reactions. (b) Draw a schematic TTT diagram and show various types of phase transformation. (c) Why more stain is induced during austenite to martensite transformation ? [5+5+2=12]

A5. (a) Derive the force requirement in a single stage wire drawing process. Express it in terms of reduction of area. (b) What would be the (expression of) force requirement in case of frictionless drawing? [6+5=11]

A6. Write short notes on:

- (a) Friction hill in a rolling process.
- (b) Plane strain deformation
- (c) HCP crystal structure
- (d) Elastic and Anelastic deformation
- (e) Von-Mises' yield criteria

PART-B : (WELDING: 33 Marks)

- B1. (a) Explain how and why porosity occurs in fusion weld bead.
(b) Explain why damp flux coated electrodes should not be used for welding MS.
(c) Explain the significance of H, P, J, K in IS specification of coated electrodes.
(d) Explain arc blow and its influence on weld quality.
(e) Explain how embrittlement is formed during fusion welding.
(f) Metal transfer in a consumable electrode process. [12]

B2. Fusion welded joint produces a continuous structure. List a few merits and demerits for such a welded constructions. [10]

B3. What are the different types of power sources used in welding? What are the advantages and disadvantages of changes in polarity with DC welding. [11]

1 mark for good handwriting and neat sketching, wherever required.

Best wishes from the Course Instructors