WEST BENGAL UNIVERSITY OF TECHNOLOGY

ME-403

PRIMARY MANUFACTURING PROCESSES

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP A
(Multiple Choice Type Questions)

1. Answer *all* questions. $10 \times 1 = 10$

(i) In metal rolling, the metal is stronger

(A) in the direction of grain flow (B) perpendicular to grain flow
(C) 45° angle to grain flow (D) equally in all direction

(ii) Blocking operation in forging is

(A) finishing operation (B) first operation
(C) semi finishing operation (D) flash removing operation

(iii) Operation of cutting a specified small portion of metal towards the edge of the job is called

(A) nibbling (B) notching (C) trimming (D) shaving

(iv) The main criterion for selection of electrode diameter in arc welding is

(A) material to be welded (B) type of welding process
(C) thickness of material (D) voltage used

(v) Pig iron is obtained from iron ore, in a blast furnace by the process of

(A) oxidation (B) reduction

(C) carbonation (D) desulphurization

(vi) Seamless tube is produced by

(A) pierching (B) spinning (C) blanking (D) sliting

(vii) Feeding is considered to be difficult if centre-line feeding resistance (CFR) is

(A) greater than 25% (B) greater than 50%

(C) greater than 75% (D) greater than 90%

(viii) For electron beam welding the pressure is usually maintained to

(A) 10^{-3} mm of Hg (B) 10^{-4} mm of Hg

(C) 10^{-2} mm of Hg (D) 10^{-5} mm of Hg

(ix) Chills are used in casting moulds to

(A) achieve directional solidification

(B) reduce blow hole

(C) reduce freezing time

(D) increase the smoothness of the casting surface

(x) Compared to hot rolling, cold rolling

(A) requires lesser force (for same reduction)

(B) enables larger reduction (in thickness)

(C) provides less accuracy

(D) provides better surface integrity

GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. Why allowances are kept in pattern making? Enumerate various pattern makers allowances briefly. 2+3

3. (a) Explain the principle of 'resistance welding' and its advantages. 2+3

(b) Two steel sheets of 1.0 mm thick are resistance welded in a lap joint with a current of 10000 A for 0.10 s. The effective resistance of the joint can be taken as 100 micro ohms. The joint be considered as a cylinder of 5mm diameter and 1.5 mm height. The density of steel is 0.00786 g/mm^3 and heat required for melting steel is 10 J/mm^3. Determine the percentage of heat lost to the surroundings.

4. Using an open-die forging operation, a solid cylindrical piece of stainless steel having 100 mm diameter x 72 mm height is reduced in height to 60 mm at room temperature. Assuming the coefficient of friction as 0.22 and the flow stress for this material at the required true strain as 1000 Mpa, calculate the forging force at the end of hammer stroke. 5

5. (a) What is the significance of 'permeability number' in green sand molding? 2+3
(b) Calculate the permeability number of a sand specimen if it takes 1 min 15 s to pass 2000 cm^3 of air at a pressure of 6 g/cm^2, through a standard specimen of length and diameter 50.8 × 50.8 mm.

6. Briefly describe centrifugal casting. 5

GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. (a) Find the time taken to fill up a cylindrical casting of 40 cm diameter and 20 cm height by a sprue having gate diameter of 2 cm in the case of top gating and bottom gating. The static head available for filling metal in both cases is 25 cm. 5+7+3
(b) Describe various types of forging.
(c) What is strain hardening and its effect?

8. (a) Describe Laser Beam Welding with a neat sketch. What is the advantage of Laser Beam Welding over Electron Beam Welding? 8+4+3
(b) Describe directional solidification and method of achieving the same.
(c) Why is the metal pattern heated during making the mould for shell mould casting?
(d) What is core print and its function?

9. (a) Explain the relevance of the facing sand towards the casting quality. Name the facing sand normally used. 4

(b) A sample of 50 g sand was taken and placed on the top sieve of standard stack of sieves in a sieve shaker device. After shaking the sieve-set for 15 minutes, the amount of sand retained in each sieve and pan is given in the following table. Determine the grain fineness number and specify the application for which this sand is suitable. 6

AFS Mesh Number	6	12	20	30	40	50	70	100	140	200	270	Pan
Multiplier	3	5	10	20	30	40	50	70	100	140	200	300
Sand weight retained	0	0	2	3	2.5	5	6	5	14	4	3	5

(c) Explain with a suitable sketch the hot-chamber die casting process. Compare this with cold-chamber die casting process. 5

10.(a) Explain the effect of friction and lubrication in metal forming processes. 3+2+4+6

(b) Enlist different types of forming defects and explain any two of them.

(c) A strip with a cross-section of 150 mm x 6 mm is being rolled with 20% reduction of area, using 400 mm diameter steel rolls. Before and after rolling, the shear yield stress of the material is 0.35 kN/mm^2 and 0.4 kN/mm^2, respectively. Calculate (i) the final strip thickness, (ii) the average shear yield stress during the process. (iii) the angle subtended by the deformation zone at the role centre.

11.(a) Determine the die and punch sizes for blanking a circular disc of 20 mm diameter from a C20 steel sheet whose thickness is 1.5mm. Also compute the punching force exerted and the necessary stripping force. Shear strength of annealed C20 steel is 294 MPa. 5+5+5

(b) Explain the principle of rolling with a neat sketch. Describe with sketches different kinds of rolling mills.

(c) Compare between closed die forging and open die forging.

12.(a) Explain submerged arc welding process and its advantages over other arc welding process. 8

(b) Mention and explain with sketches the various types of flames that are used in gas welding. 7