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ME 181801

Roll No. of candidate

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2023

B.Tech. 8th Semester End-Term Examination

MANUFACTURING METHODS

(New Regulation w.e.f. 2017-18 & New Syllabus w.e.f. 2018-19)

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks for the questions.

Questions 1 to 8 are compulsory. Answer any *one* question from the rest.

1.   Multiple choice questions   (10)

   (i)   Converging passage (sprue) for feeding liquid metal into the mould is used
         to   (1)
         (a)   Increase the velocity of the liquid metal
         (b)   Reduce the mould filling time
         (c)   Avoid aspiration of air
         (d)   Decrease waste of liquid metal

   (ii) Considering no frictional and other losses, velocity (in m/s) of the liquid
         metal at the bottom of the sprue of height 30 cm would be   (1)
         (a)   1.326   (b)   2.426
         (c)   3.126   (d)   5.886

   (iii) The ratio of solidification time for a solid cylinder of diameter D and height
         D and a solid cube of side L of same material is equal to   (2)
         (a) D/L (b) $(D/L)^2$
         (c) L/D (d) $(L/D)^2$

   (iv) Infiltration refers to which of the following in powder metallurgy (PM)
         processing?   (1)
         (a)   Filling the pores of the PM part with a low melting point molten metal
         (b)   Soaking oil by capillary action into the pores of a PM part
         (c)   Filling the pores of the PM part with polymers
         (d)   Mixing additives during mixing and blending stage

                                                                  [Turn over

(v) To get uniform thickness in the width direction of a plate in cold rolling operation, rolls must be provided with   (1)

   (a) Offset   (b) Low rpm

   (c) Front and back tension   (d) Camber

(vi) In case of indirect extrusion, extrusion load   (1)

   (a) Increase linearly

   (b) Decrease linearly

   (c) Increases linearly and then remains approximately constant

   (d) Increases linearly then decreases gradually

(vii) The term "vehicle" in lapping refers to   (1)

   (a) The coolant used

   (b) The conveyor belt used to transfer products

   (c) The abrasive used

   (d) The lubricants used to retain the abrasive grains

(viii) A circular blank of 35 mm diameter is to be punched out from a steel sheet metal of 2 mm thickness. The radial clearance between punch and die is 0.04 mm. The punch and die sizes are _____ and _____ respectively.   (2)

   (a) 34.92 mm and 35 mm   (b) 35 mm and 34.92 mm

   (c) 34.92 mm and 35.08 mm   (d) 34.92 mm and 35.04 mm

2. A cylindrical riser with diameter to height ratio of 0.5 is to be designed for a sand casting mould for a steel rectangular plate casting having dimensions 10.0 cm × 8.0 cm × 2.0 cm. Determine the dimensions of the riser using NRL method. Variation of volume ratio with shape factor is shown in figure below. (7)
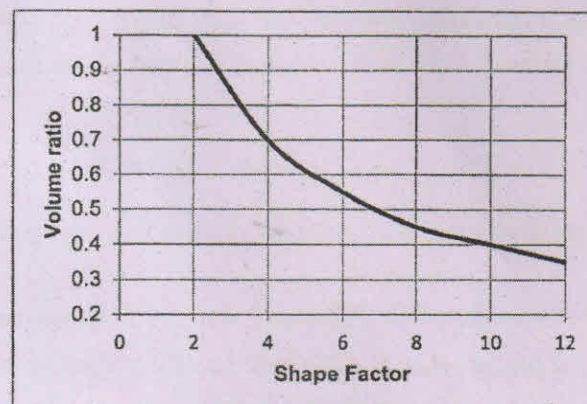
3. A rectangular metal plate of 200 mm wide and 30 mm thick is to be reduced in a two-high rolling mill to a thickness of 10 mm. Entrance velocity = 18m/min, roll velocity = 20 m/min. The diameter of roll = 600 mm. Coefficient of friction is 0.1. Determine (7)

   (a) Minimum number of passes required

   (b) Rolling Force in the first pass,

   (c) Rolling torque in the first pass and

   (d) Rolling power (total) in the first pass

   The work material has a flow curve defined by the equation $\sigma = 250\varepsilon^{0.1}$

4. A cylindrical part is warm upset forged in an open die. The original diameter and height of the part are 45 mm 35 mm, respectively. Final height of the part is 20 mm. Coefficient of friction at the die-work interface = 0.2. The work material has a flow curve defined by the equation $\sigma = 600\varepsilon^{0.1}$. Determine the forging force in the operation. (7)

5. A cylindrical billet that is 100 mm long and 50 mm in diameter is reduced by indirect (backward) extrusion to a 15 mm diameter. Die angle = 90°. If the Johnson equation has a = 0.8 and b = 1.5, and the work material has a flow curve defined by the equation $\sigma = 700\varepsilon^{0.15}$. Determine the ram force when the billet length is 60 mm. (7)

6. A steel wire of 10 mm diameter and 100 mm length is drawn in a wire drawing operation in two stages at an initial drawing speed of 0.4 m/s. The diameter is reduced by 20% in each stage. The work material has a flow curve defined by the equation $\sigma = 500\varepsilon^{0.3}$. Determine the drawing force and power in the second stage of drawing. (Neglect friction and strain hardening). (8)

7. A hole of 50 mm diameter is to be made in a steel plate of 5 mm thickness by punching operation. The ultimate shear strength (τ) of the material is 500 MPa. The radial clearance c is given by the equation $c = 0.0032t\sqrt{\tau}$ mm, where t is the stock thickness is mm. Punching has been done with 40% penetration of the punch. Assume 5 mm shear provided on the punch. Without elastic recovery. Determine punch and die sizes, and punching force (kN). (7)

8. A cup of 10 cm height and 8 cm diameter is to be made from as steel sheet of 2 mm thickness. Determine (a) blank size, (b) number of draws required, (c) reduction in each draw and (d) drawing force in the first draw. The yield strength of the material is 430 MPa. (7)

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Answer any *one* from the following questions.

9. Analyse the selection and influence of Stand-Off Distance (SOD) in an unconfined explosive forming process. (10)

10. Recommend a suitable surface finishing operation with all details for finishing an IC engine cylinder. (10)

11. With a typical setup, explain the gear hobbing process. (10)