Time: 2 Hours   Full Marks: 35

Write all answers in a SINGLE answer-script.
Answer any FIVE questions

1 (a) Discuss on the frictional force, pressure distribution, neutral point and effect of the coefficient of friction across the roll gap in rolling process with neat sketches.
(b) A 250 mm wide annealed brass strip is rolled from a thickness of 20 mm to 12 mm. If the roll force (per roll) is limited to 6000 kN, determine the roll size required. If the roll speed is 100 rpm, calculate the power required per roll in kW. Assume K=900 MPa & n= 0.49 for this material.

[3+4]

2 (a) Draw a sketch of a drawing die.
(b) What do you mean by optimum die angle?
(c) For the drawing of a cylindrical rod prove that

$$\sigma_{xa} = \sigma_o \left(\frac{1+B}{B}\right)\left[1 - \left(\frac{D_a}{D_b}\right)^{2B}\right]$$ (symbols have their usual meaning)

[1+2+4]

3 (a) What do you mean by 'flash' of a forged part ? What is flashless forging?
(b) Calculate the press capacity (in kN) to forge a steel billet of dimension 500x500x300 (length x breadth x height, in mm) to reduce its height by 20% maintaining a square cross-section (enlarged) under (a) partially lubricated condition (μ=0.3) (b) no lubrication. Assume average yield stress for the process = 120 MPa.

[2+5]

4. (a) What do you mean by front or back tension in rolling?
(b) Determine the rolling schedule for cold rolling of plain carbon steel strips from 400 x 3.00 (mm) to 400 x 2.4 (mm) with 150 mm diameter roll diameter rolls. Roll load (per roll) may not exceed 1000 kN. Take K=580 MPa, n=0.18 for the material.

[3+4]

5. (a) Explain how pipes can be extruded in (a) direct extrusion (b) indirect extrusion.
(b) A round aluminium billet of 150 mm length and 50 mm diameter is to be extruded to a diameter of 40 mm of round cross section. Assume K=350 MPa and n=0.17; a=0.8, b=1.2. Calculate the force to be applied at the starting of the process for (a) indirect extrusion (b) direct extrusion.

[3+4]

6. (a) What is impact extrusion ? Explain with diagram.

(b) A billet 400 mm long and 25 mm diameter is to be extruded in a direct extrusion process. The extruded cross-section having thickness = 5 mm is given below:

12 mm

25 mm
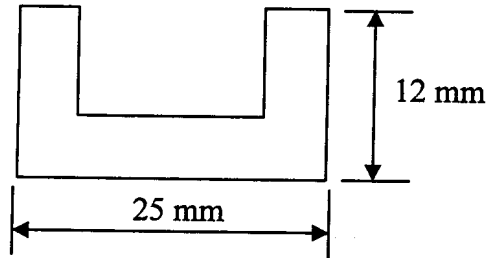
Take K=430 and n=0.19 for the work material. For Johnson's formula, assume a=0.8 and b=1.4. Calculate the ram force at stroke length= 400,300,200 & 100 mm and make an approximate plot. Use the shape factor formula as below:

$$K_s = 0.98 + 0.02 \left(\frac{C_x}{C_c}\right)^{2.25}$$

[2+5]

7. Discuss with example and sketches on the three methods (a) slab method or the conventional method (b) slip-line & hodograph (c) finite element method for estimating the forces required for a bulk deformation process.

[2+2+3]