BACHELOR OF PRODUCTION ENGINEERING EXAMINATION, 2018

3RD Year-2nd Semester

MATERIAL FORMING

Time: 3 hours Full Marks 100

Answer any TWO questions from EACH group.
All parts of a question (a, b etc) should be answered a one place.

GROUP—A

1. When a compressive force of 400 tons (metric) is applied to the top surface of a well lubricated cube it just causes plastic flow. The cube is 80mm on each edge. What force would be required to produce flow if the face of the cube other than the top were constrained by die forces 100 and 200 tons?

10

2. Show that at the point of necking,

$$\frac{d\sigma}{d\varepsilon} = \sigma \quad \text{and} \quad \frac{d\sigma}{d\phi} = S$$

where σ = true stress, ε = true strain
and S = engg. stress, φ = engg. strain.

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3. Fig.1 shows initial configuration (i. e. before application of load) of a structure consisting of two bars AC and BC pin-jointed at A, B and C and their initial cross-sectional area is A_0. Bars AC and BC are of metal whose true stress and engineering strain curve is expressed by $\sigma=B\varphi^m$. Considering tensile instability show that

$$W_{max} = 2A_0 Bm^m (1-m)^{1-m} \sqrt{1-\left\{\frac{h_0(1-m)}{l_0}\right\}^2}$$

Where W_{max} is the maximum load, the truss can carry.

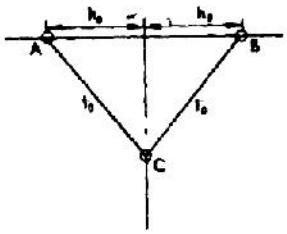

Fig.1

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GROUP—B

4. Find out the drawing stress and maximum possible reduction of area for frictionless drawing of cylindrical rod with no back pull.

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5. A steel wire is drawn from an initial diameter of 127 mm to final diameter of 102 mm at a speed of 90 m/min. The half-cone angle of the die is 6° and the coefficient of friction at the job-die interface is 0.1. A tensile test on the original steel specimen gives a tensile yield stress 207 N/mm^2. A similar specimen shows a tensile yield stress of 414 N/mm^2 at a strain of 0.5. Assuming a linear stress-strain relationship for the material, determine the drawing power and the maximum possible reduction with the same die. No back tension is applied.

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6. The following equation expresses the pressure for the extrusion of aluminum bar:

$$p = \sigma_0(0.47 + 1.2\ln R)e^{4\mu L/D}$$

Billets 200 mm in diameter and 400mm long are extruded into 19mm diameter bars. In order to increase the length of the product by 3m, would it be more economical in terms of pressure to increase the billet length or the diameter? (Assume μ =0.1)

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GROUP—C

7. Derive an expression for deep drawing force. Indicate the assumptions.

15

8 Determine the total forging load per unit width of the flat workpiece forged between a fixed platen and moving platen considering sliding (Coulomb) friction throughout the interface. State different assumptions clearly.

15

9. Derive expressions for pressure distribution in forging of a cylindrical disc considering both sliding and sticking friction.

15

GROUP-D

10. Determine the roll pressure for strip rolling with front and back tensions indicating the assumptions used in the method of roll pressure evaluation.

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11 Estimate the maximum bending force required to carry out bending operation. Write the assumptions clearly.

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12 (a) What are the adverse and beneficial effects of friction? Explain the purpose of lubrication.
(b) Discuss the advantages and limitations of hot forming.

7+8