



Name :
Roll No. :
Invigilator's Signature :

CS/M. Tech (ME)/SEM-2/MME-204/1/2013

2013

**ADVANCED METAL FORMING AND JOINING
PROCESSES**

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Answer any *five* of the following. $5 \times 14 = 70$

1. a) Distinguish between Coulomb's friction and constant friction factor (μ). 4
- b) Derive an expression for pressure distribution in case of plane strain forging of a plate :
 - i) With Coulomb's friction at the interface.
 - ii) With constant friction factor at the interface.

Also draw the pressure distribution curve. 10

2. a) Draw a typical true-stress strain curve for a ductile material and explain it. Compare this curve with engineering stress-strain curve and load extension curve. 7

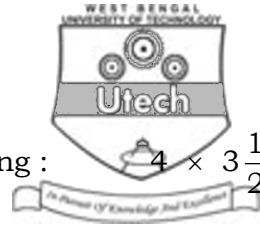


- b) Draw the various ideal stress strain curve and corresponding dynamic model. Explain briefly. Correlate the true stress (σ) and true strain (ϵ) with Engineering stress(s) and Engineering strain(e). 7
3. a) How yield criteria is described by the following :
i) Vonmises
ii) tresca ? 4
- b) Derive an expression relating the internal fluid pressure, p for a thin tube of radius, r and thickness, t for fully plastic condition. Perform the calculations both for tresca and vonmises yield criteria. What will be the work done if the cylinder radius is increased by 20% ? Make calculation for plane strain and plane stress cases. 10
4. Sheet steel is reduced from 4.0 to 3.5 with 500 mm roll diameter having a coefficient of friction equals to 0.04. The mean flow stress in tension is 205 MPa. Neglect strain hardening and roll flattening.
- a) Calculate the roll pressure at the entrance to the rolls, the neutral point, and the roll exist.
- b) If $m = 0.4$, what is the roll pressure at the neutral point ?
- c) If 35 MPa front tension is applied in 4 (a), what is the roll pressure at the neutral point ?



5. a) Prove Hencky's theorem for sliplines. 5
- b) Derive Hencky's equation for sliplines. 5
- c) Present the slipline field and hodography for Extrusion through a perfectly smooth wedge-shaped die of semi angle, α of reduction, $r = 2 \sin \alpha / (1 + 2 \sin \alpha)$. 4
6. a) Explain with neat sketch the principle of ultrasonic beam welding. 7
- b) Discuss the advantage and disadvantage of ultrasonic beam welding along with the application. 7
7. a) Why is it necessary to provide clearance between punch and die in a shearing operation ? Give reason. 4
- b) Explain the function of the following components with reference to sheet metal dies :
 - (i) Pilots
 - (ii) Back gauge
 - (iii) Dowel pin
 - (iv) Die stop. 4
- c) Distinguish between bending and drawing in sheet-metal operations. 3
- d) A sheet which has already been bent in a cold state offers great resistance to further bending. Explain the reason. 3

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8. Write short notes on any *four* of the following :

$4 \times 3\frac{1}{2}$

- a) Welding of stainless steel
- b) High energy rate forming process
- c) Hysteresis effect in plastic working
- d) Laser beam welding
- e) Formability of sheet metal
- f) Yield locus.

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