

Total Pages—4

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26.04.16

(Set-K)

B.Tech-6th
Theory of Metal Forming

Full Marks : 70

Time : 3 hours

Answer Q.No.1 and any **five** from
the remaining questions

The figures in the right-hand margin indicate marks

1. Answer the following questions : 4 2 × 10
- (a) Define true stress and true strain. State the importance of true strain in metal forming.
 - (b) Represent on a stress-strain diagram the dynamic model for elastic perfectly plastic situation in metal forming.
 - (c) Represent the principal stresses on a Mohr's circle for a situation where $\sigma_1 = \sigma_2 = 0$ and it is uniaxial compression.
 - (d) Describe the Bauschinger effect as observed in reversal of stress.

(2)

- (e) State and explain the Tresca Yield criteria to explain the maximum shear stress phenomenon.
- (f) Draw the yield locus for Von mises yield criteria.
- (g) State the Levy-Mises Equation to describe incremental plastic strain.
- (h) Describe friction hill in a rolling processes.
- (i) Show with a sketch the dead zone in an extrusion process. Why does such a zone appear?
- (j) State and explain the concept of hydrostatic extrusion.
2. (a) Using stress tensor in 2 dimensions, show that the normal and shear stresses at any point lie on the periphery of a circle. 4
- (b) The state of strum at a point is given by $\sigma_x = 2 \text{ KN/m}^2$, $\sigma_y = 5 \text{ kN/m}^2$, $\tau_{xy} = 1 \text{ KN/m}^2$. All other stress components are zero. Determine the stress invariants if the material is plastic. 6

(3)

3. (a) State the upper Bound theorem. What is velocity discontinuity? Describe principles of metal flow at the boundary between two zones in velocity field. 4
- (b) Derive an expression for power required for deformation in a plane-strain forging process. 6
- (a) State Haneky's theorem on slip line field property. Show with a sketch the slip lines (hodograph) for a plane strain wedge indentation. 5
- (b) State the advantages of lubrication in metal forming operation. Explain the different types of defects that occur in forging, extrusion and deep drawing without application of lubricant. 5
5. (a) Explain the concept of deformation by slip. 3
- (b) Derive an expression for pressure in an axis symatric extrusion process using slab method. 7

6. (a) Describe a deep drawing operation and represent stresses at a point in the sheet metal. Derive an expression for the punch force required for deformation. 6

(b) Derive Von-Karman's equation for cold rolling. State the assumptions made. 4

7. Answer any four :

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

(a) Lower bound theorem

(b) Strain rate effect in cold working

(c) Anisotropy in Yielding

(d) Deviatoric stress

(e) Residual stress.