

[Total No. of Questions - 8]  
(2123)

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M. Tech 1st Semester Examination

Metal Forming

PE-103

Time : 3 Hours

Max. Marks : 100

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt any 5 (five) questions. Marks of questions are indicated against each question. Draw neat and comprehensive sketches wherever necessary to clearly illustrate your answer. Assume missing data suitably if any and specify the same.

1. (a) Define plasticity. State its effects in metal forming. Explain the importance of plasticity with reference to the hot and cold working of metal forming. What is plastic incompressibility? Explain in detail.
  - (b) Define true-stress and strain with the help of the true-stress-strain curve.
  - (c) A mild steel rectangular specimen of length 120 mm is extended to 140 mm. Neglecting the elastic deformation and taking that material is isotropic, determine the true strains in length, width and thickness directions.  
[(2+3+4+3)+5+3=20]
2. (a) State and explain the Tresca maximum sheer-strain energy criterion.
  - (b) State and explain the Poisson's ratio for plastic deformation flow rule. How this rule affects on the strain hardening function? Explain.

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- (c) What is the effect of heat generation and heat transfer on metal forming processes? Explain with suitable examples.  
(5+(5+4)+6=20)
3. (a) Write the procedure for prediction of working loads during wire drawing and tube drawing process. Consider suitable examples for both the processes and answer the question. Give suitable sketches in support of the examples.
- (b) Write the name of the various parameters affecting the process of strip drawing. Explain in detail how these parameters are affected on strip drawing.
- (c) A round rod of annealed brass 70-30 is being drawn from a diameter of 5 mm to a diameter of 3 mm at a speed of 0.5 m/s. Assume that the frictional and redundant work together constitutes 35% of the ideal work of deformation. Determine the working load required for this operation.  
(10+(1+4)+5=20)
4. (a) State and explain the principle and mechanism of lubrication in metal forming.
- (b) What is hydrodynamic and their film lubrication? Explain. Explain the process of hydrodynamic lubrication in metal forming with a simple sketch.
- (c) Write the name of the various defects occurred during metal forming processes. Explain the causes of defects during rolling with simple sketches and their remedial actions.  
(5+(3+5)+(2+5)=20)
5. (a) State and explain the basic theory of deep drawing of circular blanks. Give simple sketch in support of your answer.
- (b) Write the name of the various parameters affecting the deep drawing process. Explain in detail how these parameters are affected on deep drawing.

- (c) What is ironing? Write its disadvantages in reference to the deep drawing operation.  
(8+(2+5)+5=20)
6. (a) How rolling mills are classified? Explain the rolling process with a simple sketch showing at least three stages of rolls.
- (b) Deduce an expression for prediction of roll pressure for flat strip rolling in the leading and lagging zones. Assume suitable notation for this expression and specify the same.
- (c) State and explain the various factors which affect rolling force.  
(2+6)+8+4=20)
7. (a) Explain the process of tube drawing with a suitable sketch.
- (b) State the procedure in brief to predict the working load for plain strain forging of disc under condition of well lubrication.
- (c) A 300 mm wide strip 25 mm thick is fed through a rolling mill with two powered rolls each of radius 250 mm. The work thickness is to be reduced to 22 mm in one pass at a roll speed of 50 rev/min. The work material has a flow curve defined by  $K = 275 \text{ MPa}$  and index  $(n) = 0.12$ . Determine the roll force and torque to drive each roll. Given, average flow stress  $(Y_f) = K \cdot \epsilon^n / (1 + n)$  and true strain  $(\epsilon) = \ln(t_0/t_f)$ , where,  $t_0$  = starting thickness and  $t_f$  final thickness in mm.  
(6+5+9=20)
- Write short notes on the followings:
- (a) Boundary and extreme pressure lubricants in reference to the lubrication in metal forming.
- (b) Radial stress and punch load in deep drawing.
- (c) Front tension and back tension and their affect in rolling of metal.
- (d) Cold drawing and applications of solid lubricants in cold drawing.  
(5×4=20)