

III B.Tech II Semester Regular Examinations, Apr/May 2008
METAL FORMING
(Production Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain about the deformation process in ductile metals such as copper or aluminium.
(b) Define and explain viscous flow.
(c) Describe briefly the reasons for permanent deformation in materials. [8+4+4]
2. (a) Explain the effects of % cold work on the formability of the material.
(b) Explain the effects of the following on the recrystallization temperature.
i) addition of alloying elements
ii) Purity of metals
iii) Grain size. [6+10]
3. (a) Explain the three regions in the stress-strain rate behaviour of a superplastic material.
(b) Explain the mechanism of superplasticity by grain-boundary sliding method. [8+8]
4. Describe the important features of different types of mechanical presses used in drawing operation. Explain them in detail. [16]
5. (a) What is Forging? Draw neat diagrams of Forging equipment and indicate their characteristic features.
(b) Discuss in detail the forging process in plane strain with Coulomb friction. [9+7]
6. (a) Define the following terms in rolling of metals:
i. Specific roll pressure
ii. Angle of contact
iii. Forward slip
(b) Discuss the common defects in rolled products and the means of eliminating them. [9+7]
7. Discuss the effect of:-
(a) the type of extrusion,
(b) the extrusion ratio
(c) the working temperature and

- (d) speed of deformation on the force required to cause extrusion. [4×4]
8. (a) Explain wire drawing and tube drawing operations.
- (b) Describe briefly production of seamless pipes.
- (c) What is the treatment given for successful drawing of high carbon music and spring wires? [8+5+3]

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1. (a) Why is the stress-strain curve has a positive slope beyond the elastic limit? Explain
(b) Why specimens during tensile test may neck down to a point, before fracture occurs? Explain
(c) Explain the following:
Breaking stress; ultimate tensile stress; yield stress. [5+5+6]
2. (a) What is full annealing process? What are the various stages in the process. Explain all the stages in detail.
(b) Explain why pure metals have low recrystallization temperatures as compared with impure metals and alloys. [10+6]
3. (a) Explain the three regions in the stress-strain rate behaviour of a superplastic material.
(b) Explain the mechanism of superplasticity by grain-boundary sliding method. [8+8]
4. (a) Many missile components are made by spinning. What other methods could you use if spinning process were not available? Explain.
(b) Discuss the applications of metal spinning and compare its advantages with those of other metal forming processes. [8+8]
5. (a) Explain various forging operations.
(b) Derive an equation for forging pressure in case of a cylindrical plate under plane strain conditions with coulomb friction. [7+9]
6. (a) With the help of a neat sketch show rolling load and discuss the limiting condition for driving the ingot or fillet inside the rollers.
(b) A steel plate 20mm thick is to be rolled to 14mm in a four high mill having rod diameter of 480mm of yield stress 12 Kg/mm². Determine the following:
i. Angle of bite
ii. Coefficient of friction if this the maximum reduction possible.
(c) Explain briefly cluster roll stand, with the help of a neat sketch. [6+5+5]
7. (a) Compare and contrast direct extrusion with indirect extrusion.
(b) What is the effect of friction on the stresses acting on an extrusion die?

- (c) Discuss briefly cold and hot extrusion. [5+5+6]
8. (a) What is the purpose of using mandrel during tube production
- (b) Discuss various methods to reduce wall thickness of a tube. [6+10]

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1. (a) Explain how the % elongation and % reduction in cross sectional area of a material related to its ductility and brittleness.
(b) Explain what is anisotropic yielding.
(c) How plastic instability can be related to forming process? Explain .
[7+4+5]
2. Write short notes on the following:
(a) Recovery
(b) recrystallization
(c) Grain growth
[5+6+5]
3. Explain the following:
(a) Off spring grains
(b) Coarsse equi-axed grains
(c) strain rate sensitivity
(d) super plastic materials
[4×4]
4. (a) Many missile components are made by spinning. What other methods could you use if spinning process were not available? Explain.
(b) Discuss the applications of metal spinning and compare its advantages with those of other metal forming processes.
[8+8]
5. (a) Discuss the basic types of forging equipments. Distinguish between press forged and drop forged components in terms of microstructure and properties.
(b) What are the causes and remedies for common forging defects?
[9+7]
6. (a) Describe, with the help of a neat sketch, the cluster roll stand.
(b) Discuss various problems and defects in rolling.
(c) Discuss 4 important problems and defects on rolled products and explain briefly means of eliminating them.
[5+6+5]
7. (a) Discuss the effect of extrusion variables on extrusion pressure.
(b) Describe briefly the extrusion of tubing.
[10+6]
8. (a) Describe how to determine the redundant deformation of drawn wire.

- (b) What is limit of drawability for steady-state wire drawing?
- (c) Discuss the common defects in drawn rods and wires and indicate the remedies for them. [5+4+7]

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1. (a) You are given the equation for the true stress true strain curve of the materials. Is this information sufficient to determine, which material is tougher. Explain.
(b) Describe stress-strain curve and flow curve for a ductile metal. [6+10]
2. (a) Explain the importance of friction in the analysis and working of metal forming.
(b) For equal amounts of cold working more strain hardening is introduced into initially fine grained metal. Give the necessary explanation. [10+6]
3. (a) Give the names of some superplastic aluminium alloys, giving their composition, working temperature, strain rate sensitivity values.
(b) What are the alloys in which grain refinement by phase separation takes place?
(c) Explain the superplastic behaviour of Ti-6Al-4V alloy [8+2+6]
4. (a) Make a list of common bending operations. Explain them fully give in application for each one of them.
(b) Explain why the tubes buckle when bent. [10+6]
5. Write a short notes:
 - (a) Classification of Forging processes.
 - (b) Briefly discuss cold forging of steel components.
 - (c) What defects are found in forging process? Give their sources of occurrence and remedies. [5+4+7]
6. (a) Describe rolling of bars.
(b) List the advantages and disadvantages of hot working of metals.
(c) Indicate the assumptions made in the theory of rolling. Derive Von Karman's equation. [4+5+7]
7. (a) Explain the deformation of a metal during extrusion and possible defects.
(b) An aluminium alloy is hot extruded at 400°C at 50mm s⁻¹ from 150mm diameter to 50mm diameter. The flow stress at this temperature is given by $\sigma = 200 (\epsilon)^{0.15}$ (Mpa). If the billet is 380 mm long and the extrusion is done through square dies without lubrication, determine the force required for the operation. [9+7]

8. (a) Explain wire drawing and tube drawing operations.
(b) Describe briefly production of seamless pipes.
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