

III B.Tech. II Semester Regular Examinations, April/May -2005
METAL FORMING
(Production Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Distinguish between engineering stress strain diagram and true stress strain diagram. How they relate to each other.
(b) Details of a specimen subjected to tensile test are given below:
Initial diameter = 12 mm
Gauge Length = 50 mm
Maximum Load = 90 KN
Fracture Load = 70 KN
Diameter at Fracture = 10 mm
Calculate
 - i. True Fracture stress
 - ii. Engineering stress at maximum load
 - iii. True strain at Fracture
 - iv. Engineering strain at fracture
2. (a) Describe the concept of 'Work Hardening=' process. In what way it will be helpful for metal deformation.
(b) Explain the following terms:
 - i. Recovery
 - ii. Recrystallization
 - iii. Grain growth
 - iv. Strain Hardening
3. (a) With the help of diagram, explain 'shear spinning' operation, its practical applications, advantages and limitations.
(b) Explain the concept of 'Springback' in Bending operation. What are its units ? How the springback can be controlled?
4. (a) Sketch a Knuckle joint press with details and indicate the elements.
(b) List out different presses that are classified on number of drive gears. Briefly explain. In what way the capacity of hydraulic press can be specified. How it can be varied ?
5. (a) Discuss the reasons and remedies for defects in drawing.
(b) Explain the process of Tube extrusion? How the Seamless tubes are manufactured?

6. (a) Discuss how hydrostatic extrusion helps in improving complexity of extruded parts. Mention its limitations. List out various lubricants used in this process.
- (b) Calculate the drawing load required to obtain 30% reduction in area on a 12 mm diameter copper wire.
Following data is given: $\sigma_0 = 240 \text{ N/mm}^2$ $2\alpha = 12^\circ$ $\mu = 0.10$ Also calculate the power of the electric motor if the drawing speed is 2.3 m/sec. Take efficiency of motor as 98%.
7. (a) Sketch and describe the various sequence of operations in forging of an automobile connecting rod.
- (b) Discuss various forging defects mentioning reasons and remedies. Suggest suitable methods of reducing them in forged components?
8. (a) Why do we require different classification of rolling mills used in practice. Mention their relative advantages and applications.
- (b) How do you analyse the principles of roll pass design for different product shapes.

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1. Explain the terms:
 - (a) "True Stress" and "True Strain". How they differ from the concepts of Engg. Stress and Engg. Strain
 - (b) Discuss the relationships between
 - i. True stress and Engineering stress
 - ii. True strain and Engineering strain
2.
 - (a) Discuss the various types of crystal structures of metals with neat sketches.
 - (b) Differentiate between Edge dislocation and Screw dislocations, with neat sketches.
3.
 - (a) With the help of diagram, explain 'shear spinning' operation, its practical applications, advantages and limitations.
 - (b) Explain the concept of 'Springback' in Bending operation. What are its units ? How the springback can be controlled?
4.
 - (a) Sketch and explain the working of a transfer die used in practice. Explain various elements used for it.
 - (b) Differentiate between Compound, Combination and Progressive dies.
5.
 - (a) How the size of a blank is calculated for drawing a cup ? Explain the effect of following parameters on component produced.
 - i. Draw Die radius.
 - ii. Drawing Speed
 - (b) A cold rolled steel cup with an inside radius 30 mm and a thickness 3 mm is to be drawn from a blank of radius 40 mm. The shear yield stress and the maximum allowable stress of the material can be taken as 210N/mm^2 and 600N/mm^2 respectively.
 - i. Determine the drawing force, assuming that the coefficient of friction $\mu = 0.1$ and $\beta = 0.05$.
 - ii. Determine the minimum possible radius of the cup which can be drawn from the given blank without causing a fracture.
6.
 - (a) Discuss the effects of friction and lubrication in Tube Drawing and Deep Drawing operations.
 - (b) Discuss the various defects that are found in Deep Drawing and compare with defects in extruded products.

7. (a) Determine the forging load at the start and completion of hot forging of a steel billet for the following data:
Billet Size:
Length = 2 metres
Width = 0.8 mts
Thickness = 0.2 mts
Tool bite = 0.3 mts
Yield stress = 50 Mpa at start = 150 Mpa at completion of forging Reduction in forging = 50%.
- (b) Discuss Orbital Forging with a neat sketch. Mention its relative merits and applications?
8. Write short notes on the following:
- (a) Types of Roll materials
 - (b) Process parameters in Rolling
 - (c) Defects in Rolling and their remedies
 - (d) Rolling Mills

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 - (b) Discuss the relationships between
 - i. True stress and Engineering stress
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2. (a) Discuss the concept of 'Strain Aging'. Explain its effect in flow curve of a low carbon steel with a sketch.
(b) Define the following:
 - i. Dislocation climb
 - ii. Cross slip
 - iii. Jogs in dislocation
 - iv. Perfect and partial dislocation
3. (a) Define 'Bending'. Sketch the nomenclature of a bent part of the specimen. Indicate various elements in it. Differentiate between Bend angle, Bend radius and Bend allowance. Explain each element briefly.
(b) A 38 cms long, 19 mm wide and 2.5 mm thick strip is tube bent in a V-shaped die. Calculate the bending force necessary if the steel has 630N/mm^2 tensile strength. Also what type of punch and die used for this purpose?
4. (a) Sketch and explain the working of a transfer die used in practice. Explain various elements used for it.
(b) Differentiate between Compound, Combination and Progressive dies.
5. (a) Describe a basic extrusion process and indicate elements in it. Sketch some typical cross-sections that are extruded.
(b) Discuss the effects of deformation speed, die materials and lubricants in hot and cold working processes.
6. (a) Analyse the Tube Drawing operation. Mention necessary assumptions. Explain the functions of die angle in Tube drawing.
(b) Discuss maximum possible reduction in Tube Drawing operation.

7. (a) Determine the forging load at the start and completion of hot forging of a steel billet for the following data:
Billet Size:
Length = 2 metres
Width = 0.8 mts
Thickness = 0.2 mts
Tool bite = 0.3 mts
Yield stress = 50 Mpa at start = 150 Mpa at completion of forging Reduction in forging = 50%.
- (b) Discuss Orbital Forging with a neat sketch. Mention its relative merits and applications?
8. (a) Differentiate between Two high Reversing Mill and Three High Mill. Sketch them.
- (b) Discuss the various stages of Shape Rolling of a component with sketches? What are its applications?

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1. (a) A tensile specimen with 22.8 mm Initial diameter and 50 mm gauge length reaches maximum load of 89 KN, and fractures at 71 KN. Minimum diameter of fracture is 10.8 mm Determine.
 - i. Engineering Stress at Maximum load.
 - ii. True Fracture stress.
 - iii. Also determine True Engineering strain(b) What do you understand by 'Yield Criteria'. How it varies in ductile metals. Discuss with necessary equations.
2. (a) Discuss the various types of crystal structures of metals with neat sketches.
(b) Differentiate between Edge dislocation and Screw dislocations, with neat sketches.
3. (a) Define the term 'Deep Drawability'. What is its usual range? How it can be estimated? In what way it differs from Drawing?
(b) How do you estimate cutting forces in Blanking and Piercing? Derive the governing equations.
4. (a) Sketch and explain the working of a transfer die used in practice. Explain various elements used for it.
(b) Differentiate between Compound, Combination and Progressive dies.
5. (a) Distinguish between extrusion, drawing and forging ? Compare their relative merits. How does extrusion pressure varies with Ram travel?
(b) A shell is to have its wall thickness reduced from 1.8 mm by 11%. The new shell will have a new diameter of 40 mm.
Determine:
 - i. Mean Height of the shell
 - ii. Shell diameter needed to draw the ironed shell.
6. (a) Sketch and describe the construction and working of hydrostatic extrusion and mention some of its applications and advantages.
(b) Discuss the effects of deformation speeds, lubricants and different die materials in hot and cold working processes.
7. (a) Explain Rotary forging. How it differs from conventional forging. Is Rotary swaging a feasible process of forging. Describe with sketch.

- (b) Describe different tools used in forging operation. Show them with sketches. Explain the function of each.
8. (a) Define the following terms in Rolling operation
- i. Roll Gap
 - ii. Camber
 - iii. Neutral Point
 - iv. Draft
- How camber is helpful?
- (b) Explain the function of backing rolls? Discuss with a neat sketch about the operation of Single and Double backing rolls?

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