NEW SCHEME

ME64

USN

Sixth Semester B.E. Degree Examination, July/August 2005

Mechanical Engineering

Manufacturing Process III

Time: 3 hrs.] [Max.Marks : 100

Note: *1. Answer any five questions.*
2. Answer should be brief and to the point.
3. Draw neat and proportional sketches whenever required.
4. Sketches must be drawn by pencils.
5. Assume necessary data, if required.

1. (a) Explain briefly how the different metal working processes are classified on the basis of force applied. draw necessary sketches. **(10 Marks)**

(b) Define workability of a material with the help of suitable diagram explain briefly how the residual stresses are formed in metal working processes? **(2+2=4 Marks)**

(c) What are the factors that governs the temperature rise of the workpiece in metal working process? Hence compare the temperature rise when a cylinder of aluminimum and titanium is quickly deformed to $\bar{\varepsilon} = 1.0$ at room temperature (consider frictionless deformation process) on the basis of following data :

	$\bar{\sigma}$ MPa	$\bar{\varepsilon}$ (Mean strain)	σ (density) $kg-m^{-3}$	C(specific heat) $Jkg^{-1}K^{-1}$
Al	200	1.0	2690	900
T_1	400	1.0	4500	519

$\bar{\sigma}$ = uniaxial mean flow stress.

2. (a) With the help of slip-line field theory, define elastic and plastic deformation. Why experimentally observed value of shear stress necessary to produce a slip is found to be much less than the theoretical value? **(4+4=8 Marks)**

(b) Define Tresca and Von-mises yield criteria and establish the relationship between tensile and shear yield stress. Consider the yielding occurs under uniaxial tensile loading and under pure shear. **(2+2+2=6 Marks)**

(c) An aluminimum alloy having σ_0(uniaxial flow stress) as 500 MPa is subjected to three principal stresses : σ_x as 200 MPa (tensile), $\sigma_y = 100$ MPa (tensile), $\sigma_z = 50$ MPa (compressive) and shear stress = 50 MPa (τxy). Will the material exhibit yielding? If not, what is the safety factor? **(6 Marks)**

3. (a) Deduce the expression for forging pressure and load in open-die forging by slab analysis (consider sliding occurs at interface). Hence draw the Friction - hill and explain briefly the effect of different parameters on Friction-Hill. **(5+5=10 Marks)**

(b) A block of lead having $625mm^2$ cross sectional area and 150mm length is pressed between flat dies to a size having $hmm \times 100mm \times 150mm$ (length). If the uniaxial flow stress of the material is 6.9 MPa and co-efficient of friction is 0.25, calculate the total forging load. **(10 Marks)**

Contd.... 2

4. (a) With the help of neat sketches, briefly explain 'Four-stand continuous mill' and 'Planetary mill'. (2+2=4 Marks)

(b) With the help of suitable sketch, show the different parameters of rolling. Explain the significance of Neutral-point. What is the limiting condition for unaided entry of the slab into the rolls? Make comments on this condition. (3+2+1=6 Marks)

(c) Calculate the rolling load if steel sheet is hot rolled 30 percent from a 40mm thick slab using 900 mm diameter roll. The slab is 760mm wide. Assume $\mu = 0.30$. The plane strain flow stress is 140 MPa at entrance and 200 MPa at the exit during rolling. [Use simplified analysis of rolling]. What would be the rolling load if sticking occurs. For this condition, if the rolls operate at 100 rpm, calculate the power required for this hot reduction. (4+4+2 Marks)

5. (a) Classify the different press tools used in sheet metal forming and make a comparative study of press tools on different features. (4 Marks)

(b) Draw neat sketches of compound die and progressive die. Briefly explain their principle of working. (5+5=10 Marks)

(c) With the help of suitable sketch of bending process, define the different terms used in bending. Define spring back and spring back ratio in bending. (2+3+1=6 Marks)

6. (a) Draw the outline of processes and operations involved in making powder metallurgy parts. (5 Marks)

(b) Explain briefly the different characteristics of metal powders and their effect on the physical properties of the compacted products. (5 Marks)

(c) Explain briefly different sintering mechanism. (5 Marks)

(d) What are the advantages and limitations of powder-metallurgy? (5 Marks)

7. (a) With suitable sketches, explain briefly direct and indirect extrusion. (8 Marks)

(b) Draw the cross-section of a drawing die and explain the different elements of drawing die. (6 Marks)

(c) By using slab analysis, find the expression for draw stress during strip drawing of wide sheet. (6 Marks)

8. (a) Show the different nomenclature associated with 'Deep Drawing'. What is LDR? What is the effect of anistropy on LDR? (3+2+2=7 Marks)

(b) Estimate the LDR for steel sheet subjected to deep drawing using the following data :

	Strain ratio (R) → LDR
Elongation in length = 25%	2 → 2.5
Decrease in width = 15%	3 → 3.0

(3 Marks)

(c) With the help of neat sketches, explain the principle of operation of electrohydraulic and electromagnetic forming. Explain the basic principles of high energy rate forming processes. (4+4+2=10 Marks)

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NEW SCHEME

ME64

Reg. No.

Sixth Semester B.E. Degree Examination, January/February 2006

Mechanical Engineering

Manufacturing Process III

Time: 3 hrs.) (Max.Marks : 100

Note: *1. Answer any FIVE full questions.*
2. All questions carry equal marks.

1. (a) With neat sketches, explain true stress and true strain and derive the relationship between nominal strain and true strain. **(8 Marks)**

   (b) Explain the following yield criterion :

   i) Von - Mises ii) Tresca. **(6 Marks)**

   (c) A metal has a tensile yield load of 4500 kN. A well lubricated cube of thin metal is compressed on its two principal planes with loads equal to 1500 kN on each side. Using Von Mises yield criteria, determine the load required to be applied on the third principal plane to cause deformation of the cube. **(6 Marks)**

2. (a) How are metal forming processes classified? Explain with neat sketches. **(8 Marks)**

   (b) With a typical example explain the effect of temperature on the stress and strain during metal working processes. **(6 Marks)**

   (c) Explain the different mechanisms of friction during metal working. **(6 Marks)**

3. (a) Derive an expression for forging pressure and load acting in plane strain considering Coulomb's friction at the interface. **(8 Marks)**

   (b) Calculate the forging load required to transform a 1m long 1m diameter cylindrical bloom into a square section of equal area in a hydraulic pressure. Assume $\sigma_0 = 450 MPa$; plane strain and sticking friction with m=1 as conditions of forging. **(6 Marks)**

   (c) Explain with a neat sketch the operation and working of a double acting steam hammer. **(6 Marks)**

4. (a) With neat sketch, explain the different types of rolling mills. **(8 Marks)**

   (b) Explain with neat sketches, the various defects encountered in rolled products. **(6 Marks)**

   (c) Calculate the rolling load if sheet steel is hot rolled 40% from a 40mm thick slab using a 900 mm diameter roll. The slab is 760 mm wide. Assume $\mu = 0.3$. The plane strain flow is 140 MPa at entrance and 200 MPa at the exit from the roll gap due to increase in velocity. What would be rolling load if sticking friction occurs? **(6 Marks)**

5. (a) Explain, with the help of neat sketches, the dead zone formation and the influence of optimal cone angle in drawing. **(8 Marks)**

   (b) Explain with neat sketches the different types of extrusion. **(6 Marks)**

   (c) What is meant by redundant work in drawing process. **(6 Marks)**

Contd.... 2

6. (a) How are sheet metal forming presses classified? Explain with neat sketches, any three of them. (8 Marks)

(b) Explain the following press operations :

i) Roll bending

ii) Rubber forming

iii) Strech forming. (6 Marks)

(c) With a simple sketch, explain the functioning of a progressive die. (6 Marks)

7. (a) Explain what is meant by limited draw ratio (LDR) with reference to deep drawing and explain the effect of anisotropy on LDR. (8 Marks)

(b) Classify high energy forming methods and with a neat sketch explain electro-hydraulic forming method. (6 Marks)

(c) Write short notes on any TWO of the following :

i) Forming limit criteria

ii) Advantages and disadvantages of metal working process

iii) Electromagnetic forming. (6 Marks)

8. (a) Explain briefly the various methods of powder production. (8 Marks)

(b) What are various finishing operations carried out on powder metallurgical products after sintering. (6 Marks)

(c) List the advantages and applications of powder metallurgical process. (6 Marks)

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ME:24

USN

NEW SCHEME

Sixth Semester B.E. Degree Examination, July 2006
Mechanical Engineering
Manufacturing Process III

Time: 3 hrs.] [Max. Marks:100

Note: *1. Answer any FIVE questions.*
2. Assume necessary data, if required.

1 a. Explain briefly the effect of hot working and cold working. What do you mean by the term "Recovery"? **(06 Marks)**

b. What is "Refining"? Explain the structure of wrought product obtained by hot rolling and cold rolling. **(04 Marks)**

c. Explain the effect of strain rate in metal working.
Flow stress of a material is given by,

$\sigma_0 = K\varepsilon^n MPa$

Where K = strength co-efficient = 140
n = strain hardening effect = 0.2
ε = true strain

If a plate having a thickness 20mm is reduced to a thickness 15mm by a suitable metal working process, find the value of mean flow stress. **(10 Marks)**

2 a. Define true stress and true strain. Establish their relationship and the relationship between nominal strain and true strain. **(06 Marks)**

b. A tensile specimen with a 12mm initial diameter and 50mm gauge length reaches a maximum load at 90KN and fractures at 70KN. The maximum diameter at fraction is 10 mm. Determine the engineering stress at maximum load (i.e ultimate tensile strength) and the fracture stress. What is the engineering strain at fracture? **(06 Marks)**

c. An element of a plastically deformed material is subjected to two principal stresses; tensile stress σ_x in the direction of forming (i.e along the x-axis) and p_1 compressive pressure in the direction of Y axis. The problem is in plane-strain condition. State Von-mises yielding criterion and applying this condition deduce the mathematical relationship of σ_x and p_1 in terms of uniaxial flow stress. **(08 Marks)**

3 a. A bent lever is to be formed by drop forging in multiple number of passes. With the help of suitable sketches, explain the different stages of operation. **(06 Marks)**

b. Compare 'Hydraulic press and Mechanical press' with respect to different features and salient characteristics. **(04 Marks)**

c. List the different design parameters in designing forging dies. Hence explain briefly the different steps in calculation of initial ingot size for forging. **(05 Marks)**

d. The yield stress of steel at the forging temperature is 600MPa. A right circular cylinder 75mm height and 25mm diameter is to be upset to half the height between flat dies. If the co-efficient of friction is 0.4, what is the maximum force required for upsetting? (use standard expression). **(05 Marks)**

Contd.... 2

4 a. Mass production of metal washers is to be made from steel sheet. Use suitable die for this type of production. Hence, explain the procedure of manufacturing with necessary sketches of die used. (07 Marks)

b. With the help of suitable sketch, explain briefly the mode of metal deformation and failure for punching and blanking operation. (07 Marks)

c. Determine the die and punch size for blanking a circular disc of 20mm diameter from C-20 steel sheet whose thickness is 1.5mm. It is given that material shear stress is 294MPa. If it is piercing operation, determine the punch and die size. Also calculate the punching force and stripping force. (06 Marks)

5 a. A 300mm wide aluminium alloy steel is hot rolled in thickness from 20 to 15mm. The rolls are 1.0m in diameter and operate at 100 rpm. The uniaxial flow stress for the aluminium alloy is given by $140\varepsilon^{0.2}$ MPa. Determine the rolling load and the power required for this hot reduction. Use Qp (a factor which depends on percentage of reduction and ratio of roll radius thickness) as 1.5. (07 Marks)

b. Draw the pressure distribution (in non-dimensional form) along the contact length of the roll during rolling of a strip. Show and explain the salient characteristics on this curve. Also explain the effect of back tension and front tension when applied in the plane of the sheet and in the rolling direction. (07 Marks)

c. i) Explain briefly the effect of "Roll camber" and "Roll flattering".
ii) What is Merchant Mill? (06 Marks)

6 a. What are the different factors that influence the powder-metallurgy process? Briefly explain. (06 Marks)

b. What are the various finishing operation carried out on powder-metallurgy products after sintering? Explain any two of them. (04 Marks)

c. Briefly explain cold isostatic pressing in powder metallurgy with a suitable schematic diagram. (05 Marks)

d. What do you understand by "pre-sintering" and "sintering"? Explain. (05 Marks)

7 a. Classify the different processes used in tube drawing. With the help of suitable sketch, explain the process using moving mandel. (05 Marks)

b. With suitable sketches, explain indirect and hydraulic extrusion. (06 Marks)

c. Briefly explain the different defects associated with extrusion. (04 Marks)

d. Draw the cross-sectional view of conical drawing die and explain the significance of different elements. (05 Marks)

8 a. Briefly explain the principle of deep drawing and list a few defects in deep drawn products. (05 Marks)

b. Explain briefly the rubber forming process with respect to sheet metal forming. (05 Marks)

c. Classify the different high energy rate forming processes and with suitable sketches, explain any two of them with their advantages, disadvantages and applications. (10 Marks)

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ME64

NEW SCHEME

Sixth Semester B.E. Degree Examination, July 2007
Mechanical Engineering
Manufacturing Process - III

Time: 3 hrs.] [Max. Marks:100

Note : ***Answer any FIVE full questions.***

1 a. How are metal working processes classified on the basis of force applied? Explain with neat sketches. **(10 Marks)**

b. Derive the expressions for True stress and True strain. **(05 Marks)**

c. An Aluminum alloy having σ_0 (uni axial flow stress) as 500 MPa is subjected to three principal stresses. σ_x as 200 MPa (tensile), σ_y = 100 MPa (tensile), σ_z = 50 MPa (compressive) and shear stress = 50 MPa. Will the material exhibit yielding? If not, what is the safety factor? **(05 Marks)**

2 a. Explain briefly the effect of friction and lubrication in metal working process. **(06 Marks)**

b. Define Tresca and Von-Mises yield criteria and establish the relationship between tensile and shear yielding stress. **(06 Marks)**

c. Determine the Engineering strain, true strain and reduction for
i) a bar which is doubled in length ii) a bar which is halved in length. **(08 Marks)**

3 a. Deduce the expression for forging pressure and load in open-die forging by slab analysis and draw the friction – hill and explain briefly the effect of different parameters on friction – hill. **(08 Marks)**

b. Explain the parameters to be considered during die design in forging. **(06 Marks)**

c. Explain different types of forging defects. **(06 Marks)**

4 a. With neat sketch, explain different types of Rolling mill arrangements. **(10 Marks)**

b. Calculate the rolling load if steel sheet is hot rolled 30 percent from a 40mm thick slab using 900 mm diameter roll. The slab is 760 mm wide. Assume μ=0.3. The plain strain flow stress is 140 MPa at entrance and 200 MPa at the exit during rolling [Use simplified analysis of rolling]. What would be rolling load if sticking occurs? For this condition, if the rolls operate at 100 rpm, calculate the power required for this hot reduction. **(10 Marks)**

5 a. With neat sketch, explain Backward Extrusion Process. **(06 Marks)**

b. With neat sketch, explain a tube drawing process. **(06 Marks)**

c. Explain the various defects in deep drawing process. **(08 Marks)**

6 a. With neat sketch, explain the working of progressive and compound die arrangement in sheet metal working. **(10 Marks)**

b. Explain the magnitude of spring back in sheet metal work. **(04 Marks)**

c. With neat sketch, explain Electro Magnetic forming process. **(06 Marks)**

7 a. Explain briefly the various methods of powder production. **(08 Marks)**

b. What are the various finishing operations carried out in Powder Metallurgical products after sintering? **(06 Marks)**

c. List the advantages and applications of Powder Metallurgical process. **(06 Marks)**

8 Write short notes : **(20 Marks)**

a. Effect of temperature in metal working process.
b. Comparison between forged and cast product.
c. Defects in rolled products
d. Pneumatic hammer in forging