Code No: RR321802 **Set No. 1**

III B.Tech II Semester Supplementary Examinations, Nov/Dec 2005
MECHANICAL WORKING OF METALS
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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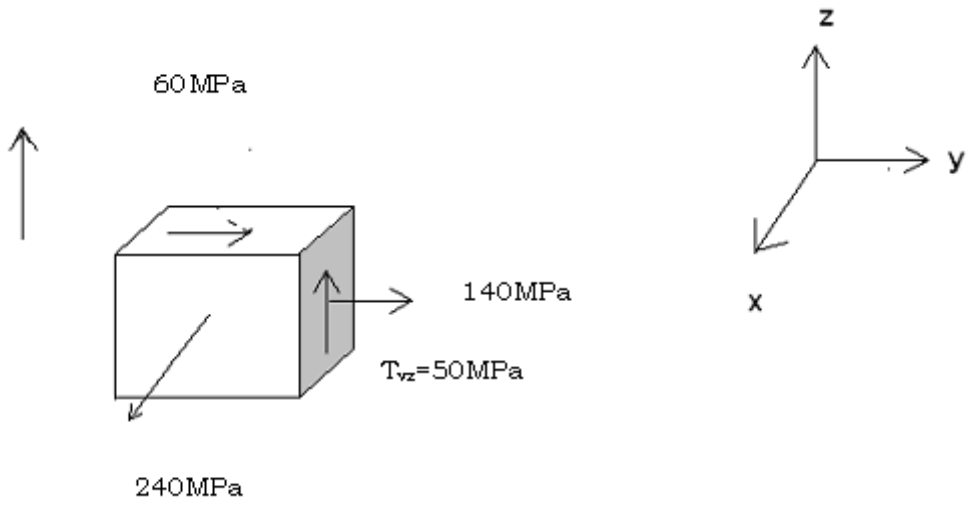
1. The stress state is given below [7+9=16]

   (a) $\sigma_x = 150MP_a$, σ_y = -45MPa, τ_{xy} = 30MPa, calculate the stresses acting on a plane which is oriented at an angle of 30^0 to the x,y axes.

   (b) Find out the principal stresses σ_1, σ_2 and τ_{max} for the above stress state. Also find θ_n and θ_s

2. a. Von Mises proposed J_2=K^2 where $J_2$is second invariant of the stress deviator. What is k and obtain a relationship between σ_o and k with the help of Von Mises criterion. [8]



   (b) Stress analysis structural member under load gives the stress state as shown. The yield strength of the material is 500 MP_a. Using von-mises criterion find out whether the member is going to yield or not. [8]

3. (a) What are the effects of friction in metal forming processes? [6]

   (b) Why is it necessary to have a lubricating system in plastic deformation processes and what are the various lubricating systems used in metal forming units. [10]

4. With sketches explain various Forging equipment and mention their relative advantages, limitations and applications. [16]

5. What is Rolling? Give the classification of rolling processes? [16]

6. (a) Describe with neat sketch extrusion of tubing. [8]

(b) Explain the residual stresses in rods, wires and tubes drawn. [8]

7. (a) An Aluminum alloy is hot extruded at 400^0C at 2 in/sec from 6 inch diameter to 2 inch diameter. The flow stress at this temperature is given by $\sigma = 200$ $(\varepsilon)^{0.15}$ MPa. If the billet is 15 inches long and the extrusion is done through square dies without lubrication, Determine the force required for the operation. [8]

   (b) With the necessary equations and sketches, describe and explain the extrusion process. [8]

8. Using the equation $P_e = P_d +$ 4 Γi L/D , suggest a simple method for measuring the frictional shear stress if only break through pressure can be measured. [16]

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Code No: RR321802 **Set No. 2**

III B.Tech II Semester Supplementary Examinations, Nov/Dec 2005
MECHANICAL WORKING OF METALS
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Consider an elemental cube whose faces represent the principal planes. [8+8=16]
   (a) Draw max-shear stress planes for this cube. Justify your representation with valid reasons.
   (b) How do you establish the directions of principal stress for a given state of stress. Explain the notations followed to establish the principal stresses and max shear stress plane, in detail.

2. The stress state is given by

   $\sigma_x = 200$ MPa $\sigma_y = 120$ MP$_a$

   $\begin{bmatrix} 200 & 0 & 40 \\ 0 & 120 & 0 \\ 40 & 0 & 160 \end{bmatrix}$ Find principal stresses using Mohr's circle

   $\sigma_o = 500$ MPa find out whether the material is going to yield or not. Use both Tresca and Von Mises criteria. [16]

3. Give the classification of metal forming processing based on the Temperature and discuss in detail. [16]

4. Explain the distribution of normal stress and longitudinal stress for compression between plates in a plane strain condition. [16]

5. (a) Explain the construction of rolling mill? [8]
   (b) Give the classification of rolling mills? [8]

6. Extrusion is a process involving three-dimensional compression. Explain why brittle materials can be worked by extrusion more successfully than by some other metal working methods.? [16]

7. (a) Differentiate between Hot extrusion and Cold extrusion. [8]
   (b) Mention the applications of Hot and cold extrusions. [8]

8. Using the equation $P_e = P_d +$ 4 Γi L/D , suggest a simple method for measuring the frictional shear stress if only break through pressure can be measured. [16]

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Code No: RR321802 **Set No. 3**

III B.Tech II Semester Supplementary Examinations, Nov/Dec 2005
MECHANICAL WORKING OF METALS
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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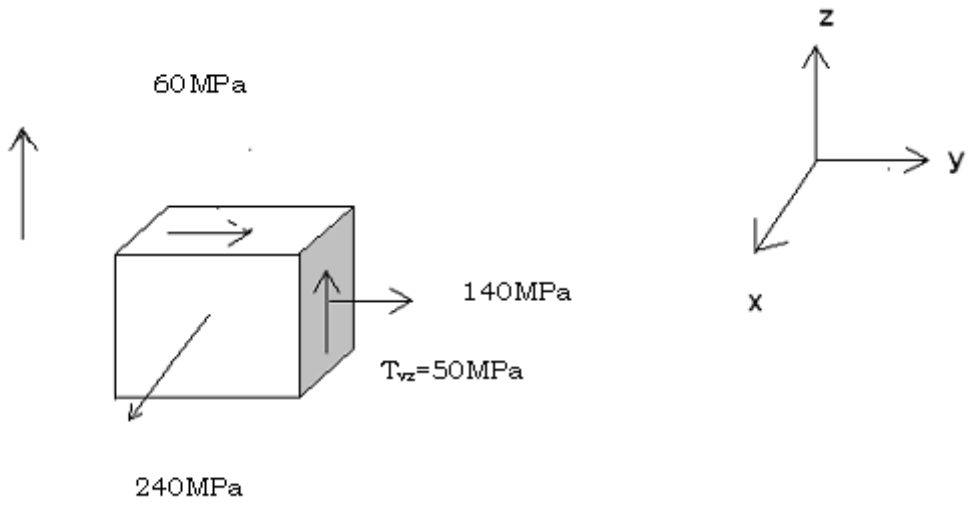
1. (a) Distinguish between True and Engineering stresses and strains. [7]
   (b) Explain principal planes, stresses ans axes. Show that $\sigma_x + \sigma_y + \sigma_z$ = constant for any plane. [9]

2. a. Von Mises proposed J_2=K^2 where $J_2$is second invariant of the stress deviator. What is k and obtain a relationship between σ_o and k with the help of Von Mises criterion. [8]



   (b) Stress analysis structural member under load gives the stress state as shown. The yield strength of the material is 500 MP_a. Using von-mises criterion find out whether the member is going to yield or not. [8]

3. (a) Explain deformation processing situation with the help of a diagram. [8]
   (b) What are the basic assumptions made and principles used in mechanics of metal working [8]

4. A block of lead 30mmx30mmx150mm is pressed between flat dies to size 6.5mmx100mmx150mm. If the uniaxial flow stress is σ_o=10MPa and μ = 0.25 determine the pressure distribution over the 100mm dimension and the total forging load. [16]

5. Discuss the construction and working principle of Tandem mill. [16]

6. Estimate the pressure required to extrude Aluminum curtain rail of I section 12.5 mm high with 6 mm wide flanges, all 1.5 mm thick from 25 mm diameter bar stock. [16]

7. (a) Describe deformation in extrusion and explain possible defects and suitable remedies. [8]
   (b) Compare direct extrusion with indirect extrusion. [8]
8. (a) What is Impact Extrusion? Give it's applications. Can it be applicable for Stainless steels and Ni-based alloys? [8]
   (b) What is the effect of pressure with respect to Direct Extrusion and Indirect Extrusion. Show graphically. [8]

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Code No: RR321802 **Set No. 4**

III B.Tech II Semester Supplementary Examinations, Nov/Dec 2005
MECHANICAL WORKING OF METALS
(Metallurgy & Material Technology)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Distinguish between True and Engineering stresses and strains. [7]
   (b) Explain principal planes, stresses ans axes. Show that $\sigma_x + \sigma_y + \sigma_z$ = constant for any plane. [9]

2. State Von Mises' and Tesca criteria. Derive both the relations, compare them and mention various advantages and disadvantages associated with each criterion. [16]

3. (a) Explain the changes that take place during recovery, Recrystallization and grain growth. [7]
   (b) Evaluate the press capacity necessary for forging one meter long cylindrical bloom to hexagonal section with approximately 0.33 meters side, if the yield stress is initially 400 Kg/Cm^2 but increases to 680 Kg/Cm^2 at the end of the operation. Assume [6]
      i. that the bloom is partially lubricated so that $\mu = 0.3$
      ii. that there is no lubrication.
   (c) What is the maximum pressure that would be expected?

4. (a) Critically discuss the closed die forging [8]
   (b) Explain the forging Vs forging stroke for closed die forging. [8]

5. Discuss the problems encountered during rolling. [16]

6. (a) What do you understand by the term "Extrusion ratio"? [4]
   (b) Draw the plot of Extrusion pressure verses ram travel distance for direct and indirect extrusion and discuss the salient features. [12]

7. (a) Compare Direct extrusion with Indirect extrusion [8]
   (b) Describe extrusion equipment. [8]

8. (a) The following equation expresses the pressure for the extrusion of Aluminum bars : [8]
   p = σ_o (0.47 + 1.2 ln R) exp [4μL/D]
   billets 8 inch in diameter and 16 inch long are extruded into ¾ inch diameter bars. In order to increase the length of the product by 10 feet, would it be more economical in terms of pressure to increase the billet length or diameter? (Assume that $\mu = 0.10$)

(b) In the hot extrusion of Aluminum at 350^0C, $\sigma_o = 250$ MPa for a 12 inch diameter billet, 36 inch long [4+4=8]

i. What is the break through pressure needed to extrude a 3 inch diameter if $\mu = 0.10$?

ii. What is the required extrusion pressure at the end of stroke?

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