Code No: 07A60604 **R07** **Set No. 2**

III B.Tech II Semester Examinations,APRIL 2011
MECHANICAL WORKING OF METALS
Metallurgy And Material Technology

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Is rolling process useful for making tubes? Explain your answer with proper sketches.
   (b) What do you understand by the term roll piercing? Explain with simple sketch. [8+8]

2. Explain the following :
   (a) Absolute draught
   (b) Absolute speed
   (c) Absolute elongation
   (d) central deflection. [16]

3. (a) The state of stress is given by $\sigma_x = 25$p and $\sigma_y = 5$p plus shearing stresses τ_{xy}. On a plane at 45^0 counterclockwise to the plane on which σ_x acts the state of stress is 50 MPa tension and 5 MPa shear. Determine the values of σ_x, σ_y, σ_{xy}.
   (b) How Youngs Modules(E), Shear Modulus(G), Poisson's ratio(ν) and bulk Modules(K) are related? [8+8]

4. (a) How are collapsible tubes of aluminium manufactured ? Explain with a Sketch .
   (b) Explain about various lubricants used in extrusion process ? How are collapsible tubes of aluminium manufactured ? Explain with a Sketch . [10+6]

5. (a) Give the classification of metal forming processes and discuss them in detail.
   (b) Distinguish between cold working and hot working. [8+8]

6. (a) List out forging defects and explain them with its remedies.
   (b) Show that strains in the transverse and radial directions are equal for a thin circular disk compressed in the Z-direction. [8+8]

7. (a) The yield stress of a tension specimen machined from a 0.5m wide by 0.6cm thick copper sheet is 145 MPa. The sheet is rolled further with an applied tensile force in the plane of the sheet of 0.22 MN. What roll pressure is needed just cause yielding? Ignore friction between the metal and rolls. For rolling, deformation occurs by plane-strain in which there is no increase in the width of the sheet.

(b) If the total strain energy is given by the equation expressing in terms of principal stresses $U_0 = \frac{1}{2E}\left[s_1^2 + s_2^2 + s_3^2 - 2\upsilon\left(s_1 s_2 + s_2 s_3 + s_3 s_1\right)\right]$, Express the same equation in terms of the bulk modulus and shear modulus. [8+8]

8. (a) An aluminum rod 5mm in diameter is drawn into a wire 4.75mm diameter. The half die angle is 8^0. Determine the drawing stress considering friction, if coefficient of friction is 0.03 , yield stress for aluminum is 30N/mm^2 when

   i. back pull is zero

   ii. back pull is 250m.

   (b) Explain about the cup and cone defect that is formed very often in wires. [10+6]

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Code No: 07A60604 **R07** **Set No. 4**

III B.Tech II Semester Examinations,APRIL 2011
MECHANICAL WORKING OF METALS
Metallurgy And Material Technology

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the differences between the two terms
   i. power and
   ii. torque
   (b) Using slip line field analysis derive the roll load for hot rolling condition [8+8]

2. A frictionless uniaxial compression test of a copper cylinder gave the following results:

True stress, ksi	4	10	16	24	32	38	40	41.4	42
Reduction in height, %	0	2.5	5	10	20	30	40	50	60

   (a) Plot the true-stress-true-strain curve in compression;
   (b) Construct an engineering tensile stress-strain curve up to the ultimate tensile stress from these data. [8+8]

3. (a) Find the principal stresses and the orientation of the axes of principal stress with the x, y axes for the following situation: σ_x = -60,000 psi, σ_y = +5,000 psi and τ_{xy} = +25,000 psi.
   (b) Construct a Mohr's circle of stress for each of the plane-stress conditions as given below: σ_x = -50,000 psi, σ_y = +8,000 psi and τ_{xy} = +20,000 psi. [8+8]

4. An SAE 1040 steel at the forging temperature has a yield stress of 10,000 psi. A right-circular cylinder 4 in high and 1.5 in in diameter is to be upset to half height between flat dies.
   (a) If the coefficient of friction is 0.35, what is the maximum force required for the upsetting?
   (b) How much extra force is required over what would be needed if no friction were present?
   (c) If it takes 4s to produce the forging and the efficiency is 50 percent, how much power must be available in order to do the job? [6+5+5]

5. (a) With a neat sketch explain the extrusion of lead sheath on electrical cable?
   (b) Explain the hydraulic press used for extrusion processes ? [8+8]

6. (a) On the assumption that there is no change in width during the rolling of a sheet, derive an expression for the significant strain in terms of the change in thickness of the sheet. Also express in terms of percentage reduction.

(b) Assume that the total strain energy can be split into a term depending on change of volume and a term depending on distortion can be expressed $U_0 = 1/2E\ [\sigma_1^2 + \sigma_2^2 + \sigma_3^2 - 2\nu(\sigma_1\ \sigma_2 + \sigma_2\ \sigma_3 + \sigma_1\ \sigma_3)]$in terms of principal stress. Express this equation in terms of the invariants of the stress tensor and also in terms of bulk modulus and shear modulus. [8+8]

7. (a) Explain the purpose of using a mandrel during tube production process. Explain the production of tubes, in detail.

   (b) Name the important process variables in the drawing of rods & wires. Explain about them in detail. [8+8]

8. Describe the analysis of the following processes ?

   (a) Rolling

   (b) Drawing process. [16]

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Code No: 07A60604 **R07** **Set No. 1**

III B.Tech II Semester Examinations,APRIL 2011
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. In an isotropic solid, a hydrostatic pressure produces a dilatation in which the strain in any direction is given by ε= p(1-2ν)/E. However, in an isotropic solid the strain due to hydrostatic pressure is not equal in all directions.
   (a) For a cubic crystal, determine a relationship for strain in any direction in terms of E_x, ν_y, G_{xy}.
   (b) Explain whether the dilatation can be calculated from $\Delta = \nu_x + \nu_y + \nu_z$.
   (c) Under the action of a hydrostatic pressure, what will be the shape of a face of cube whose edges are originally parallel to the cubic crystal axes? [6+4+6]
2. (a) With a neat sketch, explain the working of universal rolling mill.
   (b) Discuss the advantages and disadvantages of universal rolling mill with reference to other rolling mills? [8+8]
3. What are the various defects in rolled products? Explain in detail. [16]
4. (a) Sketch and explain die construction for the drawing process. What type of components can be made by drawing operation.
   (b) What is patenting? Why is it necessary. Discuss the patenting process in detail. [8+8]
5. (a) List out forging defects and explain them with its remedies.
   (b) Show that strains in the transverse and radial directions are equal for a thin circular disk compressed in the Z-direction. [8+8]
6. (a) Explain the advantages and limitations of Tresca criterion over Von Mises yield criterion.
   (b) Differentiate between elastic deformation and plastic deformation. [8+8]
7. Explain the following by showing the following features in an extrusion process.
   (a) sound flow of material
   (b) dead zone formation
   (c) shaving phenomenon. [16]
8. (a) What are the factors that affect recrystallization temperature? Explain them in detail.
   (b) Describe the effect of strain rate on deformation processing. [10+6]

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Code No: 07A60604 **R07** **Set No. 3**

III B.Tech II Semester Examinations,APRIL 2011
MECHANICAL WORKING OF METALS
Metallurgy And Material Technology

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Discuss the theory of cold rolling for strip undergoing plane strain deformation by rolling process. [16]

2. (a) Explain the production of seamless tubes with the help of neat sketches.
   (b) Distinguish fully between drawing process & deep drawing process. [10+6]

3. An aluminium thin walled tube (radius/thickness = 20) is closed at each end and pressurized to 1,000 psi to cause plastic deformation. Neglect the elastic strain and find the plastic strain in the circumferential (hoop) direction of the tube. The plastic stress-strain curve is given by $\overline{\sigma}= 25(\overline{\varepsilon})^{0.25}$, where stress is in Ps i. [16]

4. A 3000-lb power forging hammer has a total nominal energy of 35000 ft-lb. If the blow efficiency is 40 percent and the forging load builds up from P/3 at the beginning of the stroke to P at the end of the stroke, what is the total forging load for
   (a) a stroke of 0.2 in
   (b) a stroke of 0.6 in. [8+8]

5. Write short notes on the following.
   (a) rolling efficiency on process variables
   (b) Hydrodynamic lubrication in the rolling process.
   (c) Biting angle. [6+5+5]

6. (a) To produce short lengths of holler shapes, what extrusion process is used. explain that process with a neat sketch ?
   (b) Discuss why impact extrusion is used for softer metals like lead, copper, almuninium , tin etc. Explain ? [10+6]

7. Determine p/2k for a 60 percent plane-strain extrusion using the slip-line field given below in fig 1. [16]

8. (a) It is found experimentally that a certain material does not change in volume when subjected to an elastic state of stress. What is Poisson's ratio for this material?
   (b) Strain-gage measurements made on the free surface of a steel plate (plane stress condition) indicate that the principal strains are 0.004 and 0.001 in/in. What are the principal stresses? (E = 200 GPa and $\nu = 0.33$) [6+10]

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Code No: 07A60604 **R07** **Set No. 3**

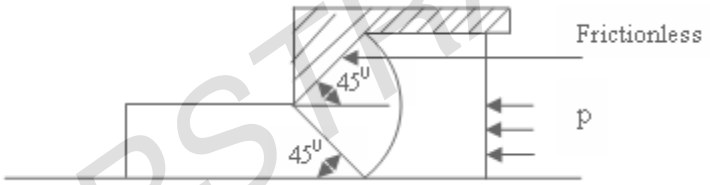

Figure 1: