Time : 60 min   Max. Marks: 30

1. a) The strain hardening exponent and strength coefficient of a ductile metal obeying power law of strain hardening are 0.28 and 550 MPa respectively. If a 2mm thick specimen of this metal with 50mm length and 12.5mm width is tested in uniaxial tension, determine the maximum load that the specimen can withstand. At the point of maximum load, determine engineering strains and true strains in the three principal directions.   (7)

   b) Derive the correlation between uniaxial tensile yield stress and yield stress in pure shear using Von-Mises and Tresca yield criteria.   (3)

2. a) When a rectangular plate of dimensions 150mm x 100mm x 2mm is subjected to biaxial stretching as shown in the figure, it has been found that the length and the width of the plate increased to 190mm and 115mm respectively. If the material's constitutive equation for plastic deformation is given by $\sigma_{eff} = 450\ \varepsilon_{eff}^{0.25}$ MPa, calculate the stresses applied on the plate and the final thickness of the plate.   (8)
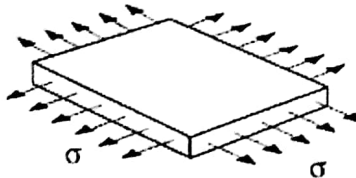
   b) Define effective strain. Show that, in the above case, the effective strain is equal to the true strain in thickness direction.   ⤷   In case of equi biaxial ten', shen effn————   (4)

3. a) Define hot working. Explain the combined effect of temperature and strain rate on the flow stress of common metals.   (3)

   b) Arrange the following metal forming processes in the increasing order of their strain rate:
   Drop forging, Superplastic forming, Press forging, Lab tensile test, Explosive forming   (2)

   c) Name the type of friction that normally exists in cold working and hot working. Give equations for frictional shear stress in both the cases.   (3)