# MCL132 METAL FORMING AND PRESS TOOLS
## Major Test (II Sem 2014-2015)

Max. Marks: 60

Time : Two hours

1. a) The diameter of a wire is to be reduced from 5mm to 3.7mm in a single pass by a wire drawing operation at room temperature. Which of the following options (dies) can be used? Justify your answer with calculations. (9)

   Die 1: Die angle = 12°; $\mu = 0.10$
   Die 2: Die angle = 10°; $\mu = 0.16$

   Determine the smallest diameter of the wire that can be produced using the above dies.

   b) A bar of length $L_0$ is reduced in cross section by extruding it seven times through dies of decreasing size. During each of these operations, the reduction in cross sectional area is 35%. Determine the total true strain, the total engineering strain and the final length of the bar. (6)

2. a) A 1.5mm thick sheet of dimensions 1m x 0.5m is cold rolled to reduce the thickness to 1.0mm with no change in width using 600mm diameter rolls in a single pass. Coefficient of friction between the rolls and the work piece is 0.05. The uniaxial flow stress of the material is given by $\sigma_0 = 400\varepsilon^{0.25}$ MPa. Determine the rolling load and power if the rolls rotate at 200 rpm ($\lambda = 0.45$). (10)

   b) The tensile properties of the above rolled sheet are YS=220 MPa, UTS=260 MPa and elongation = 15%. If 90 circular blanks of 100 mm diameter are sheared from the above rolled sheet, what is the % material utilization? What is the force required for blanking for each blank? (5)

   c) If flat bottom cylindrical cups are manufactured by deep drawing from the above circular blanks, calculate the smallest diameter of the cup that can be produced and the corresponding height of the cup. Assume efficiency of the drawing process to be 80% and neglect anisotropy. Estimate the force required for deep drawing to produce these cups and suggest suitable punch and die diameters for deep drawing. Assume $\mu = 0.1$. Give the assumptions made. (15)

3. a) If a sheet of width $w$ and thickness $t$ ($w >> t$), is bent through a radius of curvature $R_0$, derive an expression for new radius of curvature $R_f$ as a result of spring back. $E$ and $\sigma_0$ are elastic modulus and uniaxial yield stress of the material respectively. Write the assumptions made. (10)

   b) Determine the residual stresses at the outer and inner surfaces of the sheet due to spring back and also show the variation of stress in through thickness direction. (5)