Problem Sheet: Metal Forming

Problem 1: A cup of 50mm diameter and 20mm height is to be produced by drawing from a 1.5 mm thick sheet metal. Find the blank diameter and the maximum drawing force. Assume ultimate strength of the sheet metal to be 650 mm.

Problem 2: Rolling is used to reduce the thickness of a plate 15 mm thick by 3 mm using cylindrical rolls of diameter 400 mm. Calculate the bite angle.

Problem 3: A cylindrical block of diameter d_0 and height h_0 is forged to a disc of diameter d_f and height h_f in an open die forging operation:
(i) Determine the final disc diameter, d_f
(ii) Determine the true strain in the longitudinal direction.
(iii) Show that the true longitudinal strain is twice the true radial strain.

Problem 4: A 10 mm circular hole is required to be cut in a 2 mm thick sheet metal. Estimate the cutting force required assuming the shear strength of the sheet metal to be 275 MN/m^2.

Problem 5: Using open-die forging operation, a solid cylindrical piece of 304 stainless steel having 100 mm diameter x 72 mm height is reduced in the height to 60 mm at room temperature. Assuming the coefficient of friction as 0.22 and the flow stress for this material at the required true strain as 1000 MPa, calculate the forging force at the end of stroke.