MEL 234 METAL FORMING AND MACHINING
Major Test (2006-07)

Time : Two hours Max. Marks: 60

1. A rectangular block with width 50mm and height 40mm is forged under plain strain condition (length is 10 times the width) to a height equal to half of its original height. (10)

a) Calculate the total forging load in the following cases.
   i) sliding friction if the coefft. of friction =0.2 ; average uniaxial flow stress is 100 MPa and
   ii) sticking friction conditions at which the uniaxial flow stress is 24MPa;

b) If the frictional conditions are a combination of sticking and sliding, derive an expression for location of the point of transition from sticking to sliding friction from the center and determine the location of this point in the above problem.

2. a) In a turning operation, diameter of a 100mm long rod has to be reduced from 40mm to 37mm. Determine the material removal rate and machining time if the feed rate is 0.25mm/rev and spindle speed is 200rpm. (4)
b) In the above process, in one tool life, 30 components are turned at 50 m/min. and 40 components are turned at 42 m/min. Determine the Taylor's tool life equation. (6)

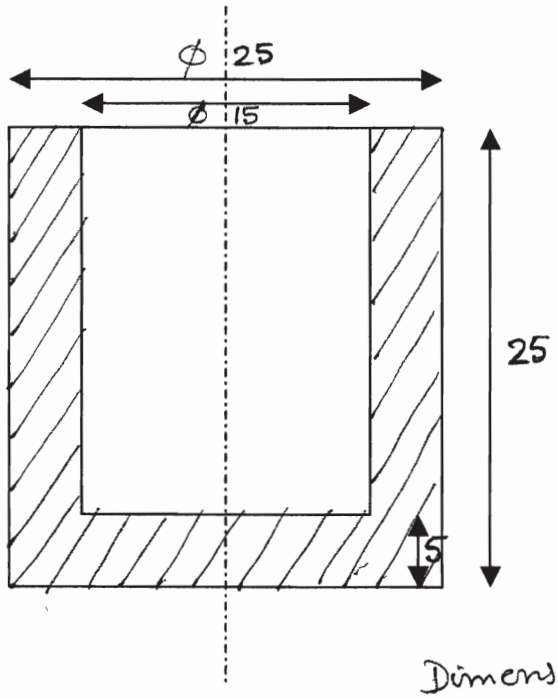
3. In an orthogonal machining with a tool with rake angle of 15°, the cutting and thrust components of force are found out to be 1200 N and 200 N respectively. The cutting speed used is 20m/min and the width of cut is 5mm. The uncut thickness and chip thickness are 0.5mm and 0.7mm respectively. Determine: a) the values of shear angle and shear strain.
   b) the coefft of friction at the tool-chip interface
   b) the percentage of total heat generated in the shear zone and the percentage of total energy dissipated due to friction at the tool-chip interface. (10)

4. A 15 mm diameter drill is used at a cutting speed of 20 m/min and a feed rate of 0.2 mm/rev. Under these conditions, the drill life is 100 min. The drilling length of each hole is 45mm and the time taken for idle motions is 20 sec. The tool change time is 5 min. Calculate a) the number of holes produced using one drill and b) average production time per hole. (10)

5. Write whether the following statements are true or false and **justify your answer.** (10)
   1. Electro-chemical machining process is the reverse of electroplating.
   2. Ultrasonic machining is best suited for ductile materials.
   3. Abrasive jet machining can be used for cutting as well as deburring operations.
   4. In laser beam machining, process efficiency increases with reflectivity of the work surface.
   5. Electron beam machining is not suitable for making fine holes in metals with high hardness.

6. a) UTS of a material is 300 MPa and it elongates 35% to reach maximum load. Determine the plastic stress-strain relation of the material if it obeys power law of strain hardening. (4)

b) A cylindrical cup as shown in the figure is to be extruded at room temperature from a 25 mm diameter annealed aluminium billet by indirect extrusion using a punch of 15mm diameter. If the uniaxial flow stress of the material is given by $\sigma_0 = 60 + 40\varepsilon$ (MPa), calculate a) the billet height required and b) extrusion force ignoring friction. (6)



Dimensions in mm.