

## HW-2

### MKT 4161 MANUFACTURING TECHNIQUES

(Due November 2, 2017)

#### **ATTENTION:**

1. Hand-write the solution on A4 size paper sheets.
2. You may use a pen or a pencil.
3. Use backsides of the sheets.
4. DO NOT use cover sheet. Make sure you print your name and ID on the top of each sheet.

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**Q1.** Estimate the roll force,  $F$ , and the torque for an AISI 1020 carbon-steel strip that is 200 mm wide, 10 mm thick, and rolled to a thickness of 7 mm. The roll radius is 200 mm, and it rotates at 200 rpm. (EVEN ID numbers: use strip with as 500 mm,  $t_i$  20 mm,  $t_f$  12 mm)

**Q2.** Take two solid, cylindrical specimens of equal diameter, but different heights, and compress them (frictionless) to the same percent reduction in height. Show that the final diameters will be the same.

**Q3.** A planned extrusion operation involves steel at  $1000^\circ\text{C}$  with an initial diameter of 100 mm and a final diameter of 20 mm. Two presses, one with capacity of 20 MN and the other with a capacity of 10 MN, are available for the operation. Is the smaller press sufficient for this operation? If not, what recommendations would you make to allow the use of the smaller press? (EVEN ID numbers: use 140 mm initial diameter extruded to 30 mm)

**Q4.** To what thickness a cylindrical billet of AA 5052-O alloy can be upset using a hydraulic press of 50 Tons. (ODD ID No: Diam. 80 mm Height: 50 mm EVEN ID: Diam. 50 mm Height: 40 mm) (friction coefficient 0,16)

**Q5.** A round wire of perfectly plastic material is drawn from 10 mm to 6 mm using a die of draw angle 12 degrees under friction conditions with a coefficient of 0,15. Predict the draw force. (EVEN ID No:  $D_{\text{initial}} = 8$  mm and  $D_{\text{final}} = 5$  mm, Friction coeff.= 0,12)

#### **Exercise:**

**E1.** Calculate the extrusion force for a round billet 300 mm in diameter, made of Aluminum alloy AA 1100, and extruded at  $450^\circ\text{C}$  to a diameter of 70 mm.

**E2.** Assume that you are the technical director of trade associations of extruders and rod and wire drawing operations. Prepare a technical leaflet for potential customers, stating all of the advantages and disadvantages of these processes.

**14.31.** A mechanical press is powered by a 23-kW motor and operates at 40 strokes per minute. It uses a flywheel, so that the crankshaft speed does not vary appreciably during the stroke. If the stroke is 150 mm, what is the maximum constant force that can be exerted over the entire stroke length?

E3.