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UNIVERSITY of JORDAN

COLLAGE OF ENGINEERING **INDUSTRIAL ENGINEERING DEPARTMEN**

Manufacturing Processes **Midterm Exam** **Time: 50 Minutes**

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Q1: A peripheral milling operation is performed on the top surface of a rectangular workpart which is 400 mm long by 60 mm wide. The milling cutter, which is 80 mm in diameter and has five teeth,overhangs the width of the part on both sides. The cutting speed is 70 m/min, the chip load is 0.25mm/tooth, and the depth of cut is 5.0 mm. Determine (a) the time to make one pass across thesurface, and (b) the maximum material removal rate during the cut. **(5marks)**

$v = f * N * h = 0.25 * 5 * 400 = 500$

$= w d v = 60 * 5 * 500 = 150\,000$

$I_c = \sqrt{Dd} = \sqrt{80 \times 5} = 20$

$t = \frac{L + I_c}{v} = \frac{400 + 20}{500} = 0.84$

2.5

Q2: A turning operation is made with a rake angle of 10°, a feed of 0.010 in/rev and a depth of cut = 0.100 in. The shear strength of the work material is known to be 50,000 lb/in^2, and the chip thickness ratio is measured after the cut to be 0.40. Determine: i) The shear force, ii) the cutting force, and iii) the power dissipated in shear.

Use the orthogonal cutting model as an approximation of the turning process. **(6 marks)**

$v = \pi D n$

$= $

$\phi = \tan^{-1}\left[\frac{r\cos\alpha}{1 - r\sin\alpha}\right] = \tan^{-1}\left[\frac{0.4\cos(10)}{1 - 0.4\sin(10)}\right] = 22.9°$

$F = R \sin\beta = 267.8$

$= $

$\phi = 45 + \frac{\alpha}{2} - \frac{\beta}{2}$

$22.9 = 45 + \frac{10}{2} - \frac{\beta}{2}$

$\beta = 54.2°$

$P = F_c V_c = 267.8 * 0.01$

$= 2.678$

$F_s = \tau * A_s = \tau * \frac{f * d}{\sin\phi} = 50000 * \frac{0.01 * 0.01}{\sin(22.9)} = 128.5$

$R = \frac{F_s}{\cos(\beta + \phi - \alpha)} = \frac{128.5}{\cos(22.9 + 54.2 - 10)} = $

330.2

5

$F_c = R\cos(\beta - \alpha) = $

236.7

$4(1)^{0.231} = 1(t_2)^{0.231}$

Q3: Turning tests have resulted in 1-min tool life at a cutting speed = 4.0 m/s and a 20-min tool life at a speed = 2.0 m/s. Project how long the tool would last at a speed of 1.0 m/s. **(5marks)**
Hint: Find the n and C values in the Taylor tool life equation.

$v_1 t_1^n = v_2 t_2^n$

$4(1)^n = 2(20)^n$

$n = 0.231$

$C = v_1 t_1^n$

$= 4(1)^{0.231}$

$= 4$

$4 = v t^n$

$4 = 1(t)^{0.231}$ $t = 403.94$

5

Q4: Which of the following favor machinability of a material? Answer "Yes" or "No". **(5 marks)**

1) High ductility material. No 2) Low strain-hardening exponent material. Yes 3) Low fracture toughness material. No
4) A strong metallurgical bond (adhesion) between tool and workpiece material ... No 5) Elements such as silicon, embedded in the workpiece material material. No

Q5: a) What are the two basic categories of cutting tools in machining? Give two examples of machining operations that use each of the tooling types. **(3 marks)**

I) Single point Examples: A) Turning B) ~~Milling~~

II) multiple point Examples: A) Broaching B) Filing

2.5

b) Mention the alternative ways by which an insert cutting tool is held in place (shank) during machining. **(3 marks)**

I) spinelle perphill parallel II) perpendicular II)

3

Q6: Name the types of chips associated with metal removal **(3 marks)**

I) Continuous II) serrated III) Discontinuous