

END TERM EXAMINATION

SIXTH SEMESTER [B.TECH.] MAY-2010

Paper Code: ETME310

Subject: Metal Cutting & Tool Design

Time : 3 Hours

Maximum Marks :75

Note: Attempt any five questions including Q.1 which is compulsory.

- Q1 (a) Explain the chip formation. Enlist various factors affecting the chip formation.
 (b) Enlist various assumptions made in the theory of 'Ernst Merchant'.
 (c) What are the meaning of 'Grit size' and 'structure' in grinding wheel specification? Discuss in brief.
 (d) Discuss the elements of 'Jig & Fixture'.
 (e) Explain 'six point location principle' in brief. (3x5=15)
- Q2 Establish the relation using Merchant Theory $\phi + \frac{1}{2}(\lambda - \alpha) = \frac{\pi}{4}$. Where ϕ = shear angle, λ = friction angle and α = rake angle. (15)
- Q3 When the rake angle is zero during orthogonal cutting, show that $\frac{\tau_s}{U_c} = \frac{(1 - \mu)r}{1 + r^2}$.
 Where τ_s = ultimate shear stress of material, U_s = specific energy consumption, μ = co-efficient of friction and r = cutting ratio. (15)
- Q4 Determine the maximum temperature along the rake face of the tool when machining mild steel, given work piece shear stress (τ_s) = $400 \times 10^6 \text{ N/m}^2$, $\alpha = 0$, $v = 2 \text{ m/sec}$, $t_1 = 0.25 \text{ mm}$, $w = 2.0 \text{ mm}$, $\mu = 0.5$,
 $\rho = 7200 \text{ kg/m}^3$, $K = 43.6 \text{ W/m}^\circ\text{C}$, $c = 502 \text{ J/kg}^\circ\text{C}$, $\theta_0 = 40^\circ\text{C}$ (15)
- Q5 A mild steel block of 20mm width is being milled using a straight slab milling cutter with 20teeth, 50mm diameter and 10° radial rake. The feed velocity of the table is 15mm/min and cutter rotates at 60rpm. If a depth of cut of 1.0mm is used what will be the power consumption, given coefficient of friction=0.5, shear stress of the material=400N/mm²? (15)
- Q6 A 300mm long bar with 30mm diameter is to be turned on a lathe. The maximum allowable feed is 0.25mm/revolution. The cost of labour and overheads/min is Rs. 10.00 and each regrinding of the tool involves an expense of Rs. 80.00. The time required for every tool change in one minute. Two alternative materials X and Y can be used. Their cost and tool life equation (for a feed of 0.25mm/rev) are as given here:
- | Material | Cost piece | Tool life equation |
|----------|------------|------------------------|
| X | Rs. 100 | $\sqrt{T}^{0.1} = 30$ |
| Y | Rs. 120 | $\sqrt{T}^{0.16} = 76$ |
- Determine which material should be used from the cost point of view. The setting and idle time involved in each piece is one minute. (15)
- Q7 (a) What is machinability? Discuss various factors affecting machinability. (5)
 (b) Determine the components of the machining force when shaping a C.I. block with depth of cut=4.0mm, feed=0.25mm/stroke, Normal rake angle of the tool= 10° , principal cutting edge angle= 30° , co-efficient of friction between chip and tool=0.6 and ultimate shear of C.I.=340N/mm². (10)