

Material Removal Processes (MCL 136)
Major Exam

Time 2 hr

F.M. 40

All answers must be brief and to the point. Assume any relevant data wherever required. All parts of a question must be answered together.

5x2=10

1. Answer in brief the followings:
 - a. Distinguish between truing and dressing of a grinding wheel.
 - b. What is hot machining and mention at least two materials which can be hot machined.
 - c. What type of cutting fluid is recommended for machining stainless steel and why?
 - d. Mention any four differences between conventional and non-conventional processes.
 - e. What is stand off distance in Abrasive Jet Machining Process and show the variation of material removal rate with stand off distance?

 2. Analytically estimate the average shear zone Temperature, θ_s for plain turning of a mild steel rod of diameter 200 mm by a carbide tool of geometry $6^\circ, 6^\circ, 6^\circ, 6^\circ, 15^\circ, 75^\circ, 0.8$ (mm) ORS at rotational speed of 500 rpm, feed of 0.10 mm/rev and depth of cut 3.0 mm under dry condition when the followings were noted: Main cutting force component, $P_z = 1200$ N, Frictional force at the rake surface, $F = 500$ N Chip thickness, $a_2 = 0.8$ mm. Assume 75% of mechanical energy gets converted into heat, 90% of the heat generated at the shear zone goes into the chips, Mechanical equivalent of heat, $J = 4.2$ J/Cal, Volume specific heat of mild steel, $\rho_v = 3600$ KJ/m³°C. Ambient temperature, $\theta_a = 30^\circ$ C. **5**

 3. With a neat sketch explain the method of embedded thermocouple technique and provide an example of a process where it can be used. What is wheel loading phenomenon? **3+2=5**

 4. Briefly explain how the fracture toughness of alumina tool may be increased with addition of zirconia. The life of a HSS plain milling cutter of diameter 75 mm was found to decrease from 50 min to 30 min due to increase in speed (N) of the cutter from 200 to 300 rpm while milling a cast iron plate at a given feed and depth of cut. How much would be the life of that cutter if the speed is 150 rpm keeping other parameters unchanged? **4+1=5**

 5. Establish expressions for determining the power of the water jet and the power of the abrasive phase in an entrained variety of Abrasive Waterjet Machining process. What are catcher plates and why are they used? **3+2=5**

 6. In an EDM process using RC type EDM generator find out an expression for material removal rate in terms of the voltage V, current I, resistance R and capacitance C. Assume the maximum capacitance voltage as V_c^* and the minimum as V_d^* . What is taper cut in EDM and how can it be prevented? **3+2=5**

 7. With appropriate machining example, explain the thermo-chemical wear of a cutting tool. Explain why cutting fluid with more cooling power is recommended for high speed machining processes like grinding. **3+2=5**
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