

Material Removal Processes (MCL 136)
Major Exam

F.M. 40

Time 2 hr

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

1. Answer in brief the followings: 5x2=10
 - a. Explain with suitable sketch the ploughing phenomenon as observed in grinding operation.
 - b. What is the mechanism of material removal in Electrochemical process? Why is it required to use inert gases during Abrasive Jet Machining Process?
 - c. With a neat sketch show the crater wear in a single point cutting tool and mention how it can be measured?
 - d. What are the major mechanisms by which cutting fluid may improve the machinability of difficult to machine materials?
 - e. Mention any two detrimental effects of high cutting temperature on workpiece?

 2. In an orthogonal machining operation, the followings were observed:
Width of cut = 2.5 mm, chip thickness = 0.7 mm, uncut chip thickness = 0.27 mm, Orthogonal rake = 0° ,
Main cutting force = 900 N, resultant thrust force = 450 N
Calculate the friction angle and the shear stress developed during machining process. 4

 3. Explain why in Electro-discharge Machining (EDM) process the heat affected zone is not very significant?
Why is tellurium copper preferred over commercially available copper material as the EDM tool material? 2+2=4

 4. Why SiC whisker reinforced ceramic tool is considered as a high-performance ceramic tool material? Why steels cannot be machined with diamond tools? 2+2=4

 5. Find an expression for the power of the abrasive phase of the abrasive water jet machining in terms of parameters like loading factor, momentum loss function, discharge coefficient, pressure and density of water jet and diameter of the orifice. 4

 6. Electrochemical machining is performed to remove material from an iron surface of 20 mm x 20 mm under the following conditions:
Inter electrode gap = 0.2 mm, Supply voltage (DC) = 12 V, Specific resistance of electrolyte = 2 Ω cm
Atomic weight of Iron = 55.85, Valency of Iron = 2, Faraday's constant = 96540 Coulombs.
Find out the material removal rate in gm/s. 3

 7. An operator was turning a rod of a given material and diameter by the cutting edges of a coated carbide insert at a given speed, feed, and depth of cut. He found that the life of a cutting edge became double when the spindle speed was reduced by 40%. How much (%) increase in life of a cutting edge is expected if the spindle speed is reduced by 60%? 3

 8. In water jet machining, the water jet is issued through a 0.3 mm diameter orifice at a pressure of 400 MPa. The density of water is 1000 kg/m³. The coefficient of discharge is 1.0. Neglecting all losses during water jet formation through the orifice, what will be the power of the water jet in kW? 2

 9. Distinguish between truing and dressing of a grinding wheel. 2

 10. With neat sketch explain the working principle of a tool work thermocouple technique used for measuring cutting temperature during machining process. What is the working principle of a piezoelectric dynamometer used for cutting force measurement? 2+2=4
-