

**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.

1. Answer in brief the followings:

5x2=10

- a. Why is specific grinding energy in grinding operation so high?
- b. With suitable sketches explain why during EDM drilling of a hole, tapering may happen and how can you control such tapering?
- c. Why a single point cutting tool always has a notch wear?
- d. Explain with suitable sketches how stabilized or partially stabilized zirconia addition in alumina ceramic can increase the fracture toughness value?
- e. With suitable sketches explain the functional mechanism of the catcher used during Abrasive Jet Machining Process?

2. In an orthogonal machining operation, the followings were observed:

Width of the chip = 0.2 mm, chip thickness = 0.5 mm, Orthogonal rake =  $6^\circ$ , Approach angle =  $15^\circ$   
Feed = 0.16 mm/rev,  $\tau_s = 300$  MPa

Calculate the coefficient of friction between the tool and the workpiece and the shear stress developed during machining process.

5

3. What is the role of the auxiliary support during Electron Beam Machining Process? How can holes of any shape be manufacturing by the EBM process? Distinguish between population inversion and stimulated emission in respect to the working of a laser system?

2+1+2=5

4. Why are SiC whisker reinforced ceramic tools not manufactured in many of the European countries? What are the advantages of cubic boron nitride cutting tools over the conventional carbide ones? Why steels cannot be machined with diamond tools?

1+2+2=5

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. In an abrasive water jet machining process, the water pressure is 4000 bar and the orifice diameter used is 0.2 mm. The mass of abrasive flowing is 1.5 kg/min. Determine the abrasive waterjet velocity assuming no loss in the mixing stage.

3+2=5

6. During Electrochemical machining of an alloy with a constant feed to the tool, mathematically prove that the gap between the tool and the workpiece reaches the steady state gap irrespective of what has been the initial gap between the tool and the workpiece. In Ultrasonic Machining process how are the vibrations reaching the USM tool and mention at least two major limitations of the USM process.

3+1+1=5

7. Explain in details the size effect phenomenon in context with micro cutting processes? Differentiate between macro and micro-cutting mechanisms?

3+2=5

*M/T = m*