

# NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

## FACULTY OF INDUSTRIAL TECHNOLOGY

### DEPARTMENT OF INDUSTRIAL ENGINEERING

#### **MANUFACTURING PROCESSES – TIE 5204**

2<sup>nd</sup> SEMESTER EXAMINATIONS APRIL/MAY 2000

Time Allowed: 3 Hours

Answer ALL questions.

---

- Qu. 1 a i) Much of the work at the Cut-Anything Company involves cutting and forming of flat sheets of fibreglass for the pleasure boat industry. Manual methods based on portable saws are currently used to perform the cutting operation, but production is slow and scrap rates are high. The foreman says the company should invest in a plasma arch machine, but the plant manager thinks it would be too expensive. What do you think? Justify your answer by indicating the characteristics of the process that make PAC attractive or unattractive in this application.
- ii) What is stereolithography?
- iii) What are the benefits attributable to Rapid Prototyping?
- b i) Explain the basic principle involved in electrochemical deburring.
- ii) Why is the tool insulated in the ECM schematic?
- Qu. 2 a) A square hole is to be machined through a 1-in plate of pure copper (valence = 1) using ECM. The hole is 1.0 in on each side, but the electrode that is used to cut the hole is slightly less than 1 in. on its sides to allow for overcut, and its shape includes a hole in its center to permit the flow of electrolyte and to reduce area of the cut. This tool design results in a frontal area of  $0.3 \text{ in}^2$ .  $C = 0.000269 \text{ in}^3/\text{A-min}$
- The applied current = 1000A. Using an efficiency of 95%, determine how long it will take to cut the hole.
- b i) If the metal from which a part is to be made is quite brittle and the part will be subjected to repeated tensile loads, would you select ECM or EDM for making it? Why?
- ii) In abrasive water jet machining, what is the kerf?

- Qu 3 a) A wire EDM operation is used to cut out punch and die components from 1-in. thick tool steel plates. However, in preliminary cuts the surface finish on the cut edge is poor. What changes in discharge current and frequency of discharges should be made to improve the finish?
- b i) What is the principal advantage of using a moving-wire electrode in EDM?
- ii) What is the nature of the surface obtained by EDM?
- Qu. 4 a i) What are the reasons why abrasive processes are technologically and commercially important?
- ii) Grinding creates high temperatures. How is temperature harmful in grinding?
- b i) Distinguish between wheel structure and wheel grade in grinding.
- ii) What are the three mechanisms of grinding wheel wear?
- Qu. 5 a) In a chemical milling operation on a flat, mild steel plate, it is desired to cut a round pocket to a depth of 0.4 in. The outside diameter of the pocket is to be 17.5 in. A solution of hydrochloric and nitric acids will be used as the etchant. Penetration rate for mild steel = 0.001 in/min  
 $F_e = 2.0$  Determine:
- i) metal removal rate in  $\text{mm}^3/\text{hr}$
- ii) time required to machine to depth, and
- iii) required diameter of the opening in cut and peel maskant required to achieve the desired pocket diameter on the part.
- b i) Why is it preferable in chemical machining to apply the etchant by spraying instead of immersion?
- ii) If you had to make several holes in a large number of duplicate parts, would you prefer ECM, EDM EBM, OR LBM? Why?

**END OF EXAM**