



**UNIVERSITI KUALA LUMPUR
Malaysia France Institute**

**FINAL EXAMINATION
JANUARY 2010 SESSION**

SUBJECT CODE : FGB 33203
SUBJECT TITLE : MODERN MACHINING
LEVEL : BACHELOR
TIME / DURATION : 3.00pm – 5.00pm
(2 HOURS)
DATE : 30 APRIL 2010

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper **CAREFULLY**.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of **FIVE (5)** questions. Answer any **FOUR (4)** questions only.
6. Answer **ALL** questions in English.

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer any four (4) questions only.

Please use the answer booklet provided.

Question 1

(a) Sketch schematically an Electrochemical Machining (ECM) setup and label its parts.

(5 Marks)

(b) Explain the principle of ECM.

(5 Marks)

(c) An Inconel-625 alloy consists of the following elements:

	Nickel	Chromium	Molybdenum	Columbium	Iron
% weight	62	22	9	4	3
Density (g/cm ³)	8.9	7.19	102.2	8.85	7.86
Valency	2	2	3	2	2
Atomic weight (g)	58.71	51.99	95.94	58.93	55.85

i. Calculate the density of the alloy.

ii. Estimate the material removal rate in (cm³/min) when the alloy is machined electrochemically in a current of 1000 A.

(10 Marks)

(d) Calculate the speed of electrolyte flow in m/s in an ECM operation so that the electrolyte temperature when it exists the gap between the workpiece and electrode does not exceed 95° C. Current density, $J = 80 \text{ A/mm}^2$, electrolyte conductivity, $k = 0.2/\Omega/\text{cm}$, electrolyte density, $\rho = 1.1 \text{ g/mm}^3$ and electrolyte specific heat, $c = 4.18 \text{ J/g}^\circ\text{C}$. The length along the electrode which the electrolyte needs to flow, $L = 120 \text{ mm}$. Assume the electrolyte temperature as it enters the gap is 25° C.

(5 Marks)

Question 2

(a) Describe the following etching techniques in chemical milling (CHM):

- i. Stepped etching
- ii. Taper etching
- iii. Overall etching

(6 Marks)

(b) A 'U' channel has a thickness of 4 mm and is 350 mm long. A taper is to be produced by Chemical machining (CHM) such that the thickness of the section is 4 mm at one end and 2 mm on the other. If the number of etchings (immersing or withdrawal) is 5 times and the etch rate per side is 0.025 mm/min, calculate the speed with which the section should be immersed into or withdrawn from the etchant tank.

(4 Marks)

(c) Draw a process flow chart for photochemical machining (PCM) to show all the steps involved.

(5 Marks)

(d) The component shown in the sketch (Figure 2.0) is to be machined by PCM using two-sided etching. Etching band is to be employed but not etching tabs. The sheet material thickness is 0.3 mm and the etch factor is 1.4. You are required to produce the artwork at 5 x magnification. Sketch the artwork and dimension it fully, taking into account the necessary etching allowance. The width of the etch band on the photo tool after photo reduction is to be 0.8 mm

(10 Marks)

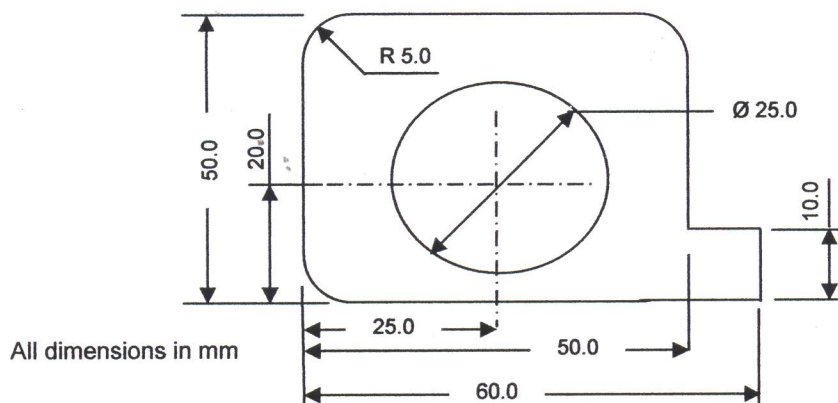


Figure 2.0

Question 3

- (a) Sketch an acoustic head for an ultrasonic machining (USM) that employs a magnetostriction transducer. Label all its parts
(5 Marks)
- (b) Differentiate the two types of transducer used in USM, namely magnetostriction and piezoelectric transducer, from the following aspects:
- i. The basis of working principle.
 - ii. An example of material suitable for constructing the transducer.
 - iii. Advantages and disadvantages.
- (6 Marks)
- (c) In water Jet machining (WJM), what are the controlled parameters that affect the machining performance? How to obtain the optimum cutting quality?
(6 marks)
- (d) Sketch a schematic diagram of WJM system and label eight (8) main equipments involved in the system. Briefly explain the functions of any four (4) of this equipment.
(8 Marks)

Question 4

- (a) List, with one (1) appropriate reason for each, six (6) favorable geometry of workpieces that are suitable to be machined using Electrical Discharge Machine (EDM).
(8 Marks)
- (b) List four (4) types of dielectric fluid in EDM. Thereafter explain four (4) basic requirement of good dielectric fluid.
(8 Marks)
- (c) Wire EDM started from scratch in early 1970s and has made steady progress with most rapid improvements occurring mid 1980s to mid 1990s. Discuss the progress that occurred in four (4) key areas as a measure of performance.
(9 Marks)

Question 5

A CO₂ laser is used to cauterize blood vessels and stem the flow of blood in a neurological operation. To avoid damage occurring to the surrounding tissue during the operation, the laser must operate in the "Top Hat" mode and have a high divergence.

- (a) Describe three (3) main processes which occur during laser action.
(9 Marks)
- (b) Briefly explain how the beam delivery system is used to achieve a high beam divergence
(8 Marks)
- (c) What are advantages of Laser Beam Machining (LBM) compared to Electron Beam Machining (EBM)? Give two (2) examples of EBM applications.
(8 Marks)

END OF QUESTION