Document No : UniKL MFI_SD_AC41
Revision No: 02
Effective Date: 01 December 2008

SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION

JANUARY 2011 SESSION

SUBJECT CODE	:	FGB 33203
SUBJECT TITLE	:	MODERN MACHINING
LEVEL	:	BACHELOR
TIME / DURATION	:	9.00am – 11.30am (2.5 HOURS)
DATE	:	12 MAY 2011

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. Answers should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of FIVE questions. Answer FOUR (4) questions only.
6. Answer all questions in English.
7. Formula sheet is appended.

THERE ARE 5 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.

SECTION A (Total: 100 marks)

INSTRUCTION: Answer only FOUR questions.
Please use the answer booklet provided.

Question 1

(a) What is the non-traditional machining process and why it is used instead of traditional machining. Also, give example of non-traditional machining processes and its usage.

(6 marks)

(b) Water Jet Machining system employs water at high pressure to cut materials. With the aid of a diagram describes the layout of the Water Jet Machining system

(9 marks)

(c) Explain the properties of abrasive use in the Abrasive Water jet Machining in term of materials, grain size and its effect on the cutting process

(5 marks)

(d) In a water jet cutting system, the orifice used has a diameter of 0.3 mm. What is the jet velocity at 4000 bar if no losses are assumed? What is the mass flow rate of water?

(5 marks)

Question 2

(a) With the aid of a diagram, explain the electrolysis involving steel, copper and copper sulphate ($CuSO_4$) solution.

(6 marks)

(b) Electrochemical Machining (ECM) uses reverse electrolysis to remove material from work piece. One of the important factors to consider in ECM process is the electrolyte.

(i) List down the function of electrolyte in the Electrochemical Machining Process.

(5 marks)

(ii) Discuss the advantages and disadvantages of using Natrium Chloride (NaCL) and Natrium Nitrate ($NaNO_3$) for steels and iron base alloys.

(6 marks)

(c) Calculate alloy density and the rate of material removal for a Electrochemical Machining of a Nickel superalloy as described in table 1.0. The tool area is 1500 mm^2 and current 2000 A.

	Nickel	*Chromium*	*Ferum*	*Titanium*
% Weight	70	20	5	5
Density (g/cm^3)	8.9	7.19	7.89	4.51
Valency	2	2	2	3
Atomic weight (g)	58.71	51.99	55.85	47.9

Table 1: Nickel Superalloy Composition

(8 marks)

Question 3

(a) What is the purpose of dielectric fluid in Electric Discharge Machining (EDM)?

(4 marks)

(b) Explain why graphite is the most commonly used material as Electric Discharge Machining (EDM) electrode.

(6 marks)

(c) In an Electric Discharge Machining (EDM) operation with Resistance-Capacitance (R-C) circuit, the Lazarenko's generator has the following characteristic: V_o = 250 V, R = 10 Ω and C = 3 μF. If the cut is required to be performed at maximum material removal rate (MMR), calculate:

(i) The discharge voltage and the charging time (t_c)

(5 marks)

(ii) The Cycle frequency (f_r) and the energy/individual discharge of the capacitor (E_d)

(5 marks)

(iii) The estimate of the expected gap to realize the cut if the dielectric strength is 180V/25 μm

(5 marks)

Question 4

(a) Discuss the effects of the following parameters on the rate of material removal and surface finish obtainable in ultrasonic machining:

(i) Amplitude and frequency of vibration

(5 marks)

(ii) Abrasive grit size

(4 marks)

(iii) Static load

(3 marks)

(iv) Increase in slurry volume concentration

(3 marks)

(b) Glass is being machined using ultrasonic machining at a material removal rate (MRR) of 6 mm^3/min using Aluminium Oxides (Al_2O_3) abrasive grits with a grit diameter of 150 µm. If the grit size is changed to 100 µm, what is the new MRR?

(6 marks)

(c) For the above problem, the initial frequency 20 kHz. If the frequency is increased to 25 kHz will the MRR increase or decrease? Calculate the new MRR.

(4 marks)

Question 5

(a) Explain the concept of undercut in term of its relation with etching depth in chemical milling. Provide sketches if necessary.

(6 marks)

(b) List down the advantages and disadvantages of chemical milling.

(9 marks)

(c) Describe the process of electron beam machining with the aid of sketches.

(10 marks)

END OF QUESTION

APPENDIX

List of formula

$$v_w = \sqrt{\frac{2p}{\rho_w}}$$

$$m_w = \rho_w . Q_w = \rho_w \frac{\pi}{4} d_0^2 v_w$$

$$\rho_{alloy} = \frac{1}{\sum \frac{\alpha_i}{\rho_i}}$$

$$MRR = \frac{1}{F\rho \sum \frac{\alpha_i v_i}{A_i}}$$

$V_s = 0.73V_o$

$V_s = V_o(1 - e_c^{-t/RC})$

$f_r = t / (t_c + t_d)$

$E_d = ½ cV_s^2$

$$\frac{MRR_1}{MRR_2} = \frac{value_1}{value_2}$$