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SET A

# UNIVERSITI KUALA LUMPUR
## Malaysia France Institute

## FINAL EXAMINATION

## SEPTEMBER 2014 SESSION

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|---|---|---|
| **SUBJECT CODE** | : | **FGB33203** |
| **SUBJECT TITLE** | : | **MODERN MACHINING** |
| **LEVEL** | : | **BACHELOR** |
| **TIME / DURATION** | : | **3.30 PM – 6.00 PM (2.5 HOURS)** |
| **DATE** | : | **08 JANUARY 2015** |

### 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 (5) questions. Answer FOUR (4) questions only.**
6. **Answer all questions in English.**
7. **Formula sheet is appended**

**THERE ARE 3 PAGES OF QUESTIONS AND 1 PAGE APPENDIX, EXCLUDING THIS PAGE.**

**INSTRUCTIONS: Answer FOUR (4) questions only.**

## Question 1

(a) Nontraditional process is an alternative machining process which traditional cutting tools are not used. Instead, energy at its direct form is utilized to machine work piece. Briefly explain at least four (4) reasons why it's used in machining process.

(8 marks)

(b) With the aid of a sketch, describe the cutting nozzle of an abrasive water jet system.

(6 marks)

(c) Explain the elements that affect the capability of abrasive jet machining.

(5 marks)

(d) Briefly discuss the characteristic of process in water jet machining. You may use sketches or diagrams.

(6 marks)

## Question 2

(a) Electrochemical Machining (ECM) uses reverse electrolysis to remove material from work piece.

(i) Explain in detail on the process of ECM in term of system and material removal rate with the assistance of diagrams.

(15 marks)

(ii) Explain the function of electrolyte in ECM process.

(5 marks)

(iii) Discuss the meaning of equilibrium gap in ECM.

(5 marks)

## Question 3

(a) Describe with the aid of sketches, the concept and process of machining work piece using ultrasonic machining (USM).

(10 marks)

(b) Explain type of materials can be machined by ultrasonic machine machining (USM) and give the examples of that material.

(5 marks)

(c) Explain the main components of ultrasonic machine machining (USM).

(5 marks)

(d) Briefly discuss the abrasive material selection in ultrasonic machine machining (USM) process.

(5 marks)

## Question 4

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

(8 marks)

(b) Briefly discuss at least four (4) the advantages and disadvantages of laser beam machining.

(8 marks)

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

(6 marks)

(d) Describe the difference between chemical machining and photochemical machining.

(3 marks)

## Question 5

(a) The Lazarenko's generator In Electric Discharge Machining (EDM) for Die Sinking operation has the following characteristic: $V_o$ = 240 V, R = 10 Ω and C = 3 µF in order to performing at maximum removal rate (MRR), calculate:

(i) Calculate the discharge voltage and the charging time ($t_c$).

(6 marks)

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

(4 marks)

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

(3 marks)

(b) Electric Discharge Machining (EDM) wire cutting is a continuously moving wire travels along a prescribed path of the work-piece by discharge sparks acting like cutting teeth. According to drawing given in figure 1, write down the coordinate system in order to perform the cutting process in EDM wire cut by assumed 0.20 of wire diameter and 40 micron spark gap.

(12 Marks)

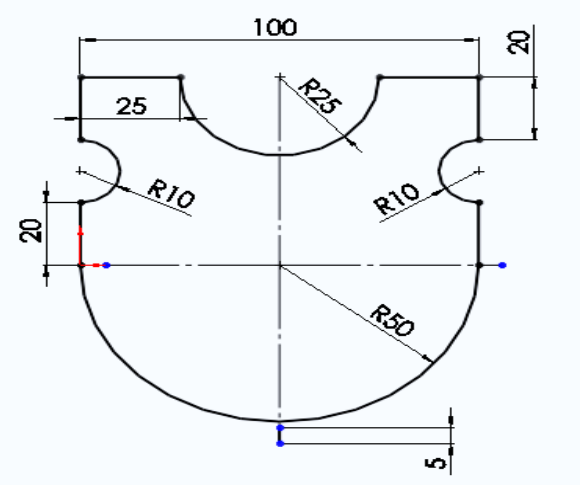


Figure: 1

**END OF QUESTION**

# APPENDIX

## List of formula

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

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

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

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

$V_s = 0.73V_o$

$V_s = V_o(1 - e^{-tc/RC})$

$f_r = 1 / (t_c + t_d)$

$E_d = ½ cV_s^2$

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