



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JULY 2010 SESSION

SUBJECT CODE : FGB 33203
SUBJECT TITLE : MODERN MACHINING
LEVEL : BACHELOR
TIME / DURATION : 9.00am – 11.30am
(2.5 HOURS)
DATE : 15 NOVEMBER 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 paper consists of **TWO (2)** sections. Section A and B. Answer **ALL** questions in section A. For section B answer **THREE (3)** questions only.
6. Answer all questions in English.

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)**INSTRUCTION: Answer all questions.****Please use the answer booklet provided.****Question 1**

- (a) Show diagrammatically the main elements of an electrodischarge machining (EDM).
(5 Marks)
- (b) Explain the advantages and disadvantages of USM and explain the effect of USM parameters on the removal rate.
(5 Marks)

Question 2

- (a) Describe the chemical machining (CHM) process, and list its fields of application.
(5 Marks)
- (b) Show diagrammatically the main elements of an electrochemical machining (ECM).
What are the advantages and disadvantages of ECM?
(5 Marks)

Question 3

- (a) What are parameters affecting the material removal rate (MRR) in abrasive jet machining (AJM)? Give three examples of typical materials that can be effectively machined by AJM.
(5 Marks)
- (b) Using a block diagram or a line sketch, show the main components of water jet machining (WJM) plant.
(5 Marks)

Question 4

- (a) State the important parameters that influence the material removal rate (MRR) in laser beam machining (LBM).
(5 Marks)
- (b) Make a comparison between LBM and EBM on the basis of their applications.
(5 Marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer any three (3) questions only.

Please use the answer booklet provided.

Question 1

In an EDM operation using Lazerenko's generator, $V_0 = 250 \text{ V}$, $R = 10 \text{ } \Omega$, and $C = 3 \text{ } \mu\text{F}$.
If the cut is required to be performed at maximum removal rate condition, calculate:

- (a) Discharge voltage
(4 Marks)
- (b) Charging time, t_c
(4 Marks)
- (c) Cycle frequency, f_r
(4 Marks)
- (d) Energy/individual discharge of the capacitor, E_d
(4 Marks)
- (e) If the dielectric used has a strength of $180 \text{ V}/25 \text{ } \mu\text{m}$, estimate the expected gap thickness to realize this cut.
(4 Marks)

Question 2

Use the chart in Figure 2.1 to design an exponential acoustic horn made of monel (acoustic speed in horn material $c = 4.22 \times 10^5$ cm/s). Its natural frequency $f_r = 20$ kHz, and its terminal diameters are $D_o = 40$ mm and $D_t = 5$ mm.

(20 Marks)

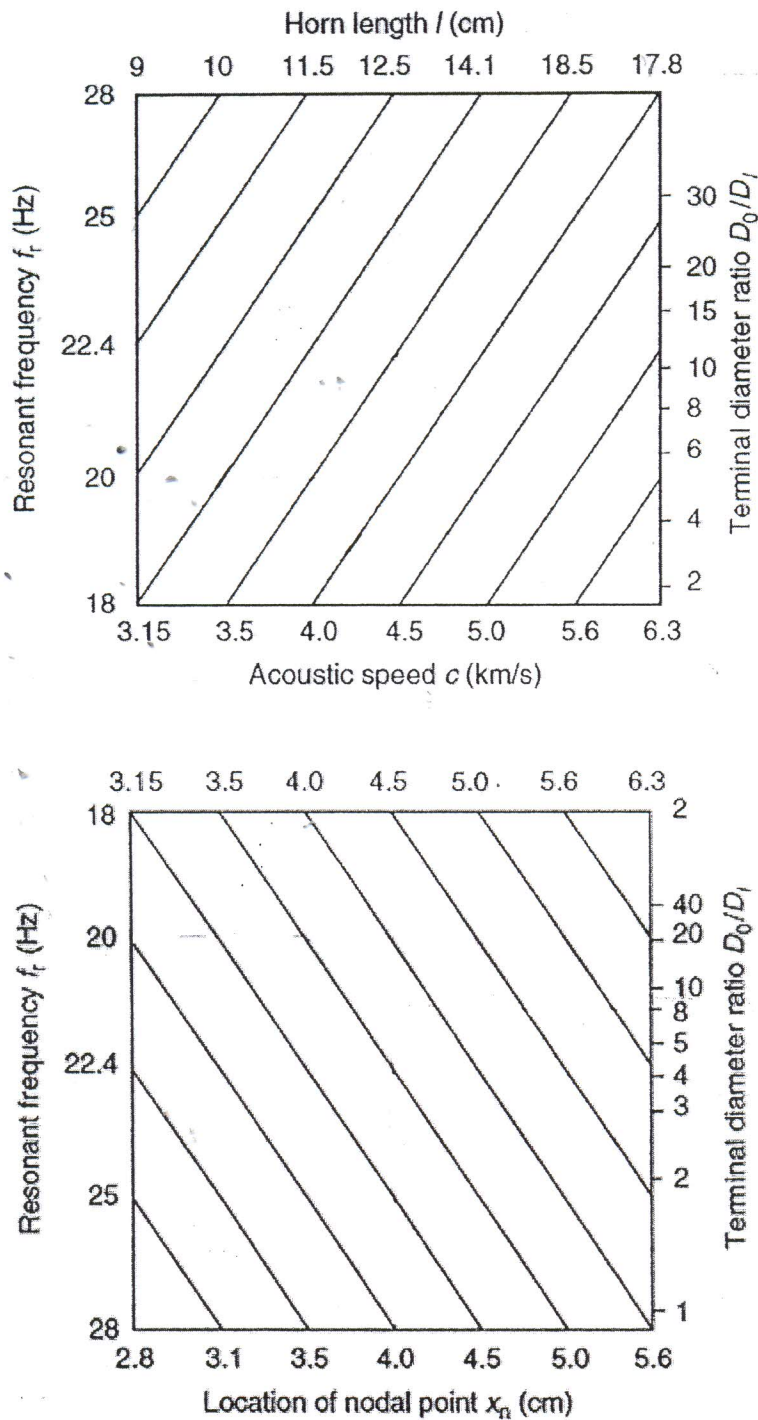


Figure 2.1 Nomogram to determine the length and nodal point of exponential acoustic horn.

Question 3

- (a) Calculate the traverse speed v_f in mm/s for cutting a tungsten sheet of 2.5 mm thick, if electron beam equipment of 10 kW is used. The equipment is capable of focusing the beam to a diameter of 0.5 mm. The following workpiece data are given: $\theta_m = 3400^\circ\text{C}$, $C_d = 8.1 \times 10^{-5} \text{ m}^2/\text{s}$, $k_t = 214 \text{ N/s } ^\circ\text{C}$.

(10 marks)

- (a) Calculate the current density by using Richardson-Dushman equation in electron beam machining. The following data are given: Absolute temperature 2300°C and work function 415 Volts.

(10 Marks)

Question 4

- (a) For pure iron, the gram atomic weight is 55.85 and the density is 7.86 gcm^{-3} . Compare
- Mass removal rate
 - Volume removal rate
- for a current value of 1000 A for two values of valency of dissolution, 2 and 3.

(10 Marks)

- (a) Calculate the weight of titanium removed in the following electrochemical machining (ECM) operation:

Machining time = 2 min

Work area = 12 cm^2 Current density = 250 A/cm^2

For titanium, the gram atomic weight is 47.9 and valency of dissolution is 4.

(10 Marks)

END OF QUESTION