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CONFIDENTIAL

SET B

UNIVERSITI KUALA LUMPUR

Malaysia France Institute

FINAL EXAMINATION

JANUARY 2011 SESSION

SUBJECT CODE	:	FLB 30402
SUBJECT TITLE	:	SIGNALS AND SYSTEMS
LEVEL	:	BACHELOR
DURATION	:	2.00pm – 4.00pm (2 HOURS)
DATE / TIME	:	03 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. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer two (2) question only.
6. Answer all questions in English.

THERE ARE 5 PRINTED PAGES OF QUESTIONS EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

(a) Briefly define the following signals classifications:

i. Continuous-time signals

ii. Discrete-time signals

iii. Deterministic signals

iv. Random signals.

(8 marks)

(b) Briefly describe the function of filters in signal processing and list four (4) categories of filters according to frequency response.

(6 marks)

(c) Find the fundamental frequency and angular frequency of the signal represented in **Figure 1.**

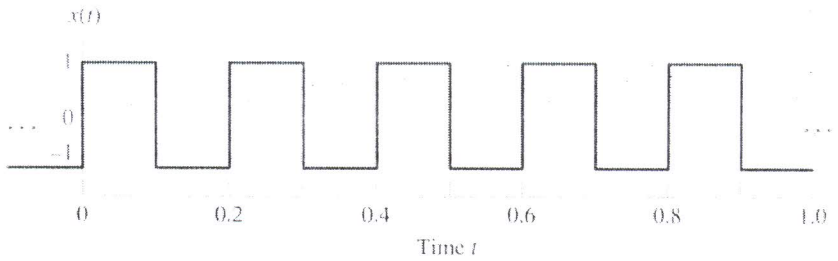

Figure 1

(6 marks)

Question 2

(a) A discrete time signal of y[n] = x[n] is shown in **Figure 2**. Applying the time scale operation, make a labeled sketch of discrete time signal y[n] = x[2n].

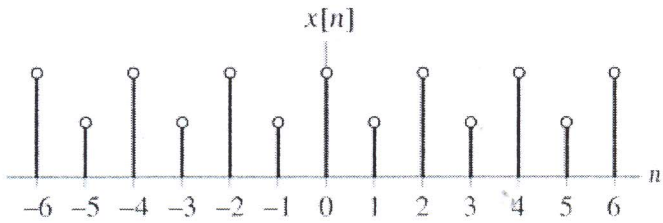

Figure 2

(4 marks)

(b) Applying the time-shift operation, draw a signal of y(t) = x(t-2) from a signal shown in **Figure 3.**

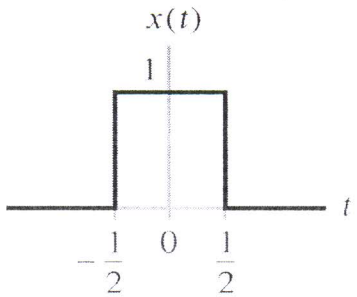

Figure 3

(4 marks)

(c) Derive a differential equation to describe a relationship between the input voltage and the load voltage of a compensation circuit shown in **Figure 4.**

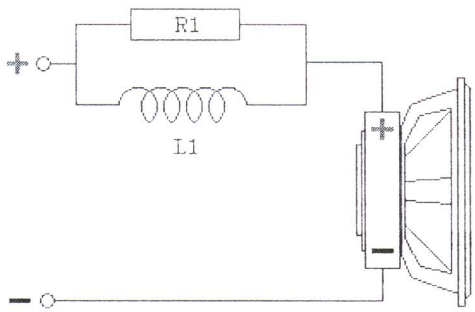

Figure 4

(12 marks)

SECTION B (Total: 60 marks)

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

Question 3

(a) **Figure 5** shows input $x_1(t)$ and response $y_1(t)$ of an LTI system. Determine the output of the system when a signal of $x_2(t)$ is applied.

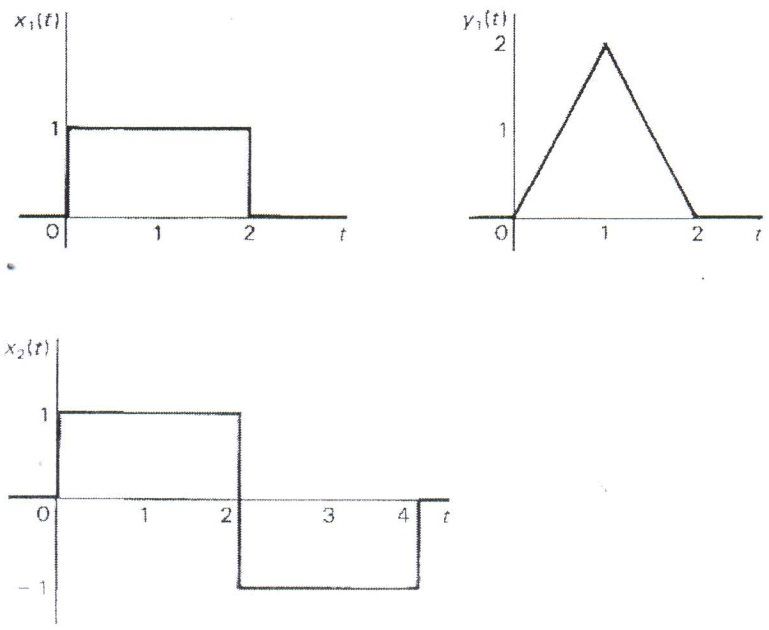

Figure 5

(12 marks)

(b) Obtain the relationship between the displacement x(t) and the applied force f(t) for a mechanical system shown in **Figure 6.**

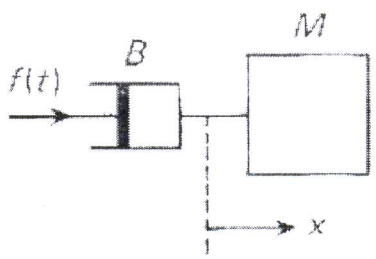

Figure 6

(8 marks)

(c) Find the convolution for the following discrete-time signals:

$$f_1(n) = [\,0, 1, 2, 1, 2\,] \text{ and } f_2(n) = [\,0, 1, 3, 1, 2\,]$$

(10 marks)

Question 4

(a) Obtain the relationship between the displacement x(t) and the applied force f(t) for mechanical systems shown in **Figure 7.**

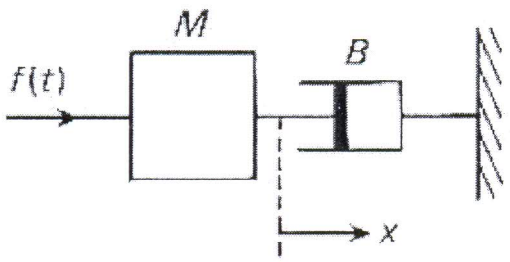

Figure 7

(8 marks)

(b) Obtain the zero-input response of the system described by the following differential equations:

$$\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 2y = \frac{dx}{dt} + 3x$$

(8 marks)

(c) Design a low-pass Butterworth filter with a maximum gain of 5 dB and a cut-off frequency of 1000 rad/s at which the gain is at least 2 dB. The filter also has a stop band frequency of 5000 rad/s at which the magnitude is required to be less than -25 dB.

(14 marks)

Question 5

(a) Briefly describe the properties of standard transfer function for following real filters.

i. Butterworth filter

ii. Chebyshev filter

iii. Elliptic filter.

(6 marks)

(b) Obtain the Fourier series of a square-wave signal shown in **Figure 8.**

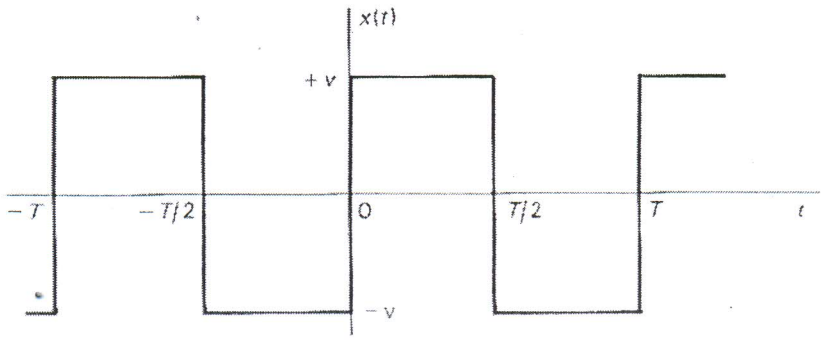

Figure 8

(10 marks)

(c) Design an analogue low-pass Chebyshev filter with maximum gain of 5 dB. The filter also has a maximum pass-band loss of 0.5 dB with a bandwidth of 2500 rad/s, a stop-band frequency of 12500 rad/sec, and a minimum stop-band loss of 30 dB or more.

(14 marks)

END OF QUESTION PAPER