UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(TAKE HOME)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	SIGNAL PROCESSING
COURSE CODE	:	BWC 40503
PROGRAMME CODE	:	BWC
EXAMINATION DATE	:	JANUARY/FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS **OPEN BOOK EXAMINATION**

TERBUKA

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Consider the follow analog signal pulse

$$x(t) = \begin{cases} t, & 0 \leq t \leq 1 \\ 0, & otherwise \end{cases}$$

Determine mathematical expressions for x(t) delayed by 2, advanced by 2, and for x(-t).

(6 marks)

(b) Plot following signals

(i) $y_1(t) = u(t) - u(t-1)$

(2 marks)

(ii) $y_2 = 2u(-t)$

(2 marks)

(c) Express the following signal as a combination of an even and an odd signal and plot x(t) and its even and odd components.

$$x(t) = \begin{cases} t & 0 \leq t < 1 \\ 0 & elsewhere \end{cases}$$

(10 marks)

Q2 (a) Consider the CT signal shown in **Figure Q2(a)**. Calculate the instantaneous power, average power, and energy present in the two signals.

(6 marks)

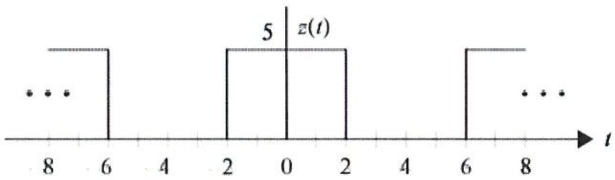

FIGURE Q2(a)

(b) Is this $y(t) = \sin(t).x(t)$ stable? Justify your answer.

(3 marks)

(c) Check whether $y(t) = \begin{cases} x(t+1) & t > 0 \\ x(t-1) & t \leq 0 \end{cases}$ is linear or nonlinear. Justify your answer.

(3 marks)

(d) Consider a voltage divider circuit system consists of input source $x(t)$ and two similar resistors in resistance are connected in series. Demonstrate whether the system has a linear characteristic.

(8 marks)

Q3 (a) Describe the convolution of two linear systems with help of mathematical relation and block diagram.

(4 marks)

(b) Find the convolution of two signals given by

$$x_1(n) = \{3, \quad 2,2\}$$

$$x_2(n) = \begin{cases} 2 & 0 \le n \le 4 \\ 0 & elsewhere \end{cases}$$

(6 marks)

(c) Analyse the continuous-time Fourier series (CTFS) expression of periodic signal $k(t) = 2e^{-0.2t}$ with fundamental period, $T_o = 2\pi$.

(*Hint*: Workout coefficients a_0, a_n and b_n for trigonometric terms and express in the form of Fourier Series)

(10 marks)

Q4 (a) Compute the N-point DFT of

$$x(n) = 3\delta(n)$$

(4 marks)

(b) Verify Parseval's theorem of the sequence.

$$x(n) = \frac{1^n}{4} u(n)$$

(6 marks)

(c) Outline the Fourier series representation of output, $y(n)$ if the input, $x(n)$ is a periodic extension of the sequence $\{2, -1, 1, 2\}$ for the system with impulse response, $h(n) = \left(\frac{1}{3}\right)^n u(n)$

(10 marks)

Q5 (a) Analyse and perform the related graphical interpretation of convolution integral of input signal $x(t) = e^{2t}$ to an LTI system, where impulse response is given by

$$h(t) = \begin{cases} 1 - t, & 0 \le t \le 1 \\ 0, & otherwise \end{cases}$$

(8 marks)

(b) Determine the output signal $y(t)$ of a linear time-invariant (LTI) system using Fourier transform for the impulse response of $h(t) = e^{(-at)}u(t)$ and unit step function of input signal, $x(t)$.

(6 marks)

(c) Suppose we have two 4-pt sequences x[n] and h[n] described as follows:

$$x[n] = \cos\left(\frac{\pi n}{2}\right), \qquad n = 0, 1, 2 \text{ and } 3$$
$$h[n] = 2^n, \qquad n = 0, 1, 2 \text{ and } 3$$

Compute 4-point circular convolution of $y[n] = x[n] \otimes h[n]$ and plot y[n].

(6 marks)

– **END OF QUESTIONS** –