UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME	:	SIGNALS AND SYSTEMS
COURSE CODE	:	BNF36002/BNR36103
PROGRAMME CODE	:	BNF
EXAMINATION DATE	:	JANUARY / FEBRUARY 2021
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS **OPEN BOOK EXAMINATION**

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

Q1 (a) Sketch the output of the following functions. Label your sketches carefully.

(i) $y(t) = (\sin t).u(t - \pi)$

(3 marks)

(ii) $y(t) = t^2.u(t - 2)$

(3 marks)

(iii) $y(t) = u(t+2) - u(t+1) + u(t-1)$

(3 marks)

(b) Given $w(t) = \sum_{-\infty}^{\infty} P(t - 6k)$, fundamental period $T_o = 6s$, analyze the energy and power signals depicted in the **Figure Q1 (b)**. Identify whether the signal is energy signals or power signals.

(7 marks)

(c) Demonstrate whether the following systems are time invariance or not. (Show necessary steps for verification)

(i) $y(t) = x(4t)$

(3 marks)

(ii) $y(t) = e^{x(t)}$

(3 marks)

(iii) $y(t) = t^{2x(t)}$

(3 marks)

Q2 (a) A system can be classified into several system properties. Describe **SIX (6)** basic system properties.

(6 marks)

(b) Consider the parallel combination of two LTI systems shown in **Figure Q2 (b)**. The impulse responses of the systems are as follow:

$$h_1(t) = 2\delta(t+2) - 3\delta(t+1)$$

$$h_2(t) = \delta(t-2)$$

If the input $x(t)$ is a unit step signal, evaluate the output waveform $y(t)$. Construct the output waveform based on your answer.

(8 marks)

(c) Determine the Fourier series of the waveform shown in **Figure Q2 (c)** and illustrate the amplitude and phase spectra.

(11 marks)

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Q3 (a) Compute the coefficients a_k using Fourier series analysis equation for the continuous-time periodic signal

$$x(t) \quad \begin{cases} 1.5 & 0 < t < 1 \\ -1.5 & 1 < t < 2 \end{cases}$$

With the fundamental frequency $\omega_0 = \pi$

Fourier series analysis equation $a_k = \frac{1}{T}\int_T x(t)e^{-jk\omega_0 t}\,dt$

(7 marks)

(b) Determine the Fourier Transform of the following signals

(i) $x(t) = sin\omega_0 t$

(9 marks)

(ii) $x(t) = 2e^{-\frac{t}{2}}u(t)$

(9 marks)

Q4 (a) Explain briefly the differences between Fourier Transform and Laplace Transform

(5 marks)

(b) Laplace transform converts the equation of mathematical model from t-(time) domain into s-(frequency) domain and Inverse Laplace Transform is vice versa. By using the definition, solve the following equations:

(i) $h(t) = (t-2)^2u(t-2)$

(4 marks)

(ii) $l(s) = \frac{s^2}{s^2+5s+6}$

(4 marks)

(c) Given the following differential equations, analyze the system by obtaining the response $y(t)$ subject to the given initial condition.

(i) $\frac{dy}{dt} + 2y = 12 \qquad where \;\; y(0) = 10$

(6 marks)

(ii) $y'' + 3y' + 2y = 0 \qquad where\; y(0) = 0.1 \;and\; y'(0) = 0.05$

(6 marks)

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- END OF QUESTIONS –

FINAL EXAMINATION

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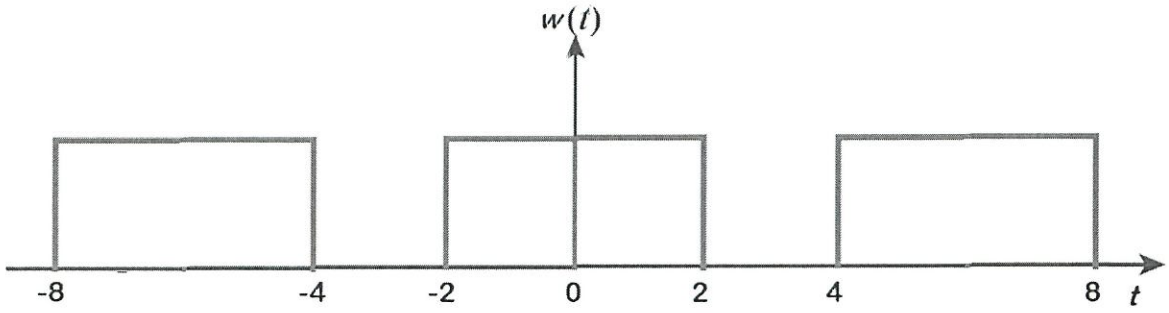

Figure Q1 (b)

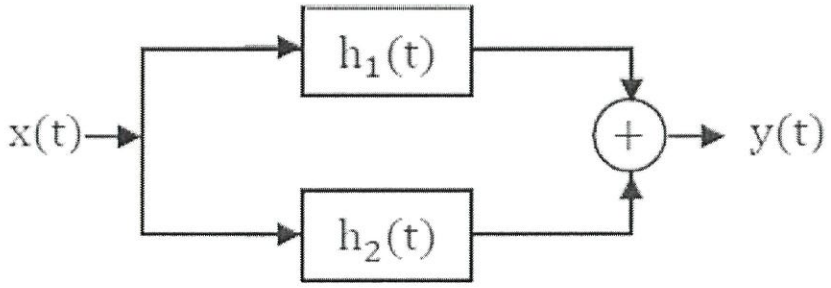

Figure Q2 (b)

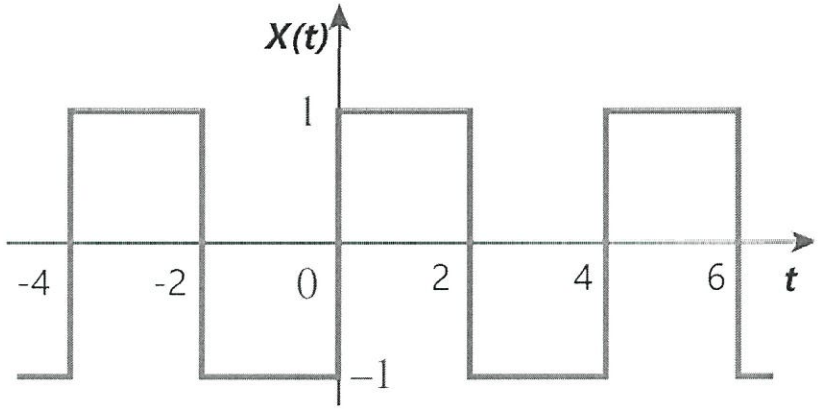

Figure Q2 (c)

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