



MACHAKOS UNIVERSITY

University Examinations 2018/2019

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FOURTH YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONIC ENGINEERING)

EE 410: SIGNAL AND SYSTEMS

DATE: 27/9/2019

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

Answer Question one and any other 2

QUESTION ONE {30 MARKS, COMPULSORY}

(a) Define the following terms [4mks]

(i) Signal

(ii) System

(b) Evaluate the following discrete-time convolution sums: [8mks]

(i) $y[n] = u[n+3] * u[n-3]$

(ii) $2^n u[-n+3] * u[n-2]$

(c) Given the expression below, sketch the frequency domain (magnitude and phase) representation of the signal

$$x(t) = 10 + 14 \cos(200\pi t - \pi/3) + 8 \cos(500\pi t + \pi/2)$$

(d) Derive the Fourier series coefficients of a triangular waveform whose width is a quarter of the period and sketch the frequency domain representation of the signal.

- (e) One input to a conventional AM modulator is a 500-kHz carrier with an amplitude of $20 V_p$. The second input is a 10-kHz modulating signal that is of sufficient amplitude to cause a change in the output wave of $\pm 7.5 V_p$. Determine
- Upper and lower side frequencies.
 - Modulation index and percentage modulation.
 - Peak amplitude of the modulated carrier and the upper and lower side frequency voltages.
 - Maximum and minimum amplitudes of the envelope.
 - Expression for the modulated wave.
 - Draw the output spectrum.
 - Sketch the output envelope.
 - Determine the maximum sideband power if the carrier output is 1 kW and calculate the total maximum transmitted power

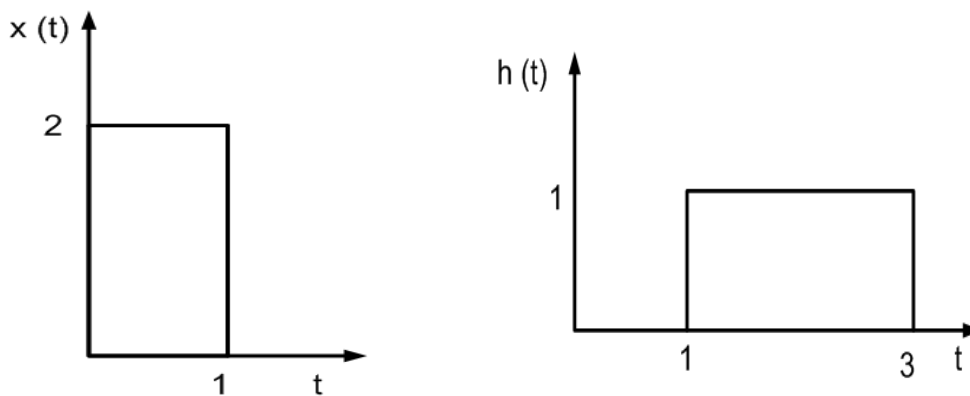
QUESTION TWO {20 MARKS}

(a) Differentiate between

[8mks]

- Continuous time signals and discrete time signals.
- Periodic signal and non-periodic signal.
- even and odd signal
- Define Energy and power signal.

(b) Perform the graphical convolution of $x(t)$ and $h(t)$ below to produce the output of $y(t)$ [12mks]



QUESTION THREE {20 MARKS}

(a) Using suitable illustrations and mathematical relations, define the following signals

[9mks]

- unit pulse signal
- continuous time complex exponential signal
- continuous time real exponential signal.

- (b) Find the Fourier Transform (FT) of $x(t) = e^{-at} u(t)$ and hence sketch the phase and amplitude spectrum of the same [11mks]

QUESTION FOUR{20 MARKS}

- (a) Define mathematically three properties of convolution [6mks]

- (b) Draw the block diagram representation of the integral equation given by [8mks]

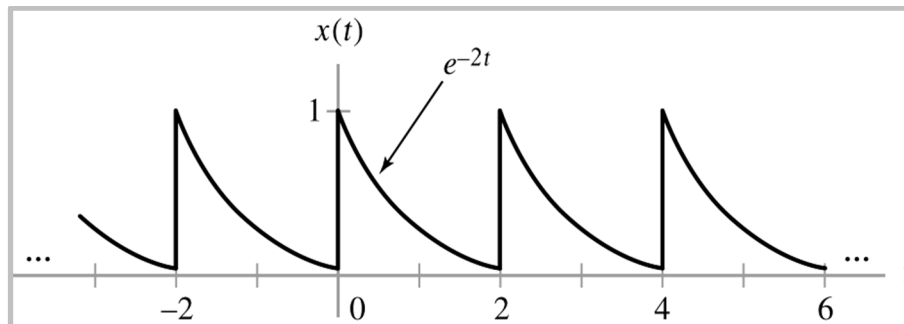
$$y(t) = -a_1 y^{(1)}(t) - a_0 y^{(2)}(t) + b_2 x(t) + b_1 x^{(1)}(t) + b_0 x^{(2)}(t)$$

- (c) Determine the inverse Laplace transform of, [6mks]

$$F(s) = 1 + \frac{3}{s+4} - \frac{5s}{s^2+4}$$

QUESTION FIVE {20 MARKS}

- (a) Find the Fourier series coefficients of the waveform below and hence sketch the phase and amplitude spectrum [12mks]



- (b) Using suitable illustrations, explain the 3 types of analogue modulation [8mks]