



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FIFTH YEAR SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (.....)

EEE 410: SIGNAL AND SYSTEMS

DATE:

TIME:

INSTRUCTIONS:

This paper consists of FIVE Questions.

Answer Question ONE [30 Marks] and any other TWO Questions [20 Marks Each].

Write your college number on the answer sheet.

This paper consists of 3 printed pages

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Define Signal and System. (2 marks)
- b) Difference between Continuous Time Signal and Discrete Time Signal. (3 marks)
- c) Check whether the following system is static or dynamic and also causal and noncausal.
 $y(n) = x(2n)$. (3 marks)
- d) Give the mathematical and graphical representation of CT (continuous time) and DT (discrete time) impulse function hence enlist their significance. (4 marks)
- e) State the two properties of unit impulse function hence state its significances (4 marks)
- f) Verify whether the system described by the equation $y(t) = x(t)^2$ is linear and time invariant. (2 marks)
- g) Determine whether the following systems are time invariant or not. (2 marks)
 - i) $Y(t) = tx(t)$
 - ii) $Y(n) = x(2n)$

- h) State the trigonometric and exponential Fourier series. (4 marks)
- i) Obtain the Fourier series coefficients for $x(n) = \sin \omega_0 n$. (4 marks)
- j) Consider the analog signal $x(t) = 4\cos 100\pi t + 15\sin 300\pi t - 2\cos 100\pi t$. Determine the Nyquist rate for this signal. (2 marks)

QUESTION TWO (20 MARKS)

- a) Determine whether the given signals is energy or power and calculate its energy and power $x(t) = \text{rect}\left(\frac{t}{T_0}\right) \cos \omega_0 t$ (4 marks)
- b) Determine whether the discrete time sequence. $x(n) = \sin\left(\frac{\pi 3n}{7} + \frac{\pi}{4}\right) + \cos\left(\frac{\pi n}{3}\right)$ (4 marks)
- c) Determine the given signal whether its of the following listed (12 marks)
- $y(n) = e^{x(n)}$**
- i. Linear (or) nonlinear:
 - ii. Time invariant (or) time variant
 - iii. Static (or) dynamic
 - iv. Stable (or) Unstable system
 - v. Causal (or) non causal

QUESTION THREE (20 MARKS)

- a) Explain in details the classification of CT signal & DT signal (10 marks)
- b) Verify the system described by the equation $y(n) = x(n)^2$ whether is linear or nonlinear; time variant or time invariant; static or dynamic; stable or unstable; casual or non-causal (10 marks)

QUESTION FOUR (20 MARKS)

- a) Find the Fourier Transform of $x(t) = e^{-at}u(t)$, $a > 0$. Plot the magnitude and phase Spectrum (8 marks)
- b) Obtain the Fourier's transform of rectangular pulse of duration T and amplitude 'A' (12 marks)

QUESTION FIVE (20 marks)

- a) Determine the LaPlace transform of unit step function (6 marks)
- The unit function is given as $u(t) = \begin{cases} 1 & \text{for } t \geq 0 \\ 0 & \text{otherwise} \end{cases}$
- b) Find out $l^{-1} \left[\frac{s+1}{2s^2+5s+3} \right]$ (6 marks)
- c) Explain and proof sampling theorem. (8 marks)