



MACHAKOS UNIVERSITY

University Examinations for 2022/2023

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

THIRD YEAR FIRST SEMESTER EXAMINATION FOR
BACHELOR OF SCIENCE (TELECOMMUNICATION AND INFORMATION
TECHNOLOGY)

SPH 310: SIGNAL PROCESSING

DATE:

TIME:

INSTRUCTIONS

ANSWER QUESTION ONE AND ANY OTHER TWO

QUESTION ONE (COMPULSORY) (30 MARKS)

- (a) Differentiate between analog and digital signals. (4 marks)
- (b) Explain what continuous-time and discrete-time signals are. (4 marks)
- (c) Compute the energy and power of the signal below. (4 marks)

$$x(t) = e^{-t} u(t)$$

- (d) Explain what a linear system is. (4 marks)

- (e) Apply partial fraction expansion to determine $x(t)$ for the system whose Laplace transform is given below.

$$X(s) = \frac{10s + 16}{s(s+2)(s+4)}$$

(4 marks)

- (f) Which of the following systems below are linear?

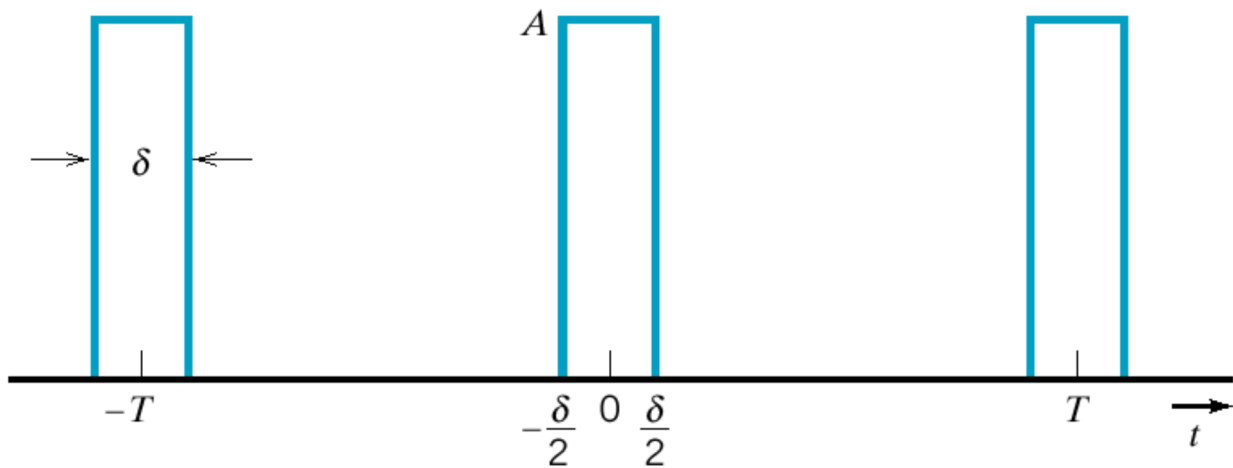
(5 marks)

(a) $y_1(t) = |\sin(3t)| x(t)$.

(b) $y_2(t) = a \frac{dx}{dt}$.

- (g) Find the complex Fourier series for the following periodic time function.

(5 marks)



QUESTION TWO (20 MARKS)

- (a) Differentiate between periodic and non-periodic signals. (4 marks)
- (b) Compute the energy and the power of the signal given below. (4 marks)

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

- (c) State Parseval's theorem. Give the relevant mathematical formulation. (4 marks)
- (d) Explain the Fourier series representation of periodic composite signals. (4 marks)
- (e) Find the Fourier transform of the signal given below. (4 marks)

$$x(t) = e^{-at} u(t), \quad \text{Re}\{a\} > 0$$

QUESTION THREE (20 MARKS)

- (a) Determine whether the system below is time-invariant. (3 marks)

$$y(t) = \frac{dx}{dt} + \sin[x(t-1)].$$

- (b) Determine the energy of the signal whose profile is given below. (5 marks)