



FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGER STATE
SCHOOL OF ELECTRICAL ENGINEERING AND TECHNOLOGY
DEPARTMENT OF MECHATRONICS ENGINEERING
FIRST SEMESTER 2019/2020 ACADEMIC SESSION

COURSE: MCE 313: Signals and Systems

TIME ALLOWED: 2 HOURS

CREDIT UNIT: 2

LEVEL: 300

Instruction: Attempt All Questions

Question one

[20 Marks]

- a) Explain with the aid of equations and graphs the following classes of Signals,
- i. Deterministic and Non Deterministic Signals
 - ii. Periodic and Aperiodic Signals
 - iii. Energy and Power Signals

[10 Marks]

- b) Classify the following signals

$$x(t) = 2\cos\frac{4\pi}{5}t + 3\sin\frac{2\pi}{3}t \text{ and } x(n) = 2\cos\frac{4\pi}{5}n + 3\sin\frac{2\pi}{3}n \text{ to}$$

- i. Continuous time or discrete time signal,
- ii. Periodic or Non-Periodic,
- iii. Power or Energy Signal and show the detailed explanation for your classification.

[10 Marks]

Question Two

[20 Marks]

- a) Given the sequences in Figure 1, $x(k)$ and $h(k)$ Evaluate $y(k) = x(k) * h(k)$, show all the necessary sequences, equations and graphs.

[10 Marks]

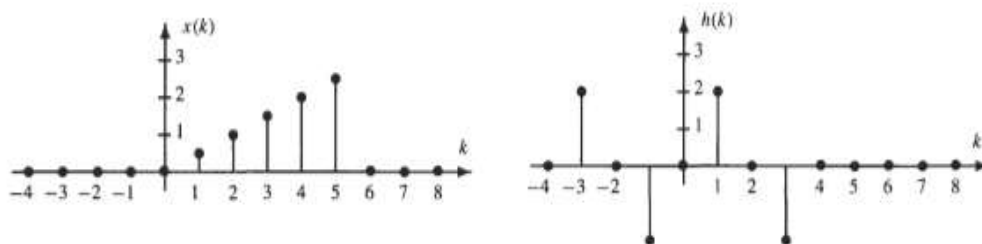


Figure 1.

- b) Compute the Laplace transform of this signal;

i. $x(t) = 10e^{-(t-2)}u(t-2) + 10e^{0.5(t-2)}u(-t+2)$

ii. $x(t) = t^4 3\delta(t) + 2e^t \cos(wt)$

[10 Marks]

Question 3 [20 Marks]

- a) As a student of Signals and Systems analysis, and you were given the three systems below, which of the systems is stable and which one is unstable and make sure you show your workings. [10 Marks]

- $y(n) = x^2(n)$
- $y(n) = e^{x(n)}/x(n-1)$
- $y(n) = \cos x(n)$

- b) For each of the systems given below, $x(n)$ and $y(n)$ represent input and output respectively, determine which of the systems is homogeneous, additive and linear, [10 Marks]

- $y(n) = \log(x(n))$
- $y(n) = 6x(n+1) + 2x(n) + 1$
- $y(n) = x(n)\sin((n\pi/2))$

Question Four

[20 Marks]

- a. Given this signal $x(t) = e^{-at}u(t)$, Find;
- the Fourier transform of the signal,
 - the amplitude and the phase of the transformed signal
 - Sketch the amplitude and phase spectrum of the transformed signal. [10 Marks]
- b. Given the circuit shown in Fig. 2, find;
- the input-output relationship,
 - determine whether the system is Memoryless, Causal, Linear, time-invariant, or stable. [10 Marks]

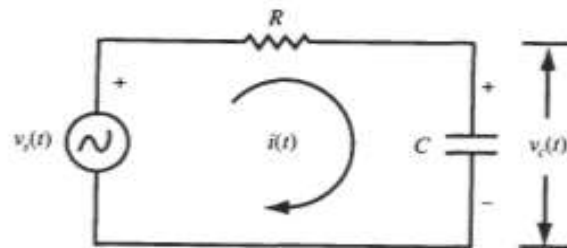


Figure 2.