Question Paper

Exam Date & Time: 19-Jun-2023 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
END SEMESTER THEORY EXAMINATION - MAY 2023
IV SEMESTER B.Sc (Applied Sciences) in Engg.
SIGNALS AND SIGNAL PROCESSING [IEE 241]

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

Missing data, if any, may be suitably assumed
Use of formula/transform table is permitted.

1) Sketch and label the even and odd components of the following CT signal. (2)

A) $x(t) = t\,[u(t) - u(t-5)]$.

B) Consider the DT signal $x[n] = 2^n\{u[n+1] - u[n-4]\}$. Sketch $x[n]$ and the following transformations on $x[n]$: (4)

(i) $y_1[n] = x[n-3]$, (ii) $y_2[n] = x[4-2n]$, and (iii) $y_3[n] = x[-n-2]$.

C) Test for linearity, time-invariance, causality, and stability properties for the CT system described by $y(t) = x(t)\cos(\Omega t)$. (4)

2) Convolute the following sequences: $x_1[n] = \alpha^n u[n]$ and $x_2[n] = \alpha^{-n}u[-n]$ with $0 < \alpha < 1$. (5)

A)

B) A system is formed by connecting two sub-systems in cascade. The impulse responses of the sub-systems are given by $h_1(t) = e^{-2t}u(t)$ and $h_2(t) = 2e^{-t}u(t)$. Find the overall impulse response $h(t)$ of the system. Also, determine if the system is stable and causal. (5)

3) Consider the signal given by $x(t) = \begin{cases} 1, & 0 < t < 1 \\ -1, & 1 < t < 2 \end{cases}$ for one period. (5)

A) Determine the trigonometric Fourier series representation of $x(t)$.

B) Using properties of CTFT, find the inverse Fourier transform of (5)

$$X[j\Omega] = \frac{1}{(a + j\Omega)^2}$$

4) Determine the DTFS representation for the following signal (3)

A) $$x[n] = \cos\left(\frac{\pi n}{3}\right) + \sin\left(\frac{\pi n}{4}\right)$$

B) Find the DTFT of the following signal $x[n] = u[n] - u[n-6]$. Sketch the (4)