Question Paper

Exam Date & Time: 16-May-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 - S2]

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) A) Plot the DT signal $x[n] = 1 - \sum_{k=3}^{\infty} \delta[n-1-k]$; for all $'n'$. Express $x[n]$ in terms of step functions. (2)

B) Find the energy and power of the following CT signal. (4)

$$x(t) = \begin{cases} 1; & 0 < t < 1 \\ -2; & 1 < t < 2 \end{cases}$$

Also determine and sketch the first derivative of $x(t)$.

C) Test for linearity, time-invariance, causality, and stability properties for the DT system described by $y[n] = log_{10}(|x[n]|)$. (4)

2) A) A system is formed by connecting two sub-systems in cascade. The impulse responses of the sub-systems are given by $h_1(t) = e^{-t}u(t)$ 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)

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

3) A) Consider the periodic waveform $x(t) = 4 + 2\,cos3t + 3\,sin4t$. Determine the complex exponential Fourier series representation of $x(t)$. Also find the total average power of the signal. (5)

B) Using properties, find the CTFT of the signal (5)

$$x(t) = \frac{1}{a^2 + t^2}$$

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