Question Paper

Exam Date & Time: 03-Jun-2022 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
IV SEMESTER B.Sc.(Applied Sciences) in Engg.
END SEMESTER THEORY EXAMINATION- MAY/JUNE-2022

SIGNALS AND SIGNAL PROCESSING [IEE 241 - S2]

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

Answer ALL the questions.
Missing data may be suitably assumed.
Use of formula/transform table is permitted.

1) A) Plot the DT signal $y[n] = 1 - \delta[n]$; for all $'n'$. Express $y[n]$ in terms of step functions. (2)

B) Find and sketch the first derivative of the following CT signal $x(t) = t\{u(t) - u(t-2)\}$. (4)

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

2) A) Consider the cascade of DT-LTI systems with impulse responses $h_1[n]$ and $h_2[n]$, respectively. Find $h_1[n]$ if $h_2[n] = \{\underline{\mathbf{1}}, -1\}$ and if the input is $x[n] = \{\underline{\mathbf{1}}, 1\}$, with an output of $y[n] = \{2, 1, \underline{\mathbf{0}}, -1, -2\}$. (5)

Note: Bold and underlined number represents the sample at $n = 0$.

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

3) A) Consider the periodic square wave with period T_0 given by (5)

$$x(t) = \begin{cases} A\ ; 0 < t < \dfrac{T_0}{2} \\ 0\ ; \dfrac{T_0}{2} < t < T_0 \end{cases}$$

Determine the (i) complex exponential Fourier series and (ii) trigonometric Fourier series of $x(t)$.

B) Find the CTFT of the signal (3)