CBCS SCHEME

USN

18EE54

Fifth Semester B.E. Degree Examination, June/July 2024
Signals and Systems

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define signals and systems. And explain the classification of signals. **(08 Marks)**

b. Given $x(n) = [6 - n][u(n) - u(n - 6)]$. Sketch the following signal
i) $y(n) = x(2n - 3)$ ii) $y(n) = x(4 - n)$ **(08 Marks)**

c. Given $x(t) = \cos(2t) + \sin(3t)$. Check for the periodicity of given signal, if periodic find its fundamental period. **(04 Marks)**

OR

2 a. Determine the system $y(t) = e^{x(t)}$ is i) Linear ii) time invariant iii) Memory iv) Causal. **(06 Marks)**

b. Find energy or power of a given signal

$$x(t) = \begin{cases} 2 & : 0 \le t \le 2 \\ -t + 4 & : 2 \le t \le 4 \\ 0 & : \text{otherwise} \end{cases}$$ **(08 Marks)**

c. For a continuous time signal x(t) shown in Fig Q2(c). Sketch the signal $y(t) = x(3t + 2)$

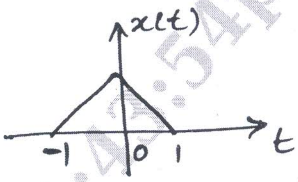

Fig Q2(c) **(06 Marks)**

Module-2

3 a. Evaluate the continuous time convolution integral given below. $y(t) = e^{-2t} u(t) * u(t + 2)$ **(10 Marks)**

b. Evaluate the step response for the LTI system represented by the impulse response $h(t) = tu(t)$. **(10 Marks)**

OR

4 a. Find the natural response of the system described by the differential equation.

$$\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = x(t) + \frac{dx(t)}{dt}$$

$$y(0) = 0 \quad : \quad \left.\frac{dy(t)}{dt}\right|_{t=0} = 1.$$ **(10 Marks)**

b. Sketch the direct form I and direct form II implementations for the difference equation.

$$y(n) + \frac{1}{2}y(n-1) - y(n-3) = 3x(n-1) + 2x(n-2)$$ **(10 Marks)**

Module-3

5 a. State and prove the following properties of continuous time Fourier transform (10 Marks)
i) Time shift ii) Frequency differentiation

b. Find the frequency response and the impulse response of the system described by the differential equation, $\frac{dy(t)}{dt} + 8y(t) = x(t)$. (10 Marks)

OR

6 a. Compute the Fourier transform of the following signals : (10 Marks)
i) $x(t) = e^{-at} \cdot u(t)$ ii) $x(t) = t\,u(t)$

b. Find the inverse Fourier transform of (10 Marks)
i) $x(jw) = \frac{jw}{(2+jw)^2}$ ii) $K(jw) = \frac{-jw}{(jw)^2 + 3jw + 2}$

Module-4

7 a. State and prove Parseval's theorem of discrete time Fourier transform. (10 Marks)

b. Find the DTFT of the signal (10 Marks)
i) $x(n) = 3^n u(-n)$ ii) $x(n) = \left(\frac{1}{3}\right)^{n+1} u(n+1)$

OR

8 a. Find the inverse DTFT for $x(e^{j\Omega}) = \frac{6}{e^{-j2\Omega} - 5e^{-j\Omega} + 6}$ (06 Marks)

b. Using the appropriate properties, find the DTFT of the following signal $x(n) = \left(\frac{1}{2}\right)^n u(n-2)$ (06 Marks)

c. Obtain the difference equation description for the system having impulse response $h(n) = \delta(n) + 2\left(\frac{1}{2}\right)^n u(n) + \left(\frac{-1}{2}\right)^n u(n)$. (08 Marks)

Module-5

9 a. Explain the properties of ROC. (06 Marks)

b. For the given difference equation find transfer function (08 Marks)
$y(n) - y(n-1) + \frac{1}{4}y(n-2) = x(n) + \frac{1}{4}x(n-1) - \frac{1}{8}x(n-2)$

c. Find the Z-transform and ROC of the function $x(n) = 2^{-n} u(-n)$. (06 Marks)

OR

10 a. Find the inverse z-transform of the following using partial fraction expansion method (10 Marks)
$x(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - \frac{3}{2}z^{-1} + \frac{1}{2}z^{-2}}$ with ROC $|z| > 1$.

b. Explain the following properties of 'Z' transform i) Time shifting ii) Convolution. (10 Marks)

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