

T.E. (Instru) Sem V - Choice Based - 1/2 - 15/11/18.
Signals & Systems

[Time: Three Hours]

[Marks:80]

- Instructions:
1. Question.No.1 is compulsory.
 2. Attempt any three questions from remaining five questions.
 3. Assume suitable data wherever necessary.

1 Attempt the following:

20

a. Determine the convolution of following signals:

$$x(t) = e^{-4t}u(t)$$

$$h(t) = u(t - 2)$$

b. Determine the Fourier series coefficients of the signal,

$$x(n) = \{1, 1, 0, 0\}.$$

c. State any two properties of Fourier transform.

d. Determine Laplace transform and sketch ROC of the signal,

$$x(t) = (e^{-2t} - e^{-3t})u(t).$$

2 a. Determine the z-transform and sketch the ROC of the signal

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$$x(n) = \begin{cases} 0, & n \geq 0 \\ -a^n, & n \leq -1 \end{cases}$$

b. Sketch the waveforms of the following signals:

4

$$1. x(t) = u(t) - u(t - 2)$$

$$2. x(t) = u(t + 1) - 2u(t)$$

c. Determine the total energy of the following signal:

6

$$x(t) = \begin{cases} 5 - t, & 4 \leq t \leq 5 \\ 1, & -4 \leq t \leq 4 \\ 5 + t, & -5 \leq t \leq -4 \end{cases}$$

3 a. Define signal. Explain classification of signals.

10

b. Determine Fourier transform and sketch the magnitude and phase response of

10

$$x(n) = \{-2, -1, 0, 1, 2\}. \text{ Use } \omega = 0, \pm \frac{\pi}{4}, \pm \frac{\pi}{2}, \pm \frac{3\pi}{4}, \pm \pi \text{ rad/sec.}$$

TURN OVER

T.E - Instru - Sem V - Choice Based - 2/2 15/11/18

Signals & Systems

2

- 4 a. Determine the Fourier series coefficients for 7
 $x(t) = (t + t^2), -\pi \leq t \leq \pi.$
- b. Determine the unit impulse response $h(t)$ of the system described by the following differential equation: 7
 $\frac{d^2y(t)}{dt^2} + 3\frac{dy(t)}{dt} + 2y(t) = \frac{dx(t)}{dt} + 2x(t).$ Use Laplace transform.
- c. Determine the response of the system given in 4(b) for $x(t) = 4e^{-2t}u(t).$ 6
- 5 a. Compute the linear convolution of following signals using analytical method: 10
 $x(n) = \{1, 3, 5, 2, 1\}$
 $h(n) = \{2, 1, 2, 1, 3\}$
- b. Determine the response of the system described by the following difference equation: 10
 $y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2) + x(n)$ to the input $x(n) = \delta(n) - \frac{1}{3}\delta(n-1).$
- 6 a. Determine, whether following systems are memory-less, stable, causal, linear and time-invariant: 10
 1. $y(t) = x(2-t)$
 2. $y(n) = x(n/2)$
- b. Determine the inverse z-transform using partial fraction method: 10

$$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$