CBCS SCHEME

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15EE54

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Signals & Systems

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Categorize the following signal as energy signal or power signal. Find out corresponding value:

$$x(t)=\begin{cases} t & 0\le t\le 1 \\ 2-t & 1\le t\le 2 \\ 0 & \text{Otherwise}\end{cases}$$

(04 Marks)

b. What are different elementary signals? Explain them with neat sketch. **(04 Marks)**

c. Sketch and label for each of the following for given signal x(t) shown in Fig. Q1 (c):

(i) $x(2t+1)$ (ii) $x(-2t+3)$ (iii) $x\left(2\left(\frac{t}{3}-2\right)\right)$

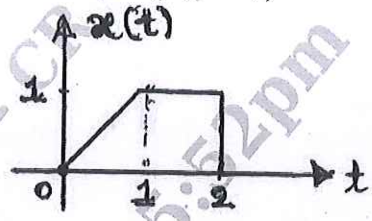

Fig. Q1 (c)

(08 Marks)

OR

2 a. Explain different classification of signals. **(05 Marks)**

b. Given discrete time system $y(n)=2x(2^n)$. Determine whether the system is,
(i) Linear (ii) Time variant (iii) Memoryless (iv) Stable. **(05 Marks)**

c. Find the even and odd part of the following signal,
(i) $x(t)=e^{-2t}\cos(t)$ (ii) $x(t)=e^{jt}$ **(06 Marks)**

Module-2

3 a. Find the following convolution sum $y(n)=\left(\frac{3}{4}\right)^n u(n)*u(n-2)$ and evaluate the value for $n=\pm 5$. **(06 Marks)**

b. Find out the total response of the system given by,

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

with $y(0)=-1,\ \left.\frac{dy(t)}{dt}\right|_{t=0}=1$ and $x(t)=\cos(t)u(t)$ **(10 Marks)**

OR

4 a. The impulse response of an LTI system is given by $h(t) = u(t) - u(t-2)$. Find the output of the system for a given input $x(t) = u(t) - u(t-3)$. Draw the output response. **(10 Marks)**

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

$$y[n] + \frac{1}{2}y[n-1] - y[n-3] = 3x[n-1] + 2x[n-2]$$ **(06 Marks)**

Module-3

5 a. Find the Fourier Transform (FT) of the following signals:

(i) $x(t) = e^{-a|t|}$ (ii) $x(t) = \frac{1}{a^2 + t^2}$ (iii) $x(t) = \cos\omega_0 t$ **(10 Marks)**

b. State and prove the following properties in Fourier Transforms:

(i) Differentiation property (Time)

(ii) Time shift property **(06 Marks)**

OR

6 a. Find the frequency response of the system and impulse response if differential equation of the system is given by,

$$\frac{d^2}{dt^2}y(t) + 5\frac{d}{dt}y(t) + 6y(t) = -\frac{d}{dt}x(t)$$ **(08 Marks)**

b. The RC filter is characterized by following impulse response find out corresponding frequency response:

$$h(t) = \frac{1}{RC}e^{-t/RC}u(t)$$

For the above LTI system plot the magnitude curve. **(08 Marks)**

Module-4

7 a. Find the Discrete Time Fourier Transform (DTFT), of a rectangular pulse sequence given by $x[n] = u[n] - u[n-N]$ **(08 Marks)**

b. A causal discrete LTI system is described by,

$$y[n] - \frac{3}{4}y[n-1] + \frac{1}{8}y[n-2] = x[n]$$

(i) Determine frequency response of the system $H(\Omega)$.

(ii) Find the impulse response $h[n]$ of the system. **(08 Marks)**

OR

8 a. Use appropriate properties to find DTFT of the following signal:

(i) $x[n] = \left[\frac{1}{2}\right]^n u[n-2]$.

(ii) $x[n] = n\left[\frac{1}{2}\right]^{|n|}$ **(08 Marks)**

b. A discrete LTI first order system is given by,

$$y[n] = x[n] + x[n-1]$$

Find out the frequency response of the system and impulse response. **(08 Marks)**

Module-5

9 a. Determine the z-transform, ROC and the location of poles and zeros of X(z) for the given x(n),

$$x(n) = -\left(\frac{1}{2}\right)^n u(-n-1) - \left(-\frac{1}{3}\right)^n u(-n-1).$$ **(08 Marks)**

b. Use the method of partial fractions to obtain time domain signal corresponding to the given X(z).

$$X(z) = \frac{z^2 - 3z}{z^2 + \frac{3}{2}z - 1} \quad \text{ROC } \frac{1}{2}|z| < 2$$ **(08 Marks)**

OR

10 a. What are the properties of Region Of Convergence (ROC) in z-transform? **(04 Marks)**

b. Find the inverse – z transform of $X(z) = \ln(1 + z^{-1})$ using power series expansion. **(04 Marks)**

c. Solve the following difference equation using unilateral z-transform:

$$y(n) - \frac{3}{2}y(n-1) + \frac{1}{2}y(n-2) = x(n) \quad \text{for } n \geq 0$$

$$y(-1) = 4,\ y(-2) = 10 \text{ and } x(n) = \left(\frac{1}{4}\right)^n u(n)$$ **(08 Marks)**

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