What are the constraints placed on the real and imaginary parts of β if the region of convergence (ROC) of the Laplace transform of x(t) which is X(s) is Re{s}> -3

Q.9 a) The system function of a causal LTI system is: [5]

$$H(s) = \frac{s+1}{s^2+2s+2}$$

Determine the response y(t) when the input $x(t) = e^{-|t|}$

b) Find the inverse Z-transform of X(z) [5]

$X(z) = \frac{z^{-1}}{3-4z^{-1}+z^{-2}}$; ROC; $|z| > 1$

Q.10 a) Consider an LTI system for which the input and output satisfy the linear constant-coefficient difference equation: [5]

$$y[n] - 0.5y[n-1] = x[n] + \frac{1}{3}x[n-1]$$

Determine the impulse response

b) A Differentiator is a continues time LTI system function [5]

$$H_C(s) = s$$

A discrete-time LTI system is constructed by replacing s in the above function by the following known bilinear transformation:

$$s = \frac{1-z^{-1}}{1+z^{-1}} * \frac{2}{T_s}$$

Find the frequency response of the discrete-time system and plot its magnitude and phase responses.

ALL THE BEST

P.T.O

Total No. of Pages:04 | Roll No.......................

FIFTH SEMESTER | **B.Tech.[EE]**

SUPPLIMENTRY EXAMINATION | **(Feb-2019)**

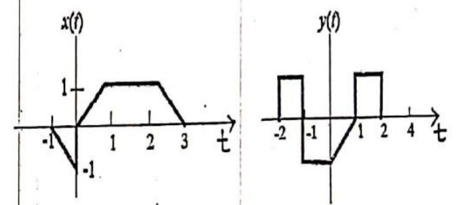
EE/EL-305 SIGNALS AND SYSTEMS

Time: 03 Hours | ***Max. Marks:50***

Note: Q.1 to Q.6 are compulsory.
Attempt any two questions from Q.7 to Q.10.
Assume any data if missing and clearly mention the assumption.

Q.1 a) Let x(t) and y(t) be given as shown in Fig.1(a) below. Sketch the following signals: [2]

1) x(2t) y(0.5t+1)
2) x(t) y(-1-t)



b) Consider a periodic signal x(t) [2]

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

With period T=2.The derivative of this signal is related to the "impulse train" g(t).

$$g(t) = \sum_{k=-\infty}^{\infty} \delta(t-2k)$$

With period T=2. It can be shown that

$$\frac{dx(t)}{dx} = Ag(t-t_1) + Bg(t-t_2)$$

Determine the values of A, B, t_1, t_2

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Q.2 a) Sketch the following signals: [2]

1) $x[n-2] + y[n+2]$

2) $x[3-n]\,y[n]$

$x[n]$ and $y[n]$ are as follows

$$x[n] = \{3,2,1,0,1,2,3\}$$

$$y[n] = \{-1,-1,-1,-1,0,1,1,1,1\}$$

*Assume 0 value as your reference, at t=0{x[n]=y[n]=0}

b) Consider a system S with input x[n] and output y[n]. This system is obtained through a series interconnection of a system S_1 followed by S_2. The input-output relationships are as follows: [2]

$$S_1: y_1[n]=2x_1[n]+4x_1[n-1]$$

$$S_2: y_2[n]=x_2[n-2]+0.5\,x_2[n-3]$$

Where $x_1[n]$, $x_2[n]$ denote input signals.

1) Determine the input-output relationship for system S

2) Does the input-output relationship of system S change if the order in which S_1 & S_2 are connected in series is reversed.

Q.3 a) Evaluate the continues-time convolution integral: [3]

$$y(t) = \cos(2\pi t)\,(u(t+1) - u(t-1)) * e^{-t}u(t)$$

b) Determine and sketch the convolution of the following two signals: [3]

$$x(t) = \begin{cases} t+1, & 0 \le t \le 1 \\ 2-t, & 1 < t \le 2 \\ 0, & elsewhere \end{cases}$$

$$h(t) = \delta(t+2) + 2\delta(t+1)$$

Q.4 a) Consider the signal: [3]

$$x[n] = a^n u[n]$$

1) Sketch the signal $g[n]=x[n]-\alpha\, x[n-1]$.

2) Use the result of part (1) in conjuction with the properties of convolution in order to determine a sequence h[n] such that

$$x[n] * h[n] = 0.5^n\{u[n+2] - u[n-2]\}$$

b) Evaluate the following discrete-time convolution sum: [3]

$$y[n] = (u[n+10] - 2u[n] + u[n-4]) * u[n-2]$$

Q.5 A system may or may not be: [5]

(1) Time Invariant

(2) Causal

Determine which of these properties hold and which do not hold for each of the following continues/discrete time signals. Justify your answers.

a) $y(t)=x(t-4)+x(4-t)$

b) $y(t)=Odd\{x(t)\}$

c) $y[n]=x[n-2]-2x[-n-8]$

d) $y[n]=Even\{x[n-1]\}$

e) $y(t)=x(\sin t)$

Q.6 a) A single-phase full bridge ac to dc converter is used to feed a **highly inductive Load.** Draw the equivalent circuit diagram of the given scenario with SCR as your switch. Determine the Fourier series of the **supply current** obtained. (Assuming the firing angle as zero degrees and input voltage one cycle to be from 0 to 360 degrees) [2]

b) Consider a continues-time LTI system whose frequency response is [2]

$$H(j\omega) = \int_{-\infty}^{\infty} h(t)e^{-j\omega t}dt = \frac{\sin(4\omega)}{\omega}$$

If the input to this system is a periodic signal x(t),

$$x(t) = \begin{cases} 1, & 0 \le t < 4 \\ -1, & 4 \le t < 8 \end{cases}$$

With period T=8, Determine the corresponding system output y(t)

c) Determine DTFS coefficient of the signal x[n] and also plot the magnitude and phase spectrum of DTFS coefficient. [1]

$$x[n] = \cos\left(\frac{\pi n}{3} + \emptyset\right)$$

Q.7 a) Find the impulse response of a system with the frequency response [5]

$$H(j\omega) = \frac{(\sin^2(3\omega))\cos\omega}{\omega^2}$$

b) Find the Z-transform and ROC of the signal: [5]

$$x[n] = 2\left(\frac{5}{6}\right)^n u(-n-1) + 3\left(\frac{1}{2}\right)^n u(n)$$

Q.8 a) Determine the Nyquist rate of the following signals: [5]

1) $x(t) = 1 + \cos(2000\pi t) + \sin(4000t)$

2) $x(t) = \left(\frac{\sin(4000\pi t)}{\pi t}\right)^2$

b) Consider the signal [5]

$$x(t) = e^{-5t}u(t) + e^{-\beta t}u(t)$$