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(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 131303 Roll No.

B. Tech.

(SEM. III) THEORY EXAMINATION, 2015-16

SIGNALS & SYSTEMS

[Time:3 hours] [Total Marks:100]

Section - A

1. Attempt **all** parts. All parts carry equal marks. Write answer of each part in short : (10x2=20)

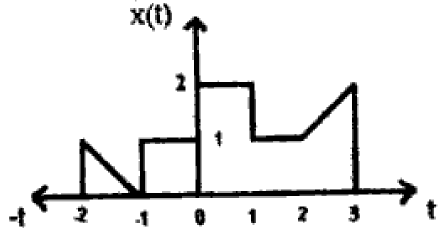
(a) Examine whether the signal is periodic or not. If periodic then find out the period.

$$x(t) = \sin(10t + 1) - 2\cos(5t - 2)$$

(b) Determine the Even and Odd part of the signal.

$$x(t) = \cos\left(Wt + \frac{\pi}{3}\right)$$

(c) Plot the signal $y(t) = x\left(\left(-\frac{t}{2}\right) + 3\right)$ where x(t) is given as



(d) Check whether the system is Linear or Non Linear.

$$2\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 3y(t) = x(t+1)$$

(e) Consider a discrete time system with input x[n] and output y[n] : $y[n] = n[x(n)]^2$

Is this system time variant or time invarient ?

(f) Find out the Laplace transform of the signal with its ROC.

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

(g) Find Z-Transform of the signal

$$x(n) = \left(\frac{1}{2}\right)^n u(n) * \left(\frac{1}{4}\right)^n u(n)$$

(h) Prove the time differentiation property of Fourier transform.

(i) Find the discrete time Fourier transform of the signal : $x[n] = a^n u(-n-1)$

(j) An LTI system is described by the differential equation $\frac{dy(t)}{dt} + 4y(t) = x(t)$. Determine its impulse response h(t) and then H(f).

Section - B

Attempt **any five** questions from this section : (5x10=50)

2. (a) Determine whether the following signal is energy or power signal.

$$x(n) = u[n] - u[n-6]$$

(b) Sketch the following signal

$$y(t) = \pi\left(\left(\frac{t}{3}\right) - 2\right) + \pi(2t - 3.5)$$

3. Find the continuous time Fourier transform of the Gate/ Rectangular signal. Also plot its magnitude response.

4. (a) Find Inverse Laplace transform for

$$X(s) = \frac{s}{s^2 a^2 + b^2}$$

(b) Find the Laplace transform for the parabolic function $x(t) = t^2.e^{-3t}.u(t)$

5. (a) Determine whether the system is BIBO stable or not.

$$y(n) = \max[x(n+1), x(n), x(n-1)]$$

(b) Check whether the system is static / dynamic and Causal / Non Causal and why ?

$$y(n) = \log_{10}|x(n)|$$

6. Determine the inverse Z-transform using partial fraction method for

$$X(z) = \frac{\left(\frac{1}{4}\right)z^{-1}}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{1}{4}z^{-1}\right)}$$

(i) $|z| > \frac{1}{2}$

(ii) $|z| < \frac{1}{4}$

(iii) $\frac{1}{4} < |z| < \frac{1}{2}$

7. (a) Uisng Fourier transform, find the convolution of :

$$x_1(t) = e^{-2t}.u(t)$$

$$x_2(t) = e^{-3t}.u(t)$$

(b) Calculate the DTFT of the following using properties of DTFT

$$x(n) = u(n+3) - u(n-3)$$

8. Determine the total response of the differential equation

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

where $y(0) = 3$, $y'(0) = 4$, $x(t) = 4e^{-2t}$ and $t \geq 0$

9. Determine the total response of the difference equation

$$y(n) + 4y(n-1) + 4y(n-2) = (-2)^n u(n)$$

where $y(-1) = 0$ and $y(-2) = 1$

Section - C

Attempt **any two** questions from this section. (2x15=30)

10. (a) Using properties of Z-transform, find Z-transform and ROC of signal

$$x(n) = n.2^n.\sin\left(\frac{n\pi}{2}\right)u(n)$$

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(b) Find DTFT of the signal :

$$x(n) = n.3^{-n}.u(-n)$$

(c) Find Laplace transform for

$$x(t) = \cos^3 2t.u(t)$$

11. (a) Check whether the system is :

$$y(n) = ev[x(n)]$$

(i) Static or Dynamic

(ii) Linear or Non-Linear

(iii) Causal or Non-Causal

(iv) Time variant or In-variant

(b) Check whether the system with impulse response is :

$$y[n] = \sum_{k-\infty}^{n+5} x(k)$$

(i) Causal / Non causal

(ii) Stable / Unstable

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12. (a) Calculate the convolution for given sequences :

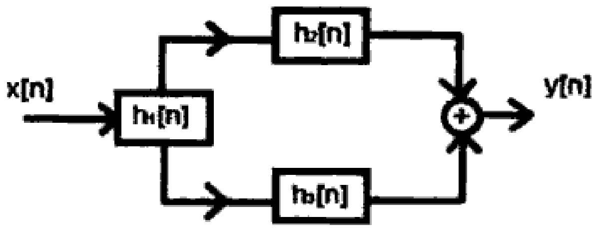
$x[n] = 1$ for n $-2, 0, 1$

2 for $n = -1$

0 else

$$h[n] = \delta[n] - \delta[n-1] + \delta[n-2] - \delta[n-3]$$

(b) An interconnection of LTI system is :



The impulse responses are :

(i) $h_1[n] = \left(\frac{1}{2}\right)^n [u[n] - u[n-4]]$

(ii) $h_2[n] = \delta[n]$

(iii) $h_3[n] = u[n-2]$

Let impulse response of overall system from x[n] to y[n] to y[n] be h[n]

(i) Express h[n] in term of $h_1[n]$, $h_2[n]$ and $h_3[n]$

(ii) Evaluate h[n]

—x—