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Total No. of printed pages = 6

CS 131601

Roll No. of candidate

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2017

B. Tech 6th Semester End-Term Examination

SIGNALS SYSTEMS

Full Marks-100 Pass Marks-35 Time-Three hours

The figures in the margin indicate full marks
for the questions.

1. Answer any *six* questions : 6×2=12
 - (a) Sketch the following signals :
 - (1) $X(t) = 2t$, for all t
 - (2) $X(n) = 2n - 3$, for all n
 - (b) State the necessary and sufficient condition for the LTI continuous time system to be casual.
 - (c) What is aliasing ?
 - (d) Define unilateral and bilateral Z-Transform.

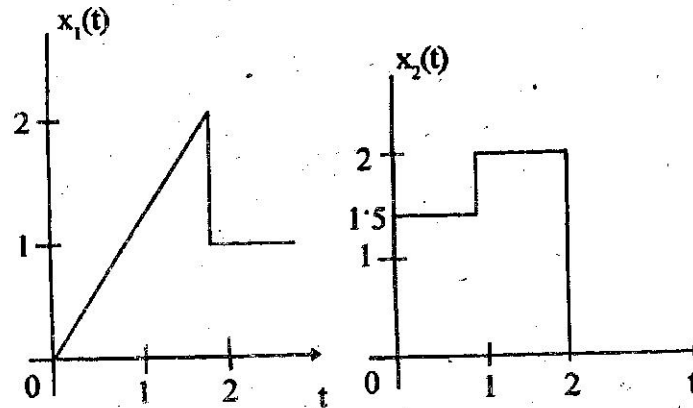
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- (e) Find the overall impulse response $h(n)$ when two systems $h_1(n) = u(n)$ and $h_2(n) = \delta(n) + 2\delta(n-1)$.
- (f) State any two properties of ROC of the Laplace transform $X(S)$ of an signal $x(t)$.
- (g) Define convolution sum with its equation.
- (h) What is the condition for the existence of DIFT?

2. Answer any six questions : $6 \times 3 = 18$

- (a) Explain the relationship between Fourier transform and Laplace transform.
- (b) Determine whether the signal $x(t) = \sin 20\pi t + \sin 5\pi t$ is periodic or not? If yes, then find the fundamental period.
- (c) Find whether signal $x(n) = (1/2)^n u(n)$ is energy or power signal and calculate their energy or power.

- (d) Write the equations for the waveforms using shifted step functions :



- (e) Find the odd and even components of the signal $X(n) = \{-2, 1, 2, -1, 3\}$
- (f) Find whether the system with impulse response $h(t) = e^{-2|t|}$ is stable or not.
- (g) What is sampling theorem? Define sampling period and sampling rate.
- (h) Determine the Laplace transform of a unit step function.

3. Answer any eight questions : $8 \times 5 = 40$

- (a) State and prove the frequency shifting property of Fourier transform.

- (b) Find out the convolution of the signals given below using the DTFT

$$X_1(n) = (1/2)^n u(n); \quad x_2(n) = (1/3)^n u(n)$$

- (c) Obtain the cascade realization of the system described by the difference equation

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

- (d) Find the Laplace transform of the signal $x(t) = e^{-at} u(t)$ and its region of convergence.

- (e) Write the basic classifications of signals and systems.

- (f) Find the inverse Z-transform of

$$X(Z) = \frac{1}{1 - \frac{1.5}{z} + 0.5z^{-2}} \quad \text{where ROC : } |Z| > 1$$

- (g) Find the transfer function and impulse response of a casual LTI system

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

- (h) Find the nyquist rate and nyquist interval for the signal

$$X(t) = \frac{1}{2\pi} \cos(4000\pi t) \cos(1000\pi t)$$

- (i) Find the Z-transform of the sequence $x(n) = a^{n-1} u(n-1)$.

- (j) Find the linear convolution of $x(n) = \{1, 2, 3, 4, 5, 6\}$ with $y(n) = \{2, -4, 6, -8\}$.

4. Answer any *three* questions : 10×3=30

- (a) Determine whether the discrete time system $y(n) = x(n)\cos\omega n$

(1) Memoryless

(2) Stable

(3) Casual

(4) Linear

(5) Time invariant.

- (b) Compute the convolution of $x(t)$ and $h(t)$ sequences

$$X(n) = \begin{cases} 1, & 0 \leq t < 2 \\ 0, & \text{otherwise} \end{cases}$$

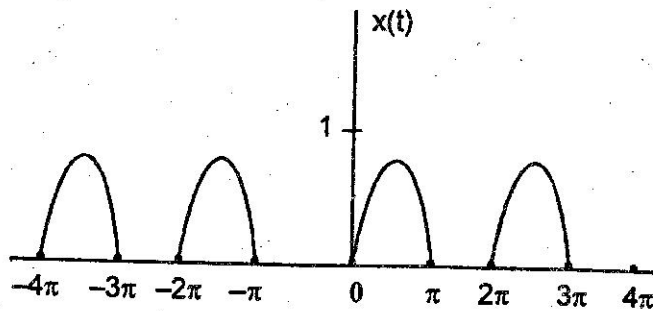
$$H(n) = \begin{cases} 1, & 0 \leq t < 3 \\ 0, & \text{otherwise} \end{cases}$$

- (c) Consider a casual LTI system that is characterized by the difference equation

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

Find the frequency response $H(e^{j\omega})$ and the impulse response $h(n)$ of the system.

- (d) Find the trigonometric Fourier series for the half wave rectified sine wave shown in the figure below.



- (e) Define Z-transform. Describe at least four properties of Z-transform.