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Total No. of Questions : 09] [Total No. of Pages : 03

Paper ID [A0760]

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B.Tech. (Sem. - 4th)

SIGNALS AND SYSTEMS (EC - 206)

Time : 03 Hours **Maximum Marks : 60**

Instruction to Candidates:

1) Section - A is **Compulsory**.
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

Section - A

Q1) *(10 × 2 = 20)*

a) The sinusoidal signal $x[n]$ has fundamental period N=10 samples. Determine the smallest angular frequency Ω for which $x[n]$ is periodic.

b) How is periodicity of a signal checked?

c) Differentiate between continuous time and discrete time systems.

d) Define a Linear System?

e) What is the importance of the ROC in Laplace Transform?

f) What do you mean by signal energy and signal power?

g) Define an LTI System?

h) Define Noise Temperature?

i) Differentiate between Stationary and Ergodicity?

j) Give the mathematical expression for SNR.

Section - B

(4 × 5 = 20)

Q2) A system is specifiedby its input-output relationship as

$$y(t)=\frac{x^2(t)}{dx/dt}$$

Show that the system satisfies the homogeneity property not the additive property.

Q3) We are given the following five facts about a real signal $x(t)$ with laplace transform $X(S)$

(a) $X(S)$ has exactly two poles.

(b) $X(S)$ has no zeros in the finite s-plane.

(c) $X(S)$ has a pole at $s = -1 + j$.

(d) $e^{2t}\, x(t)$ is not absolutely integrable.

(e) $X(0) = 8$.

Determine $X(s)$ and specify its region of convergence.

Q4) Consider the signal

$x[n] = cos\ 2\Pi\, t.$

Since $x(t)$ is periodic with a fundamental period of 1, it is also periodic with a period of N, where N is any positive integer. What are the fourier series coefficients of $x(t)$ if we regard it as a periodic signal with period 3?

Q5) Explain the following :

(a) Shot Noise.

(b) Partition Noise.

Q6) Differentiate between impulse and step response of a system?

Section - C

(2 × 10 = 20)

Q7) (a) Discuss the properties of basic system.

(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 a system S_2. The input-output relationships for S_1 and S_2 are

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

$S_2 : \ y_2\,[n] = x_2\,[n-2] + \frac{1}{2}x_2[n-3]$

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

(i) Determine the input-output relationship for system S.

(ii) Does the input-output relationship of system S change if the order in which S_1 and S_2 are connected in series is reversed (i.e if S_2 follows S_1).

Q8) (a) Explain Convolution Theorem and its graphical interpretation.

(b) For the laplace transform of

$$\begin{cases} e^{t}\sin 2t, & t \le 0 \\ 0, & t \ge 0 \end{cases}$$

Indicate the location of its poles and its region of convergence.

Q9) (a) Consider the sinusoidal signal

$x(t) = A\cos(\omega t + \phi)$

Determine the average power of $x(t)$.

(b) Determine whether or not each of the following signal is periodic

(i) $x_1(n) = u[n] + u[-n]$

(ii) $x_2[n] = \sum_{k=-\infty}^{\infty} \{\delta[n-4k] - \delta[n-1-4k]\}$.