

[Total No. of Questions - 9] [Total No. of Printed Pages - 2]

Dec-22-0137

EC-304 (Signals & Systems)

B.Tech-3rd (CBCS)

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note: Attempt Five questions in all, selecting one question from each Section A, B, C and D. Section E (Q.No. 9) is compulsory.

SECTION A

1. Show that the operation of folding and shifting is not commutative. Take any signal $x(t)$ of your choice, show all the possible solutions to find $x(-3t+2)$ starting from $x(t)$. (10)
2. What is impulse response? Show that a LTI system is causal if and only if its impulse response $h(t)$ satisfies the condition $h(t) = 0$ for $t \leq 0$. Discuss whether the system defined by $y(t) = x(-t)$ is time invariant and invertible or not? (10)

SECTION B

3. Discuss how the response of LTI systems is computed input signal and impulse response of the system. If two systems with impulse response $h_1(t) = \delta(t-1) + \delta(t+1)$ and $h_2(t) = 1$, for $-1 \leq t \leq 1$, otherwise zero are connected in series, find the impulse response of the overall system. (10)
4. Derive the relation for finding the Fourier series coefficient for complex exponential form of Fourier series. How the coefficients of a trigonometric and exponential series are related? (10)

SECTION C

5. State and prove the following properties of Fourier transform: Time shifting, Time scaling, Convolution property. (10)

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6. How many signals have a Laplace transform that can be expressed as:

$$\frac{s-1}{(s+2)(s+3)(s^2+s+1)}$$

in its region of convergence. Find all such signals. (10)

SECTION D

7. Discuss the properties of ROC of Z transform. Find the z transform of
(i) $(0.5)^n u(n)$ (ii) $(0.5)^{n+1} u(n+1)$ (iii) $n(0.5)^n u(n)$ (10)
8. What is sampling? Why the aliasing distortion occurs during sampling and how it can be treated? A signal $x(t) = \cos(4\pi t)$ is sampled at 8 Hz. Find The Signal which if sampled at 8 Hz results in same discrete time signals as obtained from $x(t)$. What is The Nyquist rate for signal $x(t) = \sin(2\pi t)\cos(2\pi t)$? (10)

SECTION E

9. i. What is the Laplace transform of $u(t-1)$
ii. If the Laplace transform of a signal is unity. What will be its Fourier transform?
iii. State the integration property of Fourier transform.
iv. What is a filter?
v. State the Dirichlet conditions for existence of Fourier Transform
vi. What is the ROC of unit impulse signal?
vii. What is the significance of unit circle in Z transform?
viii. Plot $-u(-t-1)$, $u(t)$ is unit step signal.
ix. Plot $-r(t+1)$, $r(t)$ is unit ramp signal.
x. State whether $y(t) = x(-t)$ is memoryless or not?

(2×10=20)