

**Instructions to the Students:**

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

	(Level/CO )	Mark s
<b>Q. 1 Solve Any Two of the following.</b>		
A) Find even and odd parts of $x(n) = u(n)$ and plot them.	1	6
B) i) Find that the following system is linear or not $y(t) = t.x(t)$ ii) Find that the following system is causal or not: $y(n) = x(-n)$	1	6
C) i) Determine the Nyquist rate for the following signals 1) $x(t) = \sin(200\pi t)$ 2) $x(t) = \sin^2(200\pi t)$	1	3
ii) Determine whether $u(t)$ is a power signal or energy signal by finding out the power and energy of the signal	1	3
<b>Q.2 Solve Any Two of the following.</b>		
A) Derive the formula for convolution sum for discrete time LTI systems.	1	6
B) i) Compute the following convolution sum $y(n) = x(n) * h(n)$ $x(n) = h(n) = u(n)$ ii) Compute the following convolution sum $y(n) = x(n) * h(n)$ with the tabular method of convolution sum. $x(n) = \{1, 1, 2, 3\}$ , $n=0$ to $3$ $h(n) = \{1, 1, 1\}$ , $n=0$ to $2$	1	6
C) Solve and sketch the following Convolution integral. $x(t) = 1$ for $-1 < t < 1$ $= 0$ otherwise $h(t) = 8(t+1) + 28(t+2)$	1	6

**Q. 3 Solve Any Two of the following.**

- A) Find the trigonometric Fourier Series for the following signal

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$$x(t) = 10t/2\pi, \quad 0 < t < 2\pi$$

- B) 1) State the Dirichlet conditions for the existence of Fourier series.

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2) Derive the formula for Trigonometric Fourier Series for the waveforms with even symmetry.

- C) Derive the relationship between Trigonometric and Exponential Fourier Series. i.e. derive the formula of Exponential Fourier Series starting from the formula of Trigonometric Fourier Series.

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**Q.4 Solve Any Two of the following.**

- A) State and prove the following properties of CTFT:

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1. linearity
2. time shifting
3. time reversal
4. frequency shifting
5. differentiation in time domain

- B) Find DTFT of  $x(n) = a^n u(-n-1)$  for  $|a| > 1$ . Also find its magnitude and phase.

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- C) Find the system frequency response  $H(e^{j\omega})$  for  $h(n) = 0.5\delta(n) + \delta(n-1) + 0.5\delta(n-2)$ . Also plot magnitude and phase response.

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**Q. 5 Solve Any Two of the following.**

- A) State the properties of ROC of Z transform.

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- B) For the following system functions, check whether the corresponding LTI system is causal, anticausal, or non-causal by finding the inverse Z-Transform in each case.

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$$H(z) = \frac{3-4z^{-1}}{1-3.5z^{-1}+1.5z^{-2}} \quad |z| > 3$$

- C) Find the Inverse Laplace transform of

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$$H(s) = \frac{-3}{(s+2)(s+2)} \quad \text{for } -2 < R\{s\} < 1$$

\*\*\* End \*\*\*