

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 |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------|------|
| Q. 1 Solve Any Two of the following. | | |
| 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 | 1 | 6 |
| $y(t) = t \cdot x(t)$ | | |
| ii) Find that the following system is causal or not: | | |
| $y(n) = x(-n)$ | | |
| C) i) Determine the Nyquist rate for the following signals | 1 | 3 |
| 1) $x(t) = \sin(200\pi t)$ | | |
| 2) $x(t) = \sin^2(200\pi t)$ | | |
| ii) Determine whether $u(t)$ is a power signal or energy signal by finding out the power and energy of the signal | 1 | 3 |
| Q.2 Solve Any Two of the following. | | |
| A) Derive the formula for convolution sum for discrete time LTI systems. | 1 | 6 |
| B) i) Compute the following convolution sum $y(n) = x(n) * h(n)$ | 1 | 6 |
| $x(n) = h(n) = u(n)$ | | |
| 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 | | |
| C) Solve and sketch the following Convolution integral. | 1 | 6 |
| $x(t) = 1$ for $-1 < t < 1$ | | |
| $= 0$ otherwise | | |
| $h(t) = \delta(t+1) + 2\delta(t+2)$ | | |

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**

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Fourier Series. i.e. derive the formula of Exponential Fourier Series starting from the formula of Trigonometric Fourier Series.

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 *****