

Roll No.

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017303**Mar. 2022****B.Tech. (EIOT) - III SEMESTER****Signals and Systems (ECC-01)**

Time : 90 Minutes]

[Max. Marks : 25

Instructions :

1. *It is compulsory to answer all the questions (1 mark each) of Part-A in short.*
2. *Answer any three questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) Distinguish between continuous time and discrete time signals. (1)
- (b) State $x(n) = a^{|n|}$; where $|a| < 1$ is energy or power signal. (1)
- (c) Illustrate whether the following signal is periodic or aperiodic :
 $x[n] = 2 \sin 2\pi t + 4 \cos 8\pi t$. (1)
- (d) What is the necessary and sufficient condition for the causality of an LTI system? (1)

- (e) State the Dirichlet's conditions of Fourier Series. (1)
- (f) Find the Laplace transform of $\delta(t)$. (1)
- (g) State the time shifting property for CTFT. (1)
- (h) Find the Z-transform of $\delta(n + 3)$. (1)
- (i) Describe the relation between DTFT and z-transform. (1)
- (j) For the signal $f(t) = 3 \sin 8\pi t + 6 \sin 12\pi t + \sin 14\pi t$, determine the minimum sampling frequency (in Hz) satisfying the Nyquist criterion. (1)

PART-B

- 2. (a) Sketch the signal $x[n] = u[n] - u[n - 5]$. (2)
- (b) State whether $y(t) = x^2(t)$ is linear or non-linear, time variant or invariant, invertible or non-invertible. (3)
- 3. (a) Consider $h[n] = \{1, 3, 2, -1, 1\}$ with origin at 3, and $x[n] = u[n] - u[n - 3]$, determine the output $y[n]$ of the LTI system? (2)
- (b) Evaluate the Fourier transform of $x(t) = e^{-3|t|} u(t)$. (3)
- 4. A system is described using the transfer function $H(z) = (z^{-1} + (1/2)z^{-2}) / (1 - (3/5)z^{-1} + (2/25)z^{-2})$. Determine the impulse response and the zero-state step response of the system. (5)

- 5. (a) Determine the circular convolution of $x[n]$ with $x[n]$ using DFT where $x[n] = [1, 2, 1, 0]$. (3)
- (b) Determine the initial value $x(0+)$ for the Laplace transform $X(s) = 4/(s^2 + 3s - 5)$. (2)
- 6. (a) State few properties of ROC. (2)
- (b) State and prove sampling theorem. (3)