

SIGNALS & SYSTEMS
(Common to ECE and EIE)

Time: 3 hours

Max. Marks: 70

PART – A
(Compulsory Question)

- 1 Answer the following: (10 X 02 = 20 Marks)
- Define the unit impulse and unit step functions with neat sketches.
 - Define energy and power signals.
 - Write a short note on Dirichlet conditions for Fourier series.
 - State Parseval's theorem for Discrete Fourier Series.
 - Find the Fourier transform of Unit step function.
 - Find the Inverse Fourier transform of $\delta(f - 2)$?
 - Write a short note on Magnitude and Phase Representation of Fourier Transform.
 - State sampling theorem.
 - State Final Value theorem in Laplace Transform.
 - State any two properties of the ROC of Z-Transform.

PART – B
(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

- 2 What is a LTI system? Determine whether the following systems are Linear and Time Invariant or not:
- $y(t) = \int_{-\infty}^t x(\tau) d\tau$.
 - $y[n] = nx[n-1]$.

OR

- 3 (a) Define convolution. Find the convolution of two signals $x[n] = u[n]$ and $h[n] = \alpha^n u[n]$ $0 < \alpha < 1$ and represent them graphically.
- (b) Show that $x(t) * \delta(t - t_0) = x(t - t_0)$.

UNIT – II

- 4 (a) A train of rectangular pulses, making excursions from zero to one volt has a duration of $2\mu s$ and are separated by interval $10\mu s$. Assuming that the centre of one pulse is located at $t = 0$, obtain the trigonometric Fourier series of pulse train.
- (b) Find the Fourier Series coefficient for signal $x(t) = 2\cos 10t$.

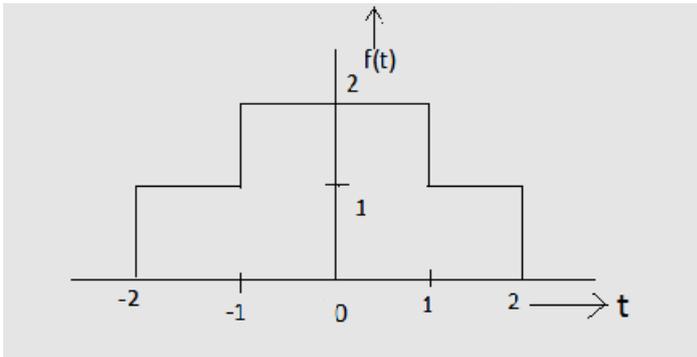
OR

- 5 (a) Determine the discrete Fourier series representation for the following sequences:
- $x[n] = \cos\left(\frac{\pi}{4}n\right)$.
 - $x[n] = \cos^2\left(\frac{\pi}{8}n\right)$.
- (b) Find the frequency response of discrete-time system described by the difference equation:
- $$y[n] - ay[n - 1] = x[n]$$

Contd. in page 2

UNIT – III

- 6 (a) State and prove frequency shifting property of Fourier transform.
 (b) Determine the Fourier transform of the signal shown in following figure below.

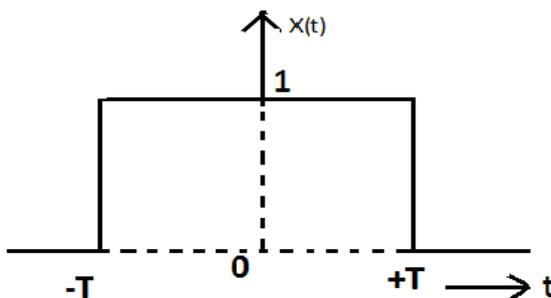


OR

- 7 (a) Define Discrete-Time Fourier Transform and write any four properties of DTFT.
 (b) Determine the DTFT of signal $x[n] = \begin{cases} 1, & n=-1 \\ 2, & n=0 \\ -1, & n=1 \\ 1, & n=2 \\ 0, & \text{otherwise} \end{cases}$

UNIT – IV

- 8 For the rectangular pulse shown in figure below, determine the Fourier Transform of $x(t)$ and sketch the magnitude-phase representation with respect to frequency.



OR

- 9 (a) The signal $g(t) = 10 \cos(20\pi t) \cos(200\pi t)$ is sampled at the rate of 250 samples per second. What is the Nyquist rate for $g(t)$ as a low-pass signal and determine the lowest permissible sampling rate for this signal?
 (b) What is Aliasing? Explain in detail with spectral details of a sample data.

UNIT – V

- 10 (a) Find the Laplace Transform $X(S)$ and sketch the pole-zero plot with the ROC for the following signals $x(t)$:
 (i) $x(t) = e^{-2t}u(t) + e^{-3t}u(t)$.
 (ii) $x(t) = e^{2t}u(t) + e^{-3t}u(-t)$.
 (b) Find the inverse Laplace Transform of $X(S)$:

$$X(S) = \frac{2S + 4}{S^2 + 4S + 3}, \quad -3 < \text{Re}(s) < -1$$

OR

- 11 (a) Determine the response of the system: $y(n) = \frac{5}{6}y(n-1] - \frac{1}{6}y(n-2) + x(n)$ to the input signal $x(n) = \delta(n) - \frac{1}{3}\delta(n-1)$ with help of Z-Transform.
 (b) Determine the inverse Z-Transform of $X(Z) = \ln(1 + az^{-1})$; ROC $|Z| > a$.