

N.B.:

1. Question no.1 is compulsory
2. Attempt any three questions out of the remaining five.
3. Assume suitable data wherever necessary.



Q. P. Code : 546102

Q 1] Answer the following

[20]

- a) Determine if the following system is memoryless, causal, linear, time invariant
 $y(t) = t x(t)$
- b) Explain in brief ROC (Region of Convergence) conditions of Laplace transform.
- c) Explain Gibbs phenomenon. What is a Gibbs oscillation?
- d) Explain relation between Fourier Transform and Laplace transform.
- e) Determine if the given sequence is periodic or not. If periodic, find out fundamental period.

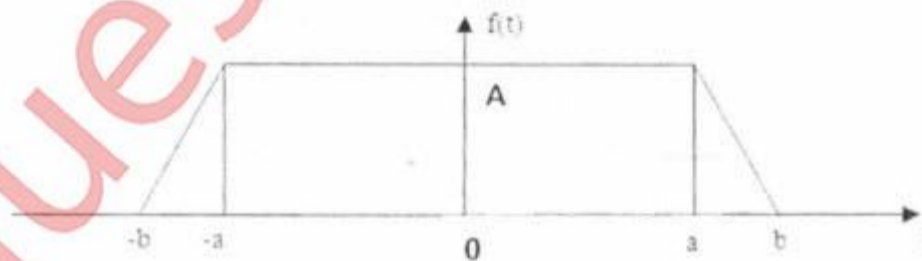
$$x[n] = \sin\left(\frac{6\pi}{7}n + 1\right)$$

Q 2] a) Find the response of the time invariant system with impulse response $h[n] = \{1, 2, 1, -1\}$ to an input signal $x[n] = \{1, 2, 3, 1\}$ using convolution as well as using Z transform. Verify your answers. [10]

b) Determine inverse Laplace Transform of [10]

$$X(s) = \frac{3s^2 + 8s + 23}{(s+3)(s^2 + 2s + 10)}$$

Q 3] a) Determine the Fourier Transform of the trapezoidal function shown in the figure below. [10]



b) Find the inverse Z transform of the following function [10]

$$X(z) = \frac{1}{1 - 0.8z^{-1} + 0.12z^{-2}}$$

for the following ROCs

- a) $|z| > 0.6$
- b) $|z| < 0.2$
- c) $0.2 < |z| < 0.6$

TURN OVER

Q 4] a) Find out DTFT of the following

[10]

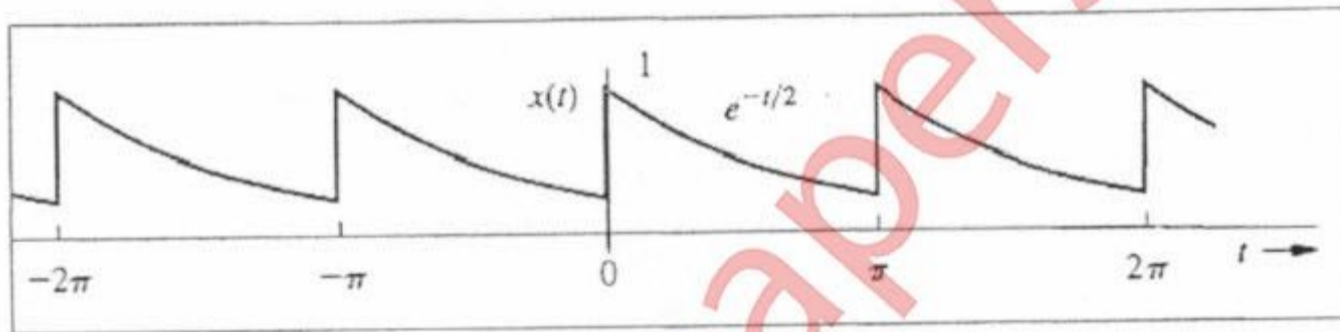
i) $x[n] = \{1, -1, 2, 2\}$

ii) $x[n] = -a^n u[-n-1]$, where $|a| < 1$

b) An LTI system is described by the following equation. Determine the transfer function and impulse response of the system. Sketch the poles & zeros of the z-plane. [10]

$$y[n] - 4y[n-1] + 4y[n-2] = x[n-1]$$

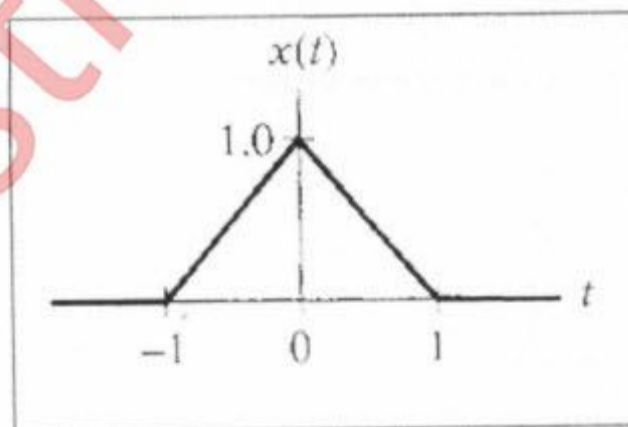
Q 5] a) Find Compact trigonometric Fourier Series for the signal $x(t)$ shown in the following figure. Sketch the amplitude and phase spectra for $x(t)$. [10]



b) The impulse response of a CT system is given below. Determine the unit step response of the system using convolution theorem of Laplace Transform. [10]

$$h(t) = u(t+2) + u(t-2)$$

Q 6] a) A CT signal has been shown below. Sketch the following signals [10]



i) $x(t-4)$

ii) $x(4-t)$

iii) $x(-2t+2)$

iv) $x(0.5t)$

b) State and prove with appropriate mathematical derivation, 'convolution in time domain' property and 'time reversal' property of Z transform. Also comment on importance of these properties in the field of communication and signal processing. [10]