



Time Allotted : 3 Hours

Full Marks : 70

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :

[1 x 10 = 10]

- (i) In a _____ signal, we can define the value of the signal at any instant of time?
☒ a) Continuous
b) Discrete
c) Both a) and b)
d) None of the above
- (ii) The discrete time system, $y(n) = x(n-3) - 4x(n-10)$ is a,
☒ a) dynamic system b) memoryless system c) time varying system d) none of the above
- (iii) Fourier transform is applicable to
☒ a) only periodic signals
b) only aperiodic signals
c) both periodic and aperiodic signals
d) only random signals
- (iv) The region of convergence of $x/(1+2x+x^2)$ is
- (v) The Nyquist theorem for sampling
1) Relates the conditions in time domain and frequency domain
2) Helps in quantization
3) Limits the bandwidth requirement
4) Gives the spectrum of the signal
a. 1, 2 and 3 are correct
b. 1 and 2 are correct
c. 1 and 3 are correct
☒ d. All the four are correct
- (vi) The system $y(t) = 2x(n+1) + x(1/n)$ is
a) causal system
b) non-causal system
c) partly (a) and partly (b)
d) none of these
- (vii) An LTI discrete time system is causal if and only if,
a) $h(n) \neq 0$ for $n < 0$ b) $h(n) = 0$ for $n < 0$ c) $h(n) \neq \infty$ for $n < 0$ ☒ d) $h(n) \neq 0$ for $n > 0$
- (viii) What is the ROC of z-transform of finite duration anti-causal sequence?
a) $z=0$
b) $z=\infty$
☒ c) Entire z-plane, except at $z=0$
d) Entire z-plane, except at $z=\infty$
- (ix) What is the one sided z-transform $X(z)$ of the signal $x[n] = \{5, 7, 0, 1\}$
a) $z^2 + 2z + 5 + 7z^{-1} + z^{-3}$
☒ b) $5 + 7z + z^3$
c) $z^{-2} + 2z^{-1} + 5 + 7z + z^3$
d) $5 + 7z^{-1} + z^{-3}$
- (x) What impact does increasing the sample size have on the sampling error?
a) Increases the sampling error
☒ b) Reduces the sampling error
c) No Effect
d) All of the above

(xi) The anti-causal sequences have components in the left hand sequences.

- a) Positive
- b) Negative
- c) Both a and b
- d) None of the above

(xii) The Z-Transform $X(z)$ of a discrete time signal $x(n]$ is defined as _____

- a) $\sum_{n=-\infty}^{\infty} x(n)Z^n$
- b) $\sum_{n=-\infty}^{\infty} x(n)Z^{-n}$
- c) $\sum_{n=0}^{\infty} x(n)Z^n$
- d) None of these

Group-B (Short Answer Type Question)

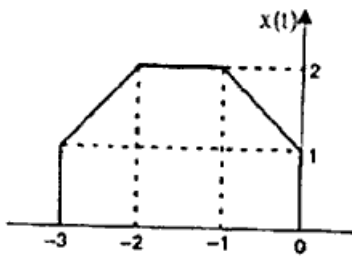
Answer any three of the following :

[5 x 3 = 15]

2. A continuous time signal is shown in fig. Find the following versions of the signal. Comment on the result.

a) $x(t-2)$ b) $x(-t)$ c) $x(-t+2)$

[5]



3. Difference Between Continuous Time and Discrete Time Fourier Series. What is magnitude spectrum and phase spectrum. <https://www.makaut.com>

[5]

4. What is Negative Frequency? Show the relation between Fourier Coefficients of Trigonometric and Exponential form

[5]

5. Obtain the transfer function of a system whose input is given by $x(n) = [2\delta(n+1) + 3\delta(n) - 2\delta(n-1) + \delta(n-2)]$ & output is given by $y(n) = [\delta(n+1) + 2\delta(n) - 4\delta(n-1) + \delta(n-2)]$. Write the time shifting property of Z transform.

[5]

6. Determine the Fourier Series of

[5]

a) $x(n) = 2 \cos \sqrt{3}\pi n$

b) $x(n) = 4 \cos \frac{\pi n}{2}$

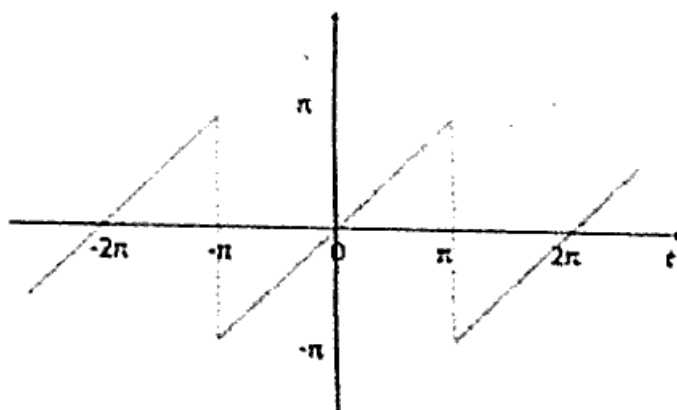
Group-C (Long Answer Type Question)

Answer any three of the following :

[15 x 3 = 45]

7.

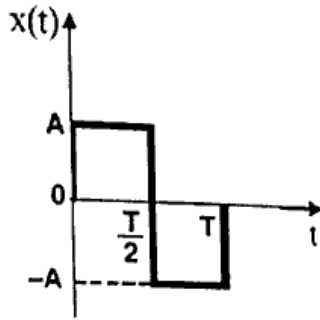
[15]



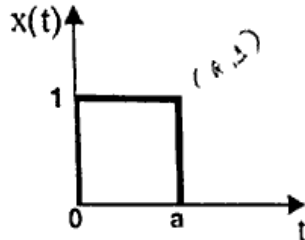
Find the Fourier series expansion of the Signal and draw the Fourier spectrum

8. (a) Determine the Laplace Transform of the following signals

[8]



(b)



[7]

9. Determine the Fourier series representation of the following discrete time signal and sketch the frequency spectrum.
 $x(n) = \{ \dots, 1, 2, -1, 1, 2, -1, 1, 2, -1, \dots \}$

[15]

10. (a) Consider the elementary signal $u(t)$.

The signal $u(t+4)$ is obtained by shifting $u(t)$ to the left by 4 units

[5]

- (b) The signal $u(-t+4)$ is obtained by reversing $u(t)$ and then shifting $u(-t)$ to the right by 4 units

[5]

- (c) The signal $x(t)$ is obtained by multiplying $u(t+4)$ and $u(-t+4)$

[7]

11. (a) Test the Stability of the system

$$y(t) = \cos(x(t))$$

[8]

- (b) Prove

$$\int_{-\infty}^{\infty} |h(t)| dt < \infty, \text{ for stability of an LTI system.}$$

*** END OF PAPER ***

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