

Section A: Objective Type Questions

Q1. Choose the appropriate Answer: (8x1.5=12)

- i. Which of the following best describes a continuous-time signal?

A A signal defined only at discrete points in time	B A signal defined for all values of time
C A signal that is only periodic	D A signal that is always bounded
- ii. A system is considered linear if it satisfies which of the following properties?

A Memorylessness and invertibility	B Time invariance and causality
C Superposition and homogeneity	D Boundedness and stability
- iii. According to the convolution property of the Fourier Transform, the Fourier Transform of the convolution of two signals is equal to

A The sum of their individual Fourier Transforms	B The product of their individual Fourier Transforms
C The convolution of their individual Fourier Transforms	D The difference of their individual Fourier Transforms
- iv. What is the Fourier Transform of the Dirac delta function $\delta(t)$

A $\delta(n)$	B $\delta(w)$
C 0	D 1
- v. What is the Laplace Transform of constant function 1?

A $\frac{1}{s}$	B s
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C $\frac{1}{s^2}$	D 0
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- vi. What is the Laplace Transform of t?

A $\frac{1}{s}$	B 1
C $\frac{1}{s^2}$	D 0
- vii. What is the minimum sampling rate for a signal with a maximum frequency component of 5 kHz, according to the sampling theorem

A 5 kHz	B 10 kHz
C 15 kHz	D 20 kHz
- viii. What happens if a signal is sampled below the Nyquist rate?

A The signal will be accurately reconstructed	B The signal will experience aliasing
C The signal will become noise-free	D The signal will remain unchanged

Section-B: Descriptive Type Questions (Short Type)

Q2: Answer all the Questions (8 x 4 =32)

- i. What distinguishes a continuous-time signal from a discrete-time signal?
- ii. Define Time varying and Time Invariant systems.
- iii. Define Fourier transform of a continuous time signal.
- iv. What is Dirac delta function? Find its Fourier transform.
- v. What is the importance of Laplace transform in signals and systems?
- vi. Discuss time shifting property of Laplace transform.
- vii. What is Autocorrelation of discrete time signals.

viii. What are Random variables?

Section – C: Descriptive Type Questions (Medium Type)

Answer all the questions: (4 x 7=28)

Q 3. What are Linear and Non-Linear systems? Check whether the system represented by $y(t) = x^2(t)$ is linear or Non-Linear.

OR

Differentiate between causal and non-causal systems.

Q 4. Explain the Time integration property of Fourier Transform.

OR

Find Fourier transform of $x(t) = e^{-at} u(t)$

Q 5. Define Laplace transform of a signal. Discuss time shifting and frequency differentiation properties of Laplace transform.

OR

Find inverse Laplace transform of

$$F(S) = \frac{3}{S} - \frac{5}{S} + \frac{6}{S^2+4}$$

Q6. Explain the importance of random variables in signals and systems.

OR

Explain the concepts of Nyquist rate and Aliasing with respect to the process of Sampling.

Section – D: Descriptive Type Questions (Long Type)

Answer any two of the following: (2 x 14=28)

Q 7. Explain the process of convolution for continuous-time signals. Derive the convolution integral and illustrate its application with an example involving two continuous-time signals.

Q 8. State and prove Frequency shifting property of Fourier transform. Also calculate Fourier transform of $x(t) = \cos 2\pi f_0 t$

Q 9. Using various properties of Laplace transform, calculate Laplace transform of following functions:

(i) $f(t) = \delta(t) + 2 u(t) e^{-2t}$

(ii) $t^2 \sin 2t u(t)$

Q 10. State and Prove Sampling Theorem.