Faculty of Engineering
End Semester Examination May 2025
EE3CO27 Signals & Systems

Programme	:	B.Tech.	Branch/Specialisation	:	EE
Duration	:	3 hours	Maximum Marks	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

	Section 1 (Answer all question(s))	**Marks**	**CO**	**BL**

Q1. A signal is an energy signal if-   1   1   1
- ○ E =0, P =0
- ● E = Finite, P = 0
- ○ E = ∞, P = finite
- ○ E = Finite, P = ∞

Q2. Which of the following is an aperiodic signal?   1   1   2
- ○ $x(t)=\sin(2\pi t)$
- ○ $x(t)=\cos(2\pi t)$
- ● $x(t)=e^{\alpha t}$
- ○ $x(t)=\sin(3t)$

Q3. The Fourier series represents a periodic signal as a sum of: 1   2   1
- ○ Exponential signals only
- ○ Trigonometric functions only
- ● Exponential and trigonometric functions
- ○ Sine and cosine functions only

Q4. The region of convergence (ROC) of the Laplace transform for a stable system lies: 1   2   2
- ● To the left of the rightmost pole
- ○ To the right of the leftmost pole
- ○ Between the poles
- ○ Everywhere in the s-plane

Q5. A system is said to be linear if it satisfies: 1   1   1
- ○ Additivity only
- ○ Homogeneity only
- ● Both additivity and homogeneity
- ○ Time invariance

Q6. A time-invariant system is one in which the output: 1   2   2
- ○ Depends on the time at which input is applied
- ● Is independent of when the input is applied
- ○ Changes with time
- ○ Depends only on the past inputs

Q7. A discrete-time system is said to be causal if: 1   1   1
- ○ Output depends only on future inputs
- ● Output depends only on past and present inputs
- ○ Output depends on both past and future inputs
- ○ Output depends only on present inputs

Q8. The convolution sum is: 1   2   2
- ● Commutative and associative
- ○ Only commutative
- ○ Only associative
- ○ Neither commutative nor associative

Q9. The Z-transform of the unit impulse sequence $\delta[n]$ is: 1   1   1
- ● 1
- ○ z
- ○ z−1
- ○ 0

Q10. The Region of Convergence (ROC) for a stable system in Z-transform lies: 1   2   2
- ● Inside the unit circle
- ○ Outside the unit circle
- ○ On the unit circle
- ○ Over the entire z-plane

Section 2 (Answer all question(s))

Q11. Explain the concept of a unit step function with the help of diagram.

Rubric	Marks
Explanation without waveform	1
Waveform	1

Q12. What is the difference between a periodic and an aperiodic signal?

Rubric	Marks
Difference 1	1
Difference 2	1
Difference 3	1

Q13. (a) Explain the classification of signals into energy and power signals, with examples of each type.

Rubric	Marks
Classification with explanation.	3
Example.	2

(OR)

(b) Explain the following signal operations with examples:
(i) Time shifting
(ii) Time scaling
(iii) Time reversal

Rubric	Marks
Signal operations	3
Examples	2

Section 3 (Answer all question(s))

Q14. Write the expression of trigonometric Fourier series and explain each coefficient.

Rubric	Marks
Trigonometric expression.	1
Explanation of coefficients.	2

Q15. (a) Find the Laplace transform of the given waveform.   7   2   3
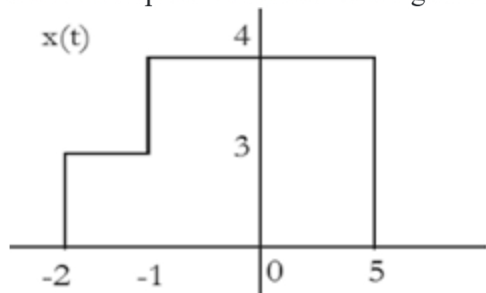
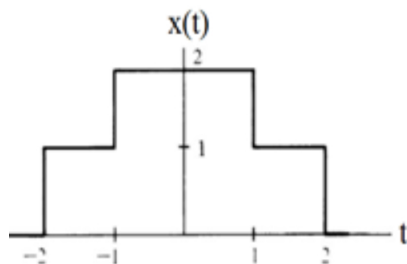| Rubric	Marks
Mathematical expression for this waveform.	3
Laplace transformation.	4

<div align="center">(OR)</div>

(b) Find the Fourier transform of the given waveform.

Rubric	Marks
Mathematical expression for this waveform.	3
Fourier transformation.	4

<div align="center">

Section 4 (Answer all question(s))

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<div align="right">Marks CO BL</div>

Q16. Define linear time invariant (LTI) system with a suitable example.   4   2   2

Rubric	Marks
Define linear time invariant (LTI) system.	2
Example.	2

Q17. (a) Discuss the concept of stability in continuous-time systems. Explain the different types of stability and describe how the system's behavior can be analyzed for stability.   6   3   4

Rubric	Marks
Concept of stability	2
Types of stability	2
Analyzation of system's behavior for stability	2

<div align="center">(OR)</div>

(b) Distinguish between-
    (i) Causal and non-causal system
    (ii) Time Variant and Invariant system

Rubric	Marks
Distinguish between causal and non-causal system	3
Distinguish between time variant and invariant system	3

Q18. Write the definition of a discrete-time system. List and briefly explain two important properties of discrete-time systems.   4   2   2

Rubric	Marks
Definition	1
Explanation of two important properties	3

Q19. (a) Two Discrete Time signals are given as follows   6   4   3
$x[n]= 2\delta[n+1] - \delta[n] + \delta[n-1] + 3\delta[n-2]$
$h[n]= 3\delta[n-1] - 4\delta[n-2] + 2\delta[n-3]$
Find the convolution sequences
$y[n]= x[n] * h[n]$.

Rubric	Marks
Write down non-zero values of x[n] and h[n].	2
Application of convolution sum	3
Final result	1

(OR)

(b) Consider a Discrete Time LTI system described by the following differential equation with initial condition and input.
$y(n) - 3/2\, y(n-1) + 1/2\, y(n-2) = x(n)$
Initial conditions,
$y(-n) = 1,\ y(-2) = 0$
Input $x[n] = 2n\, u[n]$.
Find the output y(n) of the system.

Rubric	Marks
Solution of homogeneous equation	2
Solve the particular solution	3
Final Solution	1

Q20. Write a short note on Region of Convergence (ROC) in Z-Transform using an example.   5   2   2

Rubric	Marks
Defining ROC	2
Properties	2
Example	1

Q21. List and explain the key properties of the Z-Transform, such as linearity, time-shifting, scaling in the Z-domain, and convolution.   5   3   3

Rubric	Marks
Explanation of linearity	2
Explanation of time-shifting	1.5
Explanation of scaling	1.5

Q22. Explain the different methods for finding the inverse Z-transform: **5**   **3**   **3**
- Partial fraction expansion
- Power series expansion
- Residue method

Rubric	Marks
Partial fraction expansion	2
Power series expansion	1.5
Residue method	1.5

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