



End Term (Odd) Semester Examination November 2025

Roll no.....

Name of the Course and semester: B.Tech. III Semester

Name of the Paper: **Signal and Systems**

Paper Code: TEC 304

Time: 3 hour

Maximum Marks: 100

Note:

- (i) All the questions are compulsory.
- (ii) Answer any two sub questions from a, b and c in each main question.
- (iii) Total marks for each question is 20 (twenty).
- (iv) Each sub-question carries 10 marks.

Q1. CO1

(2X10=20 Marks)

- a. Define signals and system? What is the role of signals and systems in various branches of engineering and science? Explain in detail.
- b. Determine whether the following signals are energy signals, power signals, or neither (i) $x(t) = e^{-at} u(t), a > 0$ (ii) $x(t) = t u(t)$
- c. Determine whether or not each of the following signals is periodic. If a signal is periodic, determine its fundamental period.

(i) $x(t) = \cos(t) + \sin(\sqrt{2}t)$ (ii) $x[n] = e^{\frac{j2\pi n}{3}} + e^{\frac{j3\pi n}{4}}$

Q2. CO2

(2X10=20 Marks)

- a. Consider a discrete-time LTI system with impulse response $h[n]$ given by $h[n] = a^n u[n]$ (a) Is this system causal? (b) Is this system BIBO stable?
- b. Check whether the given system $y(t) = \text{even}\{x(t)\}$ is
 - (i) Linear or nonlinear
 - (ii) time invariant or time variant.
 - (iii) Causal and non-Causal.
- c. Verify the associative property, that is,
 $\{x(t) * h_1(t)\} * h_2(t) = x(t) * \{h_1(t) * h_2(t)\}$

Q3. CO3

(2X10=20 Marks)

- a. Find the exponential Fourier series and sketch the corresponding spectra for the periodic impulse train $\delta_T(t)$.
- b. Determine the complex exponential Fourier series representation for each of the following signals: (a) $x(t) = \cos(\omega_0 t)$ (b) $x(t) = \sin(\omega_0 t)$.
- c. Find the Fourier transform of the following signals:
 - (i) $x(t) = u(t)$ (ii) $x(t) = t e^{-at} u(t)$ (iii) $x(t) = \sin(\omega_0 t)$



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Q4. CO4

(2X10=20 Marks)

a. Show that the initial value theorem for unilateral Laplace transform is

$$x(0^+) = \lim_{s \rightarrow \infty} s X(s)$$

b. Find Laplace transform of the following signals (i) $x(t) = e^{-(t+1)}u(t+1)$ (ii) $x(t) = -t e^{-2t}u(t)$ (iii) $x(t) = \delta(t)$

c. Find Laplace transform of the following signals

(i) $x(t) = e^{-(t+1)}u(t+1)$ (ii) $x(t) = -t e^{-2t}u(t)$

Q5. CO5

(2X10=20 Marks)

a. Determine all possible signals that can have the following Z transforms:

$$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$$

b. State and prove the Sampling Theorem for Lowpass Signal

c. Find the Z transform of the following:

i) $x(n) = (0.5)^n u(n)$

ii) $x(n) = \cos(n\omega_0) u(n)$