



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.

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

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) $x(t) = \sin(\omega_0 t)$



End Term (Odd) Semester Examination November 2025

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 proof the Sampling Theorem for Lowpass Signal

- c. Find the Z transform of the following:

i) $x(n) = (0.5)^n u(n)$
ii) $x(n) = \cos(n\omega_0) u(n)$