AHMEDABAD UNIVERSITY
School of Engineering and Applied Science
2025–2026 Monsoon

EEE203/ECE210 Signals and Systems
End Semester Examination
Tuesday 02 December 2025. 08:00 – 11:00

NAME	ROLL NO.	A	U	2							MARKS

/70

Instructions (Please read them carefully):

- Please write your **NAME** and **ROLL NO.** on the first page of the question paper (space provided).
- **ALL QUESTIONS ARE COMPULSORY.** Write the question number explicitly while answering.
- Do mention all necessary assumptions for the completeness of the answers. All acronyms and symbols (if any) carry their usual meaning.
- There will be **NO EXTRA MARKS** for unnecessary or verbose explanations.
- All necessary steps to be mentioned while solving a problem. **ANSWER CARRIES ONLY 0.5 MARKS FOR A QUESTION OF 2 MARKS OR MORE** if partial solution steps are correct.
- Write the **serial number** (as mentioned on the left side of your name on the attendance sheet with the invigilator) at the **top left corner of the first page of your answer sheet**.

All the best!

The Four Fourier Representations

Time Domain	*Periodic* (t, n)	*Non periodic* (t, n)	
Continuous (t)	Fourier Series $x(t) = \sum_{k=-\infty}^{\infty} X[k] e^{jk\omega_o t}$ $X[k] = \frac{1}{T} \int_0^T x(t) e^{-jk\omega_o t}\, dt$ $x(t)$ has period T $\omega_o = \frac{2\pi}{T}$	Fourier Transform $x(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} X(j\omega) e^{j\omega t}\, d\omega$ $X(j\omega) = \int_{-\infty}^{\infty} x(t) e^{-j\omega t}\, dt$	Nonperiodic (k, ω)
Discrete (n)	Discrete-Time Fourier Series $x[n] = \sum_{k=0}^{N-1} X[k] e^{jk\Omega_o n}$ $X[k] = \frac{1}{N} \sum_{n=0}^{N-1} x[n] e^{-jk\Omega_o n}$ $x[n]$ and $X[k]$ have period N $\Omega_o = \frac{2\pi}{N}$	Discrete-Time Fourier Transform $x[n] = \frac{1}{2\pi} \int_{-\pi}^{\pi} X(e^{j\Omega}) e^{j\Omega n}\, d\Omega$ $X(e^{j\Omega}) = \sum_{n=-\infty}^{\infty} x[n] e^{-j\Omega n}$ $X(e^{j\Omega})$ has period 2π	Periodic (k, Ω)
	Discrete (k)	*Continuous* (ω, Ω)	*Frequency Domain*

Q1 **(A) [5 marks]** Find the Fourier coefficients of the following function:

$$x(t) = \begin{cases} -K & \text{for } -\pi < t < 0 \\ K & \text{for } 0 < t < \pi \end{cases} \qquad \text{and} \qquad x(t + 2\pi) = x(t).$$

(B) [4 marks] Determine the FS coefficients for the signal defined by

$$x(t) = \sum_{l=-\infty}^{\infty} \delta(t - 4l).$$

(C) [5 marks] Consider the two sequences

$$h[n] = \begin{cases} 1, & 0 \leqslant n \leqslant 2 \\ 0, & \text{otherwise} \end{cases}$$

and

$$x[n] = \begin{cases} 0.5, & n = 0 \\ 2, & n = 1 \\ 0, & \text{otherwise.} \end{cases}$$

Find the convolution of the above-mentioned two sequences. Also, sketch all the required intermediate steps while estimating the convolution.

Q2 **(A) [3 marks]** Determine the FS representation of the signal

$$x(t) = 3cos(\pi t/2 + \pi/4),$$

using the method of inspection.

(B) [(2 + 2 + 1) marks] Determine the Laplace transform of

$$x(t) = e^{at}u(t),$$

and depict the ROC and locations of poles and zeros in the s-plane. Also, comment on the stability and causality properties of $x(t)$. Assume that a is real.

(C) [(2 + 2 + 2) marks] Find the unilateral Laplace transform of the following signals:

(a) $x(t) = t^2e^{-2t}u(t)$

(b) $x(t) = (-e^{3t}u(t)) \star (tu(t))$

(c) $x(t) = tu(t) - (t-1)u(t-1) - (t-2)u(t-2) + (t-3)u(t-3)$

Q3 **(A) [(4 + 4) marks]** Determine the initial and final values of a signal $x(t)$ whose unilateral Laplace transform is

$$X(s) = \frac{7s + 10}{s(s + 2)}.$$

Also, find $x(t)$.

(B) [**6 marks**] Find the inverse unilateral Laplace transform of

$$\frac{2s^3 - 9s^2 + 4s + 10}{s^2 - 3s - 4}.$$

Q4 **(A)** [**(2 + 3) marks**] Determine the z-transform of the signal

$$y[n] = -\alpha^n u[-n-1].$$

Depict the ROC and the locations of poles and zeros of $X(z)$ in the z-plane.

(B) [**(2 + 1) marks**] Determine the z-transform of the signal

$$x[n] = \begin{cases} 1, & n = -1 \\ 2, & n = 0 \\ -1, & n = 1 \\ 1, & n = 2 \\ 0, & \text{otherwise.} \end{cases}$$

Use the z-transform to determine the DTFT of $x[n]$.

(C) [**(3 + 3) marks**] Determine the z-transform of

$$x[n] = -u[-n-1] + \left(\frac{1}{2}\right)^n u[n].$$

Depict the ROC and the locations of poles and zeros of $X(z)$ in the z-plane.

Q5 **(A)** [**(1.5 + 1.5 + 1.5 + 1.5 + 1.5 + 1.5) marks**] A triangular pulse signal $x(t)$ is depicted in Figure 1. Sketch each of the following signals derived from $x(t)$:

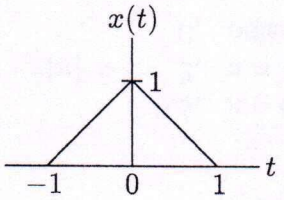


Figure 1: Figure for Question 5(A).

(a) $x(3t)$

(b) $x(3t + 2)$

(c) $x(-2t - 1)$

(d) $x(2(t + 2))$

(e) $x(2(t - 2))$

(f) $x(3t) + x(3t + 2)$

(B) [**5 marks**] Find the inverse z-transform of

$$X(z) = \frac{1 - z^{-1} + z^{-2}}{\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - 2z^{-1}\right)\left(1 - z^{-1}\right)}, \quad \text{with ROC } 1 < |z| < 2.$$