

**Course: B. Tech Computer Science and Engineering**  
**(Artificial Intelligence and Machine Learning)**  
**Subject: Signal & Systems, Subject Code: ETCS-211**  
**Semester: III**

**Time: 03 Hours**

**Max Marks: 70**

**Instructions to the Students:**

1. This Question paper consists of two Sections. All sections are compulsory.
2. Section A comprises 10 questions of short answer type. All questions are compulsory. Each question carries 2 marks.
3. Section B comprises 8 long answer type questions out of which students must attempt any 5. Each question carries 10 marks.
4. Do not write anything on the question paper.

Q. No.	SECTION -A (SHORT ANSWER TYPE QUESTIONS)	Marks
1.	a. Define the following functions mathematically: i. Unit Stem function ii. Unit Ramp function	(2)
	b. Distinguish between periodic and aperiodic signals with suitable example.	(2)
	c. What is half wave symmetry? What is its effect?	(2)
	d. Does Fourier transform exist for all aperiodic functions? If not, what are the conditions to be satisfied for the existence of Fourier transform?	(2)
	e. What is the relation between Fourier transform and Laplace transform?	(2)
	f. Why there is a one-to-one correspondence between only one -sided Laplace transform and its inverse Laplace transform?	(2)
	g. How discrete-time systems are analysed using Z-transforms?	(2)
	h. What is the condition for Z-transform to exist?	(2)
	i. Define Fourier transform of a discrete-time signal.	(2)
	j. What is the sufficient condition for the existence of DTFT?	(2)

**SECTION -B (LONG ANSWER TYPE QUESTIONS)**

2. a. What are the types of representation of discrete-time signals? Represent a sequence in all types. (10)  
b. Define a system. How are systems classified? Define each one of them.
3. Determine the Fourier series representation of  
 $x(t) = 2 \sin(\sin(2\pi t - 3)) + \sin 6\pi t$  (10)

4. Find the Fourier transform of the signal  $x(t) = \frac{1}{a^2 + t^2}$  (10)
5. Using the properties of Laplace transform, find the Laplace transform of the following signals:
- i.  $x(t) = tu(t - 2)$  (10)
  - ii.  $x(t) = e^{-3t} \sinh 2tu(t)$
6. State and prove Linearity and time shifting property of Z-Transform. (10)
7. Find the Z-transform of
- i.  $y(n) = x(n - 1)u(n)$
  - ii.  $n\delta(n - 2)$  (10)
8. Realize the system with the following transfer function in direct form-I
- $$H(s) = \frac{s + 5}{s^2 + 2s + 4} \quad (10)$$
9. State and prove the time shifting and frequency shifting properties of DTFT. (10)

===END OF PAPER===