



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

## COURSE CONTENT

MODELLING AND SIMULATION LABORATORY								
<b>III Semester: ECE</b>								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
AECE04	Core	0	0	2	1	40	60	100
<b>Contact Classes: Nil</b>	<b>Tutorial Classes: Nil</b>	<b>Practical Classes: 36</b>			<b>Total Classes: 36</b>			
<b>Prerequisite: SIGNALS AND STOCHASTIC PROCESS</b>								

### I. COURSE OVERVIEW:

This course focuses on the generation and analysis of both continuous-time and discrete-time signals, including basic operations and frequency transformations. It emphasizes the study of linear time-invariant systems and their behavior in both time and frequency domains. The laboratory sessions include experiments on correlation and convolution of signals and sequences, as well as an introduction to probability concepts such as distribution and density functions of random variables. This course provides the essential foundation required for advanced studies in signal processing and communication systems. Through hands-on practice with MATLAB software, students gain practical skills in simulating, analyzing, and implementing fundamental signal and system concepts, thereby bridging the gap between theoretical knowledge and real-world applications in communication, control, and signal processing domains.

### II. COURSES OBJECTIVES:

**The course should enable the students to:**

- I. The basic syntax of signals, generations and operations of signals and sequences using MATLAB.
- II. The spectral characteristics of signals using Fourier, Laplace and z transform.
- III. The Implementation of convolution and correlation of signals and systems.

### III. COURSE OUTCOMES:

**At the end of the course students should be able to:**

- CO1 Realize the tool basic operations addition, subtraction, multiplication and division on matrices
- CO2 Generate standard signals and sequences for performing operations on various signals
- CO3 Determine Fourier transform, properties of Fourier transform and Inverse Fourier transform of signal and sequence
- CO4 Find the poles and zeros of transfer function using Laplace and Z transforms
- CO5 Examine to convolution and correlation between signals and sequences for analyzing linear time-invariant systems
- CO6 Compute mean, mean square and power spectral density of signal to calculate Gaussian noise.

#### **IV. COURSE CONTENT:**

##### **EXERCISE -1 BASIC OPERATIONS ON MATRICES**

Review basic operations on matrices by using MATLAB.

##### **EXERCISE -2 GENERATION OF VARIOUS STANDARD SIGNALS AND SEQUENCE**

Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc and Nonstandard Signals and Sequences generated from these standard signals /sequences using Waveform synthesis by using MATLAB.

##### **EXERCISE -3 OPERATION ON SIGNALS AND SEQUENCES**

Operation on signals and sequences such as addition, subtraction, multiplication, scaling, shifting, folding, and Computation of Energy and Average Power by using MATLAB.

##### **EXERCISE -4 AUTO CORRELATION AND CROSS CORRELATION OF SIGNALS AND SEQUENCES**

Finding the output of a System for a given input and Impulse Response and finding Auto Correlation and Cross Correlation of Signals and sequences

##### **EXERCISE -5 GIBBS PHENOMENON**

Verification of Gibbs phenomenon by using MATLAB

##### **EXERCISE -6 FOURIER TRANSFORMS AND INVERSE FOURIER TRANSFORM**

Finding the Fourier Transform and inverse Fourier transform of a given signal/sequence and plotting its magnitude and phase spectrum by using MATLAB.

##### **EXERCISE -7 PROPERTIES OF FOURIER TRANSFORMS**

Verifying Time shifting and scaling, time and differentiation properties of Fourier transforms by using MATLAB.

##### **EXERCISES -8 LAPLACE TRANSFORMS**

Finding and plotting the Magnitude and Phase Spectrum of any given Signal by finding its Laplace Transform by using the properties where ever required. Also plot pole-zero diagram in S-plane

##### **EXERCISE-9 Z-TRANSFORMS**

Finding the z - transform of a given sequence and locate its zeros and poles in z-plane.

##### **EXERCISE -10 CONVOLUTION BETWEEN SIGNALS AND SEQUENCES**

Finding convolution between two signals /sequences by using MATLAB.

##### **EXERCISE-11 GAUSSIAN NOISE**

Generation of Gaussian noise, computation of its mean, M.S. value and its Skew, kurtosis, and PSD, probability distribution function by using MATLAB.

##### **EXERCISES-12 WIENER – KHINCHINE RELATIONS**

Verification of Wiener – Khinchine relations using MATLAB.

##### **EXERCISE-13 DISTRIBUTION AND DENSITY FUNCTIONS OF STANDARD RANDOM VARIABLES**

Finding distribution and density functions of standard random variables and plot them by using MATLAB

##### **EXERCISE-14 WIDE SENSE STATIONARY RANDOM PROCESS**

Checking a random process for stationary in wide sense by using MATLAB.

## **V. REFERENCE BOOKS:**

1. S. Varadarajan , M. M. Prasada Reddy , M. Jithendra Reddy , “Signals and systems introduces MATLAB programs”, I K International Publishing House Pvt. Ltd, 2023.
2. Scott L. Miller, Donald G. Childers, “Probability and Random Processes: With Applications to Signal Processing and communications”, Elsevier, 2024.
3. Krister Ahlersten, “An Introduction to MATLAB”, Book Boon, 2022.

## **VI. ELECTRONICS RESOURCES:**

1. <http://in.mathworks.com/help/matlab>
2. [http://web.mit.edu/acmath/matlab/course16/16.62x/16.62x\\_Matlab.pdf](http://web.mit.edu/acmath/matlab/course16/16.62x/16.62x_Matlab.pdf)
3. [https://www.probabilitycourse.com/chapter12/Chapter\\_12.pdf](https://www.probabilitycourse.com/chapter12/Chapter_12.pdf)
4. <http://www.iare.ac.in>

## **VII. MATERIALS ONLINE**

1. Course Outline Description
2. Lab Manual