L	T	P/S	SW/F W	TOTAL CREDIT UNITS
0	0	2	0	1

Course Title: Basic Simulation Lab

Credit Units:01

Course Level: UG

Course Code: ES-204

Course Objectives:

The purpose of this course is to provide a thorough introduction to MATLAB with an in depth study of various arithmetic, logical and mathematical operations with plots. Application of MATLAB to basic engineering techniques.

Pre-requisites: NIL

Student Learning Outcomes:

Outcome 1: (Scientific foundation) When faced with a technical problem the student should be able to use applied scientific knowledge

    1A: to identify and implement relevant principles of mathematics and computer science.

    1 B: to identify and implement relevant principles of physics and chemistry

    1 C: to identify and implement relevant principles of engineering science

Outcome 2: (Experimentation) the ability to design experiments, conduct experiments, and analyze experimental data.
Outcome 3: (Tools) an ability to use the relevant tools necessary for engineering practice.
Outcome 4: (Technical design) the technical ability to design a prescribed engineering sub-system

Outcome 8: (Teamwork) the ability to function in teams.

Pedagogy for Course Delivery:

The course would be covered under laboratory. In addition to assigning project–based learning, early exposure to hands-on design to enhance the motivation among the students. It incorporates designing of problems, analysis of solutions submitted by the students groups and how learning objectives were achieved. Continuous evaluation of the students would be covered under quiz, viva etc.

Lab/ Practicals details, if applicable:

List of Experiments:

- **1:** Creating a One and Two-Dimensional Array (Row / Column Vector) (Matrix of given size) then, (A). Performing Arithmetic Operations - Addition, Subtraction, Multiplication and Exponentiation. (B). Performing Matrix operations - Inverse, Transpose, Rank with plots.

- **2:** Performing Matrix Manipulations - Concatenating, Indexing, Sorting, Shifting, Reshaping, Resizing and Flipping about a Vertical Axis / Horizontal Axis; Creating Arrays X & Y of given size (1 x N) and Performing

  (A). Relational Operations - $>$, $<$, $==$, $<=$, $>=$, $\sim=$

  (B). Logical Operations - $\sim$, &, |, XOR

- **3:** Generating a set of Commands on a given Vector (Example: X = [1 8 3 9 0 1]) to

  (A). Add up the values of the elements (Check with sum)

  (B). Compute the Running Sum (Check with sum), where Running Sum for element j = the sum of the elements from 1 to j, inclusive.

  (C) Generating a Random Sequence using rand() / randn() functions and plot them.

- **4:** Evaluating a given expression and rounding it to the nearest integer value using Round, Floor, Ceil and Fix functions; Also, generating and Plots of (A) Trigonometric Functions - sin(t),cos(t), tan(t), sec(t), cosec(t) and cot(t) for a given duration, 't'. (B) Logarithmic and other Functions – log(A), $\log_{10}$(A), Square root of A, Real n^{th} root of A.

- **5:** Creating a vector X with elements, $Xn = (-1)^{n+1}/(2n-1)$ and Adding up 100 elements of the vector, X; And, plotting the functions, x, x^3, e^x, $\exp(x^2)$ over the interval $0 < x < 4$ (by choosing appropriate mesh values for x to obtain smooth curves), on A Rectangular Plot

- **6:** Generating a Sinusoidal Signal of a given frequency with Titling, Labeling, Adding Text, Adding Legends, Printing Text in Greek Letters, Plotting as Multiple and Subplot. Time scale the generated signal for different values. E.g. 2X, 4X, 0.25X, 0.0625X.

- **7:** Solving First, Second and third Order Ordinary Differential Equation using Built-in Functions and plot.

- **8:** Writing brief Scripts starting each Script with a request for input (using input) to Evaluate the function h(T) using if-else statement, where,

    ○ $$h(T) = (T - 10) \text{ for } 0 < T < 100$$

        ▪ $= (0.45\ T + 900)$ for $T > 100$.

    Exercise: Testing the Scripts written using A). T = 5, h = -5 and B). T = 110, h =949.5

- **9**: Generating a Square Wave from sum of Sine Waves of certain Amplitude and Frequencies.

- **10.** Basic 2D and 3D plots:

    parametric space curve.

    polygons with vertices.

    3D contour lines, pie and bar charts.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
NIL	100%	100%

Lab/ Practical/ Studio Assessment:

	Continuous Assessment/Internal Assessment				End Term Examination	
Components (Drop down	**A**	**PR**	**LR**	**V**	**PR**	**V**
Weightage (%)	5	10	10	5	35	35

Text

- Rudra Pratap " Getting started with Matlab 7", Oxford publication.

References

- Stephen J. Chapman "MATLAB Programming for Engineers" Cengage Learning
- Bruce L Littlefield, Duane C Hanselman "Mastering Matlab 7" Pearson Publication
- Agam Kr. Tyagi "MATLAB and Simulink for Engineers" Oxford Publication.