COURSE TITLE	**COMPUTER PROGRAMMING FOR ROBOTICS**
COURSE CODE	**01ME0611**
COURSE CREDITS	**4**

Objective:

1 The key objective of this course is to provide students with fundamental to moderate-level concepts of programming skills. In addition, it emphasizes various programming concepts with their application in the domain of robotics.

2 Learn the programming for robotics

Course Outcomes: After completion of this course, student will be able to:

1 Implement fundamental programming constructs for solving robotics-based computational problems.

2 Develop and execute scripts and programs using appropriate data structures and control statements.

3 Design and integrate user-defined functions to solve structured and real-time engineering problems.

4 Analyze and visualize numerical data using two-dimensional and three-dimensional plotting techniques for engineering interpretation

5 Formulate and develop complete programming solutions for real-world robotics applications using symbolic and numerical computation techniques

Pre-requisite of course:NIL

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction** Arithmetic Operations with Scalars, Display Formats, Data Display Formats, Elementary Math Built-in Functions, , Definition of Scalar Variables: Assignment Operator, , Norms for Variable declaration, Standard/Predefined Variables and Keywords, , Introduction to Script Files: Notes, Creating, Saving, and Running a Script File, Examples and Problems.	4

Contents : Unit	Topics	Contact Hours
2	**Array Creation and Operations** Defining Arrays, Creating a One-Dimensional Arrays, Creating a Two-Dimensional Array, , Zeros, Ones and Eye, Commands, Transpose of an Array, , Array Addressing: Vector, Matrix, Use of a Colon, , Addition of Elements to Existing Variables, Deleting Elements, , Built-in Functions for Array Handling, , Strings and Strings as Variables, Problems;, Mathematical Operations: Addition and Subtraction, Multiplication, Division, , Element-by-Element Operations, , Using Arrays with Built-in Functions, , Built-in Arrays for Analyzing Arrays, Random Number Generation, Exercise Problems.	10
3	**Programming Commands and their Applications** Relational and Logical Operators,, Conditional Statements: if-end Structure, If-Else-end Structure, , If-Elseif-Else-End Structure, Switch-Case Statement;, Loops: For-End Loop, While-End Loop; , Nested Loops,, Nested Conditional Statements, , Break and Continue Commands, , Applications, Exercise Problems.	8
4	**User-Defined Functions and Functions Files** Defining a Function, Structure of a Function: Function Definition Line, Input and Output Arguments,, H1 Line and Help Text Lines, Function Body; , Writing a Function, , Local and Global Variables, , User-defined Function, Function Calling, Examples, , Comparison between a Script and a Function, , Anonymous Functions, , Calling a Function inside another Function, , Sub-functions, Nested Functions, , Examples, Exercise Problems	10
5	**Two- and Three-Dimensional Plots** Defining Plots, The Plot Command: Plotting a Given Data, Plotting a Function, Fplot Command, , Plotting Multiple Graphs in a Single Plot: Using Plot Command, Hold Command, , Hold off Command, and Line Command; , Plots with Logarithmic Axes, Exercise Problems; , Three-Dimensional Plots: Line Plots, Mesh Plots, Surface Plots, , Surface Plots, Examples, Problems	6
6	**Symbolic Objects and Symbolic Expressions** Creating Symbolic Objects, Creating Symbolic Expressions, FindSym Command, , Default Symbolic Variable, Writing a Script in Symbolic Form, , Simplify Command, VPA Command, Pretty Command, , Collect Command, Expand Command, and, Factor Command, Examples, , Exercise Problems.	6
Total Hours		**44**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**List out and describe various data display formats with suitable examples.** List out and describe various data display formats with suitable examples.	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
2	**Perform data manipulation, variable declaration, arithmetic operations with scalars and creating and saving script file in a suitable programming environment.** Perform data manipulation, variable declaration, arithmetic operations with scalars and creating and saving script file in a suitable programming environment.	2
3	**List out and describe various elementary, trigonometric, and rounding functions with suitable illustrations.** List out and describe various elementary, trigonometric, and rounding functions with suitable illustrations.	2
4	**Perform Arrays Creation and their Operations such as Transpose, Addition, Subtraction, Multiplication etc. in a suitable programming environment.** Perform Arrays Creation and their Operations such as Transpose, Addition, Subtraction, Multiplication etc. in a suitable programming environment.	2
5	**List out and Describe various relational and logical operators with suitable illustrations.** List out and Describe various relational and logical operators with suitable illustrations.	2
6	**Write a program to implement relational and logical operators.** Write a program to implement relational and logical operators.	2
7	**Write a program to implement the conditional statements.** Write a program to implement the conditional statements.	2
8	**Write a program to apply for and while loops.** Write a program to apply for and while loops.	2
9	**Write a program to create a function and thereafter, calling it in script file.** Write a program to create a function and thereafter, calling it in script file.	2
10	**Write a program to create a two-dimensional plot with single and multiple graphs.** Write a program to create a two-dimensional plot with single and multiple graphs.	2
11	**Write a program to create a three-dimensional plot with single and multiple graphs.** Write a program to create a three-dimensional plot with single and multiple graphs.	2
12	**Write a program to declare symbolic variables and expressions.** Write a program to declare symbolic variables and expressions.	2
Total Hours		**24**

Textbook :

1 MATLAB: An introduction with Applications, Amos Gilat, John Wiley & Sons, 2015

References:

1 Fundamental Concepts of MATLAB Programming: From Learning the Basics to Solving a Problem with MATLAB, Fundamental Concepts of MATLAB Programming: From Learning the Basics to Solving a Problem with MATLAB, Dr. Brijesh Bakariya and Dr. Kulwinder Singh Parmar, BPB Publications, 2020

2 Matlab for Beginners: A gentle approach., Matlab for Beginners: A gentle approach., Kattan PI., Petra books, 2008

3 A guide to MATLAB: for beginners and experienced users. , A guide to MATLAB: for beginners and experienced users. , Hunt BR,, Lipsman RL, and Rosenberg JM., Cambridge university press, 2014

4 Learning to program with MATLAB: Building GUI tools. , Learning to program with MATLAB: Building GUI tools. , Lent CS. , John Wiley & Sons., 2022

5 Essentials of MATLAB programming. , Essentials of MATLAB programming. , Chapman SJ. , Cengage Learning., 2016

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
10.00	20.00	20.00	30.00	10.00	10.00

Instructional Method:

1 White Board Work, PPTs, Animations, Application Videos, etc.

Supplementary Resources:

1 https://www.youtube.com/watch?v=IuEOMyGuuIg&list=PLRWKj4sFG7-6_Xr9yqg6SMr_F80KdFVhN

2 https://swayam.gov.in/explorer