Subject Code: 01ME0611
Subject Name: Computer Programming for Robotics
B. Tech. Year - III (Semester - 6)

Type of course : Core

Prerequisite : NIL

Rationale : 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.

Course Outcome :
After completion of this course, student will be able to
1. Understand the fundamentals of computer programming for robotics.
2. Apply the knowledge gain for writing codes.
3. Write and apply the functions for different problems.
4. Apply programming skills for plotting data to learn the statistics
5. Create codes for more realistic problems in the area of interest.

Teaching and Examination Scheme :

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks			Practical Marks		
L	T	P	C	ESE(E)	IA	CSE	Viva (V)	Term Work (TW)	
3	0	2	4	50	30	20	25	25	150

Content :

Sr. No.	Content	Total Hrs.
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.	04
2	**Array Creation and Operations** Defining Arrays, Creating a One-Dimensional Arrays, Creating a TwoDimensional 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	10

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	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.	
3	**Programming Commands and their Applications** Relational and Logical Operators, ConditionalStatements: if-end Structure, If-Else-end Structure, If- Elseif-Else-End Structure, Switch-Case Statement; Loops: For-End Loop, While-End Loop; Nested Loops and Nested Conditional Statements, Break and Continue Commands, Applications, Exercise Problems.	**08**
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	**04**
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, Examples, Problems	**06**
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.	**06**

Distribution of Theory Marks

R Level	**U** Level	**A** Level	**N** Level	**E`** Level	**C** Level
10	**20**	**25**	**25**	**10**	**10**

Legends: R: Remember**; U:** Understand**; A:** Apply**; N:** Analyze**; E:** Evaluate**; C**: Create

List of Experiments :

List out and describe various data display formats with suitable examples.

1. Perform data manipulation, variable declaration, arithmetic operations with scalars and creating and saving script file in a suitable programming environment.
2. List out and describe various elementary, trigonometric, and rounding functions with suitable illustrations.
3. Perform Arrays Creation and their Operations such as Transpose, Addition, Subtraction, Multiplication etc. in a suitable programming environment.
4. List out and Describe various relational and logical operators with suitable illustrations.
5. Write a program to implement relational and logical operators.
6. Write a program to implement the conditional statements.

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7. Write a program to apply *for* and *while* loops.

8. Write a program to create a function and thereafter, calling it in script file.

9. Write a program to create a two-dimensional plot with single and multiple graphs.

10. Write a program to create a three-dimensional plot with single and multiple graphs.

11. Write a program to declare symbolic variables and expressions.

Important Equipment/Software Used :

1.Desktop Computer

Design-based Problems (DP) / Open-Ended Problems :

1. The tank in a water tower has the geometry shown in the figure (the lower part is a cylinder and the upper part is an inverted frustum of a cone). Inside the tank there is a float that indicates the level of the water. Write a program that determines the volume of the 19m water in the tank from the position (height h) of the float. The program asks the user to enter a value of h in m, and as output displays the volume of the water in m^3.
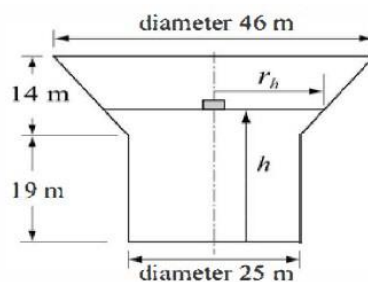
2. Flight of a model rocket

The flight of a model rocket can be modeled as follows. During the flrst 0.15s the rocket is propelled upward by the rocket engine with a force of 16 N. The rocket then flies up while slowing down under the force of gravity. After it reaches the apex, the rocket starts to fall back down. When its downward velocity reaches 20 m/s, a parachute opens (assumed to open instantly), and the rocket continues to drop at a constant speed of 20 m/s until it hits the ground. Write a program that calculates and plots the speed and altitude of the rocket as a function of time during the flight.

Recommended Books :

1. Amos Gilat. MATLAB: An introduction with Applications. John Wiley & Sons; 2004.
2. Brijesh Bakariya and Kulwinder Singh Parmar. Fundamental Concepts of MATLAB Programming: From Learning the Basics to Solving a Problem with MATLAB-BPB Publications (2020).

List of Open Source Software/learning websites :

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1. www.nptel.ac.in
2. https://swayam.gov.in/explorer

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