Syllabus for Certificate Course

AN INTRODUCTION TO SOME BASIC SCIENTIFIC TOOLS

Course design & Coordinators = Dr. Binita Borgohain & Dr. Pulak Talukdar

Course Outcome: This course will introduce students to the basics of Mathematica, MATLAB, LaTeX and Origin, some powerful computational software packages used for mathematical and scientific computations, writings, data analysis, and visualization. The course will cover the fundamentals of above programming software, including basic syntax and control structures. Students will learn how to manipulate and visualize mathematical functions and do symbolic computation in Mathematica and MATLAB, write simple documents with figures and equations in LaTeX, process data with scientific graph plotting in Origin workspace.

UNIT 1. MATHEMATICA

1. Introduction to Mathematica, basic syntax and data types, help and documentation, basic mathematical operations.
2. Solving equation and inequalities: linear equation, quadratic equation.
3. Functions and Plotting: various functions, 2D plotting, 3D plotting.
4. Calculus of functions: limits, differentiation and integration.
5. Solving differential equation and introduction to complex plotting.

UNIT 2. MATLAB

1. What is MATLAB, Commands, MATLAB Desktop and Editor, Running scripts, Variables & Data Types, Basic operations.
2. Vectors & Matrices: Creating matrices & arrays, Use of Help in MATLAB.
3. Built in functions, Plotting 2D & 3D data, Import tool, Importing data as table, Logical Arrays: Logical indexing.
4. Programming in MATLAB, Loops (for, while), Conditional statements, Polynomials in MATLAB, Numerical methods.

UNIT 3. LATEX

1. Introduction to LaTeX, Installation and working online (overleaf)/offline.
2. Creating and compiling a basic LaTeX document, Document Classes and Packages, Different LaTeX environments.
3. Designing Pages, designing different page elements like title, headers, footers, footnotes etc, formatting of space and size, Creating a table of content.
4. Creating and customizing Lists and tables, adding caption to tables.
5. Including and understanding the placement of image, adding multiple images.
6. LaTeX for Mathematical use, getting started with mathematical equations, plotting formulas.

UNIT 4. ORIGIN

1. Familiarization with the Origin Workspace, Importing Data from different sources, and Basic Data manipulation.
2. Creating and Customizing graphs.
3. Custom Graph Templates and Themes.
4. Publishing Graphs.
5. Basic Data analysis.

References:

1. Wolfram, S. An elementary introduction to the Wolfram Language. Wolfram Media (2019).
2. Hassen, A, Itzkowitz, G, Nguyen, H.D, Schiffman, J. Mathematica for Rogawski's Calculus, 2nd Edition, W. H. Freeman and Company New York (2010).
3. Kottwitz, S. LaTeX Beginner's Guide, 2nd Edition, Packt Publishing (2021).

DATE	TIME	UNIT	TOPICS	DURATION
20th March 2023 (MONDAY)	2.30 PM -3.30 PM	INTRODUCTION TO THE CERTIFICATE COURSE		1 Hour
21st March 2023 (TUESDAY)	2.30 PM -3.30 PM	Unit 1	Introduction to Mathematica, basic syntax and data types, help and documentation, basic mathematical operations	1 Hour
22nd March 2023 (WEDNESDAY)	2.30 PM -3.30 PM	Unit 3	Introduction to LaTeX, Installation and working online (overleaf)/offline.	1 Hour
23rd March 2023 (THURSDAY)	2.30 PM -4.30 PM	Unit 1	Solving equation and inequalities: linear equation, quadratic equation.	2 Hours
24th March 2023 (FRIDAY)	2.30 PM -4.30 PM	Unit 1	Functions and Plotting: various functions, 2D plotting, 3D plotting	2 Hours
25th March 2023 (SATURDAY)	2.30 PM -4.30 PM	Unit 3	Creating and compiling a basic LaTeX document, Document Classes and Packages, Different LaTeX environments.	2 Hours
27th March 2023 (MONDAY)	2.30 PM -4.30 PM	Unit 1	Calculus of functions: limits, differentiation and integration	2 Hours
28th March 2023 (TUESDAY)	2.30 PM -4.30 PM	Unit 3	Designing Pages, designing different page elements like title, headers, footers, footnotes etc, formatting of space and size, Creating a table of content	2 Hours
29th March 2023 (WEDNESDAY)	2.30 PM -4.30 PM	Unit 1	Solving differential equation and introduction to complex plotting.	2 Hours
30th March 2023 (THURSDAY)	2.30 PM -4.30 PM	Unit 3	Creating and customizing Lists and tables, adding caption to tables Including and understanding the placement of image, adding multiple images	2 Hours

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31st March 2023 (FRIDAY)	2.30 PM -4.30 PM	Unit 3	LaTeX for Mathematical use, getting started with mathematical equations, plotting formulas	2 Hours
3rd April 2023 (MONDAY)	2.30 PM -4.30 PM	Unit 2	What is MATLAB, Commands, MATLAB Desktop and Editor, Running scripts, Variables & Data Types, Basic operations	2 Hours
4th April 2023 (TUESDAY)	2.30 PM -4.30 PM	Unit 2	Vectors & Matrices: Creating matrices & arrays, Use of Help in MATLAB	2 Hours
5th April 2023 (WEDNESDAY)	2.30 PM -4.30 PM	Unit 2	Built in functions, Plotting 2D & 3D data, Import tool, Importing data as table, Logical Arrays: Logical indexing	2 Hours
6th April 2023 (THURSDAY)	2.30 PM -4.30 PM	Unit 2	Programming in MATLAB, Loops (for, while), Conditional statements, Polynomials in MATLAB, Numerical methods	2 Hours
8th April 2023 (SATURADAY)	2.30 PM -4.30 PM	Unit 4	Familiarization with the Origin Workspace, Importing Data from different sources, and Basic Data manipulation Creating and Customizing graphs	2 Hours
10th April 2023 (MONDAY)	2.30 PM -4.30 PM	Unit 4	Custom Graph Templates and Themes Publishing Graphs	2 Hours
11th April 2023 (TUESDAY)	2.30 PM -3.30 PM	Unit 4	Basic Data analysis	1 Hour
12th April 2023 (WEDNESDAY)	2.30 PM -4.30 PM	Day of Evaluation		2 Hours

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