Course Title: Computational Tools

Course Code: MATH-305

Course Type: Major Math

Prerequisites: Applications of ICT

Credit Hours: 3 (3 + 0)

Course Objectives: After completion of this course, the students will be able to:

- Write programs to solve engineering problems using MATLAB/Mathematica.
- Develop skills to analyze, decompose, and solve engineering problems algorithmically with MATLAB/Mathematica.
- Understand various programming constructs and their applications in computational problem-solving.
- Typeset articles, books and Theses in LaTeX and prepare presentations in Beamer.

Course Contents:

Introduction to MATLAB: MATLAB interface, Command Window, user input and output, Arithmetic, variables, operators and expressions, Errors in Input, Vectors and Matrices, Functions: Built-in Functions, User-Defined Functions. Graphics: two-dimensional plots, three-dimensional plot. Calculus with MATLAB Differentiation, Integration, Limits Sums and Products, Taylor Series.

Matlab Programming: Logical Operators, M-Files, Script M-Files, Function M-Files, Flow control: if statement, While loops, break, continue, For loops, Nested Loops, Array Functions.

Mathematica: Getting Acquainted, Basic Concepts, Lists, Two-Dimensional Graphics, Three-Dimensional Graphics, Equations, Algebra and Trigonometry, Differential Calculus, Integral Calculus, Multivariate Calculus, Ordinary Differential Equations.

LaTeX: A brief history of TeX and its evolution to LaTeX, Techniques for customizing page layouts and formatting documents, Inserting and formatting mathematical symbols and equations, adding and formatting tables, figures, and plots in a LaTeX document, Guidelines and best practices for writing reports, books, and theses in LaTeX.

Recommended Books:

1. Herniter, M.E., *Programming in MATLAB*, Cengage Learning, 1st edition, 2000.

2. Hunt, B.R., Lipsman, R. L. and Rosenberg, J. M., *A Guide to MATLAB: For Beginners and Experienced Users 2nd Edition*, Cambridge University Press, 2nd edition, 2006.

3. Goossens, M., Mittelbach, F. and Rahtz, S. et al., *The LaTeX Graphics Companion*, Addison-Wesley, 2nd edition, 2008.

4. Grätzer, G., *More Math into LaTeX*, Springer, 4th edition, 2007.

5. Muresan, M., *Introduction to Mathematica with Applications*, Springer Cham, 2017.

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