

## SKILL ENHANCEMENT COURSE

### SEC-1

#### **MAT-SE-3014: Computer Algebra Systems and Related Software**

Total marks: 100 (Theory 60, Internal assessment 20, Practical 20)

Per week; 2 Lectures 2 Practical, Credits 4(2+2) *Each unit carry equal credit.*

**Course Objectives:** This course aims at familiarizing students with the usage of mathematical softwares (/Mathematica/MATLAB/Maxima/Maple) and the statistical software **R**. The basic emphasis is on plotting and working with matrices using CAS. Data entry and summary commands will be studied in **R**. Graphical representation of data shall also be explored.

**Course Learning Outcomes:** This course will enable the students to:

- i) Use of softwares; Mathematica/MATLAB/Maxima/Maple etc. as a calculator, for plotting functions and animations
- ii) Use of CAS for various applications of matrices such as solving system of equations and finding eigenvalues and eigenvectors.
- iii) Understand the use of the statistical software **R** as calculator and learn to read and get data into **R**.

- iv) Learn the use of **R** in summary calculation, pictorial representation of data and exploring relationship between data.
- v) Analyze, test, and interpret technical arguments on the basis of geometry

**Unit 1: Introduction to CAS and Applications:**

Computer Algebra System (CAS), Use of a CAS as a calculator, Computing and plotting functions in 2D, Plotting functions of two variables using Plot3D and Contour Plot, Plotting parametric curves surfaces, Customizing plots, Animating plots, Producing tables of values, working with piecewise defined functions, Combining graphics.

[1] Chapter 12 (Sections 12.1 to 12.5)

[2] Chapter 1, and Chapter 3 (Sections 3.1 to 3.6, and 3.8) Chapter 6 (Sections 6.2, and 6.3)

**Unit 2: Working with Matrices:**

Simple programming in a CAS, Working with matrices, Performing Gauss elimination, operations (transpose, determinant, inverse), Minors and cofactors, Working with large matrices, Solving system of linear equations, Rank and nullity of a matrix, Eigenvalue, eigenvector and diagonalization.

[2] Chapter 7 (Sections 7.1 to 7.8)

**Practical:**

Six practicals should be done by each student. The teacher can assign practical from the exercises from [1,2].

**Text Books:**

1. Bindner, Donald & Erickson, Martin. (2011). *A Student's Guide to the Study, Practice, and Tools of Modern Mathematics*. CRC Press, Taylor & Francis Group, LLC.
2. Torrence, Bruce F., & Torrence, Eve A. (2009). *The Student's Introduction to Mathematica: A Handbook for Precalculus, Calculus, and Linear Algebra* (2nd ed.). Cambridge University Press