



# ARSD College, University of Delhi

## Model Course Handout/Lesson Plan

<b>Course Name : B.Sc. (Hons) Maths IInd year PRACTICAL</b>						
Semester	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
IV	32353401	Computer Algebra Systems and Related Software			4	4
Teacher/Instructor(s)		Amit Kumar, Rajpal Rajbhar				
Session		2021-2022				

**Course Objective:** This course aims at familiarizing students with the usage of computer algebra systems (/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:** Use of computer algebra systems (Mathematica/MATLAB/Maxima/Maple etc.) as a calculator, for plotting functions and animations. Use of CAS for various applications of matrices such as solving system of equations and finding eigenvalues and eigenvectors. Understand the use of the statistical software R as calculator and learn to read and get data into R. Learn the use of R in summary calculation, pictorial representation of data and exploring relationship between data. Analyze, test, and interpret technical arguments on the basis of geometry.

### List of Experiments:

Details of the Lab Course		
Session	Name of Experiment	Contact Hours
1	Computer Algebra System (CAS)	2Hrs
2	Use of a CAS as a calculator	2Hrs
3	Computing and plotting functions in 2D	2Hrs
4	Producing tables of values	2Hrs
5	Working with piecewise defined functions, Combining graphics. Simple programming in a CAS	4Hrs
6	Plotting functions of two variables using Plot3D and contour plot,.	4Hrs
7	Plotting parametric curves surfaces, Customizing plots, Animating plots	4Hrs
8	Working with matrices, Performing Gauss elimination, Operations (Transpose, Determinant, Inverse), Minors and cofactors,	6Hrs
9	Working with large matrices, Solving system of linear equations, Rank and nullity of a matrix, Eigenvalue, Eigenvector and diagonalization.	6Hrs
10	R as a calculator	2Hrs
11	Explore data and relationships in R, Reading and getting data into R	2Hrs
12	Combine and scan commands, Types and structure of data items with their properties.	2Hrs

13	Manipulating vectors, Data frames, Matrices and lists. Viewing objects within objects	4Hrs
14	. Constructing data objects and conversions	2Hrs
15	Summary commands: Summary statistics for vectors, Data frames, Matrices and lists. Summary tables.	4Hrs
16	Stem and leaf plot, histograms. Plotting in R: Box-whisker plots,	4Hrs
17	Scatter plots, Pairs plots, Line charts, Pie charts, Cleveland dot charts and Bar charts. Copy and save graphics to other applications	4Hrs
<b>Total</b>		<b>56 hours</b>

**Suggested Books:**

Sl. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
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	2011
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.	2009
3.	Gardener, M. (2012). Beginning R: The Statistical Programming Language, Wiley.	2012
4.	Verzani, John (2014). Using R for Introductory Statistics (2nd ed.). CRC Press, Taylor & Francis Group	2014

**Evaluation Scheme:**

No.	Component	Duration	Marks
1.	Internal Assessment		25
	• Quiz/Viva		
	• Observation & Record		
	• Attendance		
	• Model Exam		
2.	End Semester Examination	3 hr	50

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