# 20CS41O1 - R PROGRAMMING

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| Course Category: | Open Elective | Credits: | 3 |
| Course Type: | Theory | Lecture-Tutorial-Practical: | 3-0-0 |
| Prerequisite: | Require fundamental knowledge in any programming language, mathematics and statistical techniques. | Sessional Evaluation:  Univ. Exam Evaluation:  Total Marks: | 40  60  100 |
| Objectives: | * Gain a foundational understanding of R Programming basics * Master the R programming and understand how various constructs are implemented in complex problems and applications | | |

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| Course Outcomes | Upon successful completion of the course, the students will be able to: | |
| CO1 | Know the benefits of R, as well as its unique features and quirks, R editing options, Starting R, writing first R script, and finding the R environment |
| CO2 | Using functions and arguments, Making code clear and legible, Extending R with user packages, Using R as a fancy calculator, Constructing and working with vectors. |
| CO3 | Working with vectors, Representing textual data with character vectors, Working with text, and Creating, converting, and working with factors. |
| CO4 | Working with dates in R, Understanding the different ways of representing dates, Throwing time into the mix, Formatting dates and times for pretty printing, Operating on dates and times, Creating matrices, Getting values in and out of a matrix, Using row and column names in a matrix, Performing matrix calculations, and Working with multidimensional arrays. |
| CO5 | Putting data in a data frame, Getting data in and out of a data frame, Working with lists, work with functions, Playing with arguments, Finding objects within the functions, and Working with methods. |
| CO6 | Making choices based on conditions, Looping over different values, Applying functions row‐wise and column‐wise, Applying functions over values, variables, and list components, Discovering warnings, Reading errors correctly, Finding the bugs , and Optimizing debugging strategies |
| Course Content | UNIT-I  **Introduction to R programming:** History of R programming, Reserved words of R, Variables and constants of R, Operators of R, precedence and association of R, data types in R, Decision making statements in R programming, Iterative statements, functions, strings, arrays, vectors, lists, matrices, factors, data frames, data reshaping and data interfacing.  UNIT-II  **R-command packages:** Standard Command Packages, How to Get Extra Packages of R Commands, How to Install Extra Packages for Windows Users, Running and Manipulating Packages, Loading Packages, Windows-Specific Package Commands.  UNIT-III  **Some Simple Math:** Use R Like a Calculator, Storing the Results of Calculations.  **Reading and Getting Data into R:** Using the combine Command for Making Data, Entering Numerical Items as Data, Entering Text Items as Data, Using the scan Command for Making Data, Entering Text as Data, Using the Clipboard to Make Data and Reading a File of Data from a Disk.  **Reading Bigger Data Files:** The read.csv () Command, Alternative Commands for Reading Data in R, Missing Values in Data Files.  UNIT-IV  **Viewing Named Objects:** Viewing Previously Loaded Named-Objects, Viewing All Objects, Viewing Only Matching Names and Removing Objects from R.  **Manipulating Objects:** Manipulating Vectors, Manipulating Matrix and Data Frames, Manipulating Lists.  **Constructing Data Objects:** Making Lists, Making Data Frames, Making Matrix Objects.  **Forms of Data Objects:** Testing and Converting, Testing to See What Type of Object You Have, Converting from One Object Form to Another, Convert a Matrix to a Data Frame, Convert a Data Frame into a Matrix, Convert a Data Frame into a List and Convert a Matrix into a list.  UNIT-V  **Simple Hypothesis Testing:** Using the Student’s t-test, Two-Sample t-Test with Unequal Variance, Two-Sample t-Test with Equal Variance, One-Sample t-Testing, Using Directional Hypothesis Formula, Syntax and Sub setting Samples in the T-Test.  **The Wilcoxon U-Test (Mann-Whitney):** Two-Sample U-Test, One-Sample U-Test, Using Directional Hypotheses, and Formula Syntax and Sub setting Samples in the U-test.  **Paired t- and U-Tests:** Correlation and Covariance, Simple Correlation, Covariance, Significance Testing in Correlation Tests and Formula Syntax.  UNIT-VI  Introduction to Graphical Analysis:  **Box-whisker Plots:** Basic Box plots, Customizing Box plots, Horizontal Box plots,  **Scatter Plots:** 2 Basic Scatter Plots, Adding Axis Labels, www. Plotting Symbols, Setting Axis Limits, Using Formula Syntax, Adding Lines of Best-Fit to Scatter Plots.  **Pairs Plots:** (Multiple Correlation Plots) Line Charts, Line Charts Using Numeric Data, Line Charts Using Categorical Data, Pie Charts, Cleveland Dot Charts. Bar Charts: Single-Category Bar Charts and Multiple Category Bar Charts. | |
| Text Books &  References  Books | **TEXT BOOKS:**   1. Beginning R, the statistical programming language by Dr Mark Gardener.   **REFERENCE BOOKS:**   1. “R Programming for Beginners: Fast and Easy Learning” by Steven Keller, Kindle Edition. 2. “A Handbook of Statistical Analyses Using R” by Brian Everitt and Torsten Hothorn. 3. “R Graphics Cookbook” by Winston Chang. | |
| E-Resources | 1. <https://nptel.ac.in/courses> 2. <https://freevideolectures.com/university/iitm> | |