**R Programming Language**

**Subject Code : 18CS4DS03 Total Contact Hours : 30**

**Credits : 02 L-T-P : 2-0-0**

**Prerequisite:** Knowledge on programming Concepts

**Course Objective:**

* To understand the basic programming concepts of R programming language.
* To understand Data structures in R Statistical computing programming language.
* To understand the important packages and functions in R statistical computing programming language.
* To understand the importance of R in statistical analysis and customizing the analysis.
* Analyses the impact of R in the current organization over proprietary statistical software.

**Unit I: Introduction to R Environment (6 Hours)**

History and development of R Statistical computing programming language, installing R and R studio, getting started with R, creating new working directory, changing existing working directory, understanding the different data types, installing the available packages, calling the installed packages, arithmetic operations, variable definition in R, simple functions, vector definition and logical expressions, matrix calculation and manipulation using matrix data types, work-space management.

**Unit II: Data Structures, Looping and Branching (6 Hours)**

Introduction to different data types, vectors, atomic vectors, types and tests, coercion, lists, list indexing, function applying on the lists, adding and deleting the elements of lists, attributes, name and factors, matrices and arrays, matrix indexing, filtering on matrix, generating a covariance matrix, applying function to row and column of the matrix, data frame – creating, coercion, combining data frames, special types in data frames, applying functions: lapply( ) and sapply( ) on data frames, control statements, loops, looping over non vector sets, arithmetic and Boolean operators and values, branching with **if**, looping with **for**, **if-else** control structure, looping with **while**, vector based programming.

**Unit III: R - Object Oriented Programming (6 Hours)**

Introduction to object oriented concepts in R, basics of S3 classes – S3 Generic functions, OPP in linear model functions, writing S3 classes, using inheritance, introduction to S4 classes, writing S4 Classes, implementing a generic function on an S4 Classes, comparison of S3 and S4 classes, management of objects – listing objects, removing specific objects from the existing function and working directory, saving the collection of objects with save( ) function.

**Unit IV: R for Statistics (6 Hours)**

Descriptive statistics – mean (arithmetic, geometric and harmonic), median, mode for raw and grouped data, measure of dispersion – range, standard deviation, variance, coefficient of variation, testing of hypothesis – small sample test, large sample test – for comparing mean, proportion, variance, correlation and regression – significance of correlation and regression coefficients, chi-square test, non-parametric test, Analysis of Variance for one way variation and two variation – with and without interaction.

**Unit V: R with C, C++ and Python (6 Hours)**

Introduction to C and C++ programming concepts, writing C/C++ functions to be called from R, preliminaries of R to C and C++ programming languages, some mathematical programming example with R and C/C++, compiling and running the code, debugging R/C code, introduction to Python and its components, installing packages related with python in R, syntax of RPy packages.

**Course Outcome:**

* Understand the core programming concepts of R language.
* Implementation of the Looping and condition statements in R Programming
* Implementation the different options in I/O operations in R programming.
* Explain the importance of statistical functions in R programming language
* Understand the basic concepts of integrating other object oriented programming with R

**Text Book**

1. The art of R programming – Norman Matloff, no starch Press, San Francisco October 2011.
2. R in Action – Robert I. Kabacoff, Second Edition, Dreamtech Press, 2nd Edition, May 2015.

**Reference Books**

1. Introduction to Scientific Programming and Simulation using R – Owen Jones, Robert Maillardet and Andrew Robinson, CRC Press, 2nd Edition,2014
2. Advanced R – Hadley Wickham, CRC Press,2015.