# Semester-VI

# Skill Enhancement Paper

## SEC-4: Statistical Software: R

**Total Marks: 100** (Theory: 38, Internal Assessment: 12, and Practical: 50)
**Workload:** 2 Lectures, 4 Practicals (per week) **Credits:** 4 (2+2)
**Duration:** 14 Weeks (28 Hrs. Theory + 56 Hrs. Practical) **Examination:** 2 Hrs.

**Course Objectives:** The purpose of this course is to help you begin using **R**, a powerful free software program for doing statistical computing and graphics. It can be used for exploring and plotting data, as well as performing statistical tests.

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

i) Be familiar with **R** syntax and use **R** as a calculator.
ii) Understand the concepts of objects, vectors and data types.
iii) Know about summary commands and summary table in **R**.
iv) Visualize distribution of data in **R** and learn about normality test.
v) Plot various graphs and charts using **R**.

**Unit 1: Getting Started with R - The Statistical Programming Language**
Introducing **R**, using **R** as a calculator; Explore data and relationships in **R**; Reading and getting data into **R:** combine and scan commands, viewing named objects and removing objects from **R**, Types and structures of data items with their properties, Working with history commands, Saving work in **R**; Manipulating vectors, Data frames, Matrices and lists; Viewing objects within objects, Constructing data objects and their conversions.

**Unit 2: Descriptive Statistics and Tabulation**
Summary commands**:** Summary statistics for vectors, Data frames, Matrices and lists; Summary tables.

**Unit 3: Distribution of Data**
Stem and leaf plot, Histograms, Density function and its plotting, The Shapiro–Wilk test for normality, The Kolmogorov–Smirnov test.

**Unit 4: Graphical Analysis with R**
Plotting in **R:** Box-whisker plots, Scatter plots, Pairs plots, Line charts, Pie charts, Cleveland dot charts, Bar charts; Copy and save graphics to other applications.

**References:**

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. Gardener, M. (2012). *Beginning* **R:** *The Statistical Programming Language*, Wiley Publications.

**Additional Reading:**

i. Verzani, John (2014). *Using R for Introductory Statistics* (2nd ed.). CRC Press, Taylor & Francis Group.

## Practicals to be done in the Computer Lab using Statistical Software R:

[1] Chapter 14 (Exercises 1 to 3)
[2] Relevant exercises of Chapters 2 to 5, and 7

**Note:** The practical may be done on the database to be downloaded from https://data.gov.in/

### Teaching Plan (Theory of SEC-4: Statistical Software: R):

**Weeks 1 to 3:** Introducing **R**, using **R** as a calculator; Explore data and relationships in **R**, Reading and getting data into **R:** Combine and scan commands, viewing named objects and removing objects from **R**, Types and structures of data items with their properties, Working with history commands, Saving work in **R**.

[1] Chapter 14 (Sections 14.1 to 14.4).
[2] Chapter 2.

**Weeks 4 and 5:** Manipulating vectors, Data frames, Matrices and lists; Viewing objects within objects, Constructing data objects and their conversions.

[2] Chapter 3.

**Weeks 6 to 8:** Summary commands**:** Summary statistics for vectors, Data frames, Matrices and lists; Summary tables.

[2] Chapter 4.

**Weeks 9 to 11:** Stem and leaf plot, Histograms, Density function and its plotting, The Shapiro–Wilk test for normality, The Kolmogorov–Smirnov test.

[2] Chapter 5.

**Weeks 12 to 14:** Plotting in **R:** Box-whisker plots, Scatter plots, Pairs plots, Line charts, Pie charts, Cleveland dot charts, Bar charts; Copy and save graphics to other applications.

[1] Chapter 14 (Section 14.7).
[2] Chapter 7.

### Facilitating the Achievement of Course Learning Outcomes

| Unit No. | Course Learning Outcomes | Teaching and Learning Activity | Assessment Tasks |
|---|---|---|---|
| 1. | Be familiar with **R** syntax and use **R** as a calculator.<br>Understand the concepts of objects, vectors and data types. | (i) Each topic to be explained with illustrations using **R** software.<br>(ii) Students be given homework/ assignments.<br>(iii) Students be encouraged to look for new applications. | • Presentations and class discussions.<br>• Assignments and class tests.<br>• Mid-term examinations.<br>• Practical examinations.<br>• End-term examinations. |
| 2. | Know about summary commands and summary table in **R**. | | |
| 3. | Visualize distribution of data in **R** and learn about normality test. | | |
| 4. | Be familiar with **R** syntax and use **R** as a calculator.<br>Understand the concepts of objects, vectors and data types. | | |

**Keywords:** Objects, Vectors, Data types, Summary commands, Shapiro–Wilk test, Bar charts.