



SRI VENKATESWARA UNIVERSITY

II Year Syllabus for 4-Year UG Honours in B.Sc. (Data Science) as Major in consonance with Curriculum framework w.e.f. AY 2026-27

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	III	5	Database Management Systems	3	3
			Database Management Systems Lab	2	1
		6	Data Science with R	3	3
			Data Science With R lab	2	1
		7	Web Technologies	3	3
			Web Technologies Lab	2	1

SEMESTER-III
COURSE 6: DATA SCIENCE WITH R

Theory Credits: 3 3 hrs/week

Course

Objectives

1. Introduce the data science process, lifecycle, and applications in real-world domains.
2. Build proficiency in R programming for data manipulation, exploration, and visualization.
3. Train students in handling structured, unstructured, and time-based data effectively.
4. Familiarize with basic machine learning and statistical modeling using R.
5. Develop awareness of ethical, interpretability, and responsible use of data science.

Course

Outcomes

At the end of the course, students will be able to:

1. Explain the Data Science process and perform EDA (Exploratory Data Analysis).
2. Write R programs using variables, functions, loops, and packages for basic analytics.
3. Perform data wrangling, cleaning, and visualization with R libraries (dplyr, tidyr, ggplot2).
4. Build and evaluate basic machine learning models such as regression and clustering.
5. Apply data science techniques to practical case studies.

Unit 1. Introduction to Data Science Process:

Introduction- Definition - Data Science in various fields - Examples - Impact of Data Science - Data Analytics Life Cycle - Data Science Toolkit - Data Scientist - Data Science Team, Exploratory Data Analysis (EDA), Feature Engineering & Data Transformation

Unit 2. Basics of R Programming:

Introduction to R and RStudio, Data Types, Variables, Operators, Control Structures (if, loops, apply), Functions and Packages, Data Input/Output (CSV, Excel, XML, JSON).

Unit 3. Data Handling & Visualization in R:

Data Frames, Lists, Matrices, Data Wrangling with dplyr and tidyr, Handling Missing Data, Working with Date/Time in R. Visualization with ggplot2: grammar of graphics, aesthetics, geometries, scales. Faceting and layering techniques, Visualizing categorical and numerical data, Customizing and exporting plots

Unit 4. Applications & Case Studies in Data Science:

Simple Linear Regression, Multiple Regression

Model Evaluation Method: Accuracy, Confusion Matrix, ROC.

K-Means Clustering, Text Mining & Word Clouds, Recommender Systems Basics, Ethical

Issues in Data Science

Unit 5. Advanced Topics in Data Science with R :

Introduction to Time Series Analysis in R (ARIMA basics)- Concept of time series (trend, seasonality, noise), Time series objects in R (ts, zoo, xts), Plotting and decomposing time series, Stationarity and differencing, Autocorrelation & Partial Autocorrelation (ACF/PACF), AR, MA, ARIMA model basics, Forecasting using forecast package Creating interactive visualizations with plotly packages-Converting ggplot2 plots to interactive plots Animations and sliders in plotly.

Textbooks

1. An Introduction to Statistical Learning with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 2nd Edition, 2021
2. R for Data Science, Hadley Wickham and Garrett Grolemund, O'Reilly Media, 2017.

Reference Books

1. The Art of R Programming, Norman Matloff,, No Starch Press, 2011.
2. Modern Applied Statistics with S, W.N. Venables & B.D. Ripley, Springer, 2002.
3. Introduction to Data Science: Data Analysis and Prediction Algorithms with R, Rafael A. Irizarry, CRC Press, 2020.
4. Data Science from Scratch: First Principles with Python (for conceptual clarity only), Joel Grus,

Activities:

Outcome: Explain the Data Science process and perform EDA (Exploratory Data Analysis).

Activity: Use a real-world dataset (e.g., Titanic or COVID data) to:

- Outline the steps of the Data Science workflow
- Perform EDA using summary statistics and visualizations (histograms, boxplots, scatterplots)

Evaluation Method: Presentation and checklist (10-point scale):

- Clear explanation of workflow stages
- Quality of EDA insights
- Use of appropriate plots and summaries

Outcome: Write R programs using variables, functions, loops, and packages for basic analytics.

Activity: Write an R script that:

- Reads a CSV file
- Uses if, for, and while loops
- Defines and calls custom functions with arguments and return values

Evaluation Method: Code review and execution test to verify (10-point scale):

- Correctness of the syntax and logic
- Functionality of control structures
- Output accuracy and modularity

Outcome: Perform data wrangling, cleaning, and visualization with R libraries (dplyr, tidyr, ggplot2).

Activity: Clean a messy dataset using:

- dplyr for filtering, selecting, and mutating
- tidyr for reshaping and handling missing values
- Time-based operations (e.g., filling gaps, formatting dates)

Evaluation Method: Before-and-after comparison (10 point score):

- Completeness of cleaning steps
- Use of appropriate functions
- Handling of missing/time data

Outcome: Implement basic machine learning models and evaluate performance using appropriate metrics and visual tools.

Activity: Build a simple classification model (e.g., logistic regression or decision tree) using

R:

- Train/test split
- Predict outcomes
- Evaluate using confusion matrix, accuracy, precision, recall

Evaluation Method: Model report and demo (10 point scale):

- Correct implementation of model
- Use of evaluation metrics

SEMESTER-III
COURSE 6: DATA SCIENCE WITH R
Credits: 1 2 hrs/week

Practical

List of Experiments:

1. Compute Mean, Median, Mode, Variance, and Standard Deviation
2. Visualize Binomial, Normal, and Poisson Distributions
3. Perform t-test and Chi-Square Test in R
4. Calculate Correlation and Build a Simple Linear Regression Model
5. Conduct Exploratory Data Analysis (EDA) on a Real-World Dataset
6. Apply Feature Engineering: Scaling, Normalization, and Encoding
7. Practice R Programming: Variables, Control Structures, and Functions
8. Read and Write Data from CSV, Excel, JSON, and XML Files
9. Use dplyr and tidyr for Data Wrangling Tasks
10. Handle Missing Data and Detect Outliers
11. Work with Dates and Times in R
12. Visualize Data Using ggplot2 (Bar, Scatter, Histogram, Boxplot)
13. Perform K-Means Clustering and Visualize Clusters
14. Evaluate Models Using Confusion Matrix, Accuracy, and ROC Curve
15. Perform Text Mining and Create a Word Cloud
16. Time Series Forecasting with ARIMA on a real dataset (e.g., monthly airline passengers, stock prices, or temperature data).
17. Create interactive bar, line, and scatter plots using plotly. On a real dataset (e.g., COVID-19 cases, sales data, or student marks).
18. Develop a Shiny app that lets users upload a CSV file.

SRI VENKATESWARA UNIVERSITY::TIRUPATI
B.Sc. Data Science Honours
II year III Semester
COURSE 6: DATA SCIENCE WITH R

MODEL QUESTION PAPER

Time: **3 Hours**

Max. Marks: **75**

PART-A

Answer any **FIVE** of the following. Each Question Carries 3 marks.

(5X3=15)

1. Short answer question from unit-I
2. Short answer question from unit-I
3. Short answer question from unit-II
4. Short answer question from unit-II
5. Short answer question from unit-III
6. Short answer question from unit-III
7. Short answer question from unit-IV
8. Short answer question from unit-IV
9. Short answer question from unit-V
10. Short answer question from unit-V

PART-B

Answer **FIVE** of the following. Each Question Carries 12 marks.

(5X12=60)

11. a) Essay question from Unit-I
OR
b) Essay question from Unit-I
12. a) Essay question from Unit-II
OR
b) Essay question from Unit-II
13. a) Essay question from Unit-III
OR
b) Essay question from Unit-III
14. a) Essay question from Unit-IV
OR
b) Essay question from Unit-IV
15. a) Essay question from Unit-V
OR
b) Essay question from Unit-V