



SRI VENKATESWARA UNIVERSITY
II Year Syllabus for 4-Year UG Honours in BCA Data Science Honours
in consonance with the Curriculum framework w.e.f. AY 2026-27
II Year III Semester

Sl. No.	Category	Course No.	Course Name	No. of Hours		Total No. of Hours	No. of Credits		Total No. of Credits
				Theory	Practical		Theory	Practical	
1	Major-Core	5	Mathematical and Statistical Foundation	5	0	5	4	0	4
2	Major-Core	6	OOPS Through JAVA	3	2	5	3	1	4
3	Major-Core	7	Data Science With R	3	2	5	3	1	4
4	Minor	1		4	0	4	4	0	4
5	AECC	1	English	4	0	4	3	0	3
6	AECC	1	MIL (Telugu/Hindi/Sanskrit)	4	0	4	3	0	3
7	MDC	2	-	2	0	2	2	0	2
8	SEC	3	SEC: Design Thinking/Problem solving/ others	2	0	2	2	0	2
				27	4	31	24	2	26

Note:

The number of instructional hours shall be five (5) for courses involving problem-solving, and four (4) for courses comprising only theory.


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II Year Syllabus for 4-Year UG Honours in BCA 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	Mathematical and Statistical Foundation	5	4
		6	OOPS Through JAVA	3	3
			OOPS Through JAVA – Practical	2	1
		7	Data Science With R	3	3
			Data Science – Practical	2	1

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SEMESTER-III
BCA Data Science Honours
II Year III Semester
COURSE 7 : Data Science with R

Theory

Credits: 3

3 hrs/week

Course Objectives

- To introduce students to the fundamental concepts and process of Data Science and its applications across various domains.
- To develop basic programming skills using R and familiarize students with data handling techniques.
- To enable students to perform data cleaning, transformation, and visualization using R packages.
- To apply statistical and machine learning techniques such as regression and clustering for real-world problem solving.
- To introduce advanced topics including time series analysis and interactive visualizations using R.

Course Outcomes

At the End of the Course, The Students will be able to:

- Understand the Data Science life cycle, roles of data scientists, and applications in various industries.
- Write R programs using data types, control structures, functions, and packages.
- Perform data wrangling, transformation, and visualization using R libraries like dplyr, tidyr, and ggplot2.
- Apply regression models, clustering techniques, and evaluate models using appropriate metrics.
- Analyze time series data using ARIMA basics and create interactive visualizations using plotly.

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,


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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.

Text Books:

1. R for Data Science – Hadley Wickham & Garrett Golemund, O'Reilly Media.
2. An Introduction to Statistical Learning – Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani, Springer.

Reference Books:

1. Data Science for Business – Foster Provost & Tom Fawcett.
2. Hands-On Programming with R – Garrett Golemund.

Activities:

Outcome: Illustrate the stages of the Data Science life cycle, roles of Data Scientists, and the impact of Data Science across various domains.

Activity: Create a conceptual diagram or presentation showing:

- o Data Science process stages (Data Collection, Cleaning, EDA, Modeling, Evaluation, Deployment)
- o Roles in Data Science team (Data Engineer, Analyst, Scientist, Business Analyst)
- o Applications in at least two domains (Healthcare, Finance, Education, etc.)
- o Real-world example demonstrating impact

Evaluation Method:

Oral presentation or poster presentation. Use a rubric to assess clarity, correctness of life cycle mapping, domain relevance, and conceptual understanding on a 10-point scale.

Outcome: Demonstrate the ability to write basic R programs using data types, control structures, functions, and file input/output operations.

Activity: Develop an R program that demonstrates:

- o Use of data types (numeric, character, logical) and variables
- o Control structures (if-else, loops, apply functions)
- o User-defined function
- o Importing and exporting data (CSV/Excel/JSON)
- o Display of summary statistics

Evaluation Method:

Lab demonstration and viva voce. Use a rubric to assess program correctness, logical structure, use of control statements, and output accuracy on a 10-point scale.

Outcome: Apply data wrangling, transformation, and visualization techniques to analyze structured datasets.

Activity: Prepare a data analysis report that includes:

- o Data cleaning and handling missing values
- o Data transformation using dplyr/tidyr
- o Creation of at least three visualizations using ggplot2
- o Use of faceting or layering techniques
- o Interpretation of graphical results

Evaluation Method:

Mini project submission and presentation. Use a rubric to assess data preprocessing accuracy, visualization quality, interpretation skills, and overall presentation on a 10-point scale.

Outcome: Implement regression and clustering models and evaluate model performance using appropriate metrics.

Activity: Develop a case study analysis that includes:

- o Simple and Multiple Linear Regression models
- o Confusion Matrix and Accuracy calculation
- o K-Means clustering implementation
- o Interpretation of model outputs
- o Discussion on ethical considerations in model deployment

Evaluation Method:

Case study presentation or lab demonstration. Use a rubric to assess correctness of model implementation, evaluation metrics usage, clustering interpretation, and ethical awareness on a 10-point scale.

Outcome: Analyze time series data using ARIMA basics and create interactive visualizations for forecasting and reporting.

Activity: Create a forecasting analysis report that includes:

- o Conversion of dataset into time series object (ts/zoo/xts)
- o Decomposition of time series (trend, seasonality, noise)
- o ACF and PACF plots
- o Basic ARIMA model development and forecasting
- o Conversion of ggplot2 graph into interactive plot using plotly

Evaluation Method:

Project demonstration and technical viva. Use a rubric to assess correctness of time series modeling, forecasting accuracy, interactive visualization quality, and clarity of explanation on a 10-point scale.


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SEMESTER-III

COURSE 7: Data Science with R

Practical

Credits: 1

2hrs/week

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.


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BCA Data Science Honours
II Year III Semester
COURSE 7 : Data Science with R

Time : 3 Hrs

Max Marks : 75

SECTION - A

Answer any FIVE of the following

5 X 3= 15 Marks

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

SECTION-B

Answer FIVE of the following.

5 X 12=60 Marks

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


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