



**VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BALLARI**  
JNANASAGARA CAMPUS, BALLARI-583 105

**Department of Studies in Computer Science**

*SEP: Credits Structure under Choice based Credit System*  
**[CBCS]**

*Syllabus of V & VI Semester*

*Bachelor of Science*



**With effect from 2025-26 Onwards**

Approved in the BOS dated 25.03.2026

*[Handwritten signatures and dates]*  
25/03/2026  
25/03/2026  
e. to Sastri

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## Curriculum Structure

Semester	Course No.	Theory/ Practical	Credits	Paper Title	Marks	
					S.A.	I.A.
V	24MJCS5L	Theory	4	Python Programming	80	20
	24MJCS5P	Practical	2	Python Programming Lab	40	10
	24ELCS5L	Theory	2	Software Engineering	40	10
	24SKCS5L	SEC	2	Elementary Research Methodology	40	10
VI	24MJCS6T	Theory	4	R Programming	80	20
	24MJCS6P	Practical	2	R Programming Lab	40	10
	24ELCS6L	Theory	2	Cyber Security	40	10
	24PROJCS6P	Project	2	Project	40	10

Title of the Subject: <b>PYTHON PROGRAMMING</b>	
Course Code: <b>24MJCS5L</b>	CIA Marks: <b>20 Marks</b>
Semester: <b>V Sem</b>	SEE Marks: <b>80 Marks</b>
Contact Hours(L:T:P): <b>4-0-0</b>	Credits: <b>04 Credits</b>
Duration of Exam: <b>03 Hrs</b>	Total Contact Hours: <b>56 Hrs</b>

**Course Outcomes (COs):** After completing this course satisfactorily, a student will be able to:

- Have a strong understanding of Python syntax and programming fundamentals.
- Able to develop structured & modular Python programs. Apply object-oriented principles in Python.
- Work with data structures, file handling, and database operations.
- Apply object-oriented principles in Python.
- Utilize Python libraries for data science, web development, and automation

### PYTHON PROGRAMMING

Unit	Description	Hours
1	<b>Introduction to Python: Overview of Python:</b> History and features of Python, Installing Python and setting up the environment, <b>Basic Syntax and Data Types:</b> Variables, Constants, and Keywords, Data Types: Integers, Floats, Strings, Lists, Tuples, Dictionaries, Sets, <b>Operators in Python,</b> Arithmetic, Comparison, Logical, Bitwise, Membership, and Identity Operators, <b>Taking User Input &amp; Type Conversion, Basic I/O Operations.</b>	08
2	<b>Control Structures and Functions: Decision Making in Python:</b> if, if-else, elif statements, <b>Looping Constructs:</b> for loop, while loop, Loop control statements: break, continue, pass, <b>Functions in Python,</b> Defining and calling functions: Function arguments: Positional, Keyword, Default, Variable-length, Lambda functions, Recursion, <b>Exception Handling:</b> try-except block, Raising and handling exceptions.	12
3	<b>Data Structures in Python: Lists and Tuples:</b> Creating, accessing, modifying, slicing, List comprehensions, <b>Dictionaries and Sets:</b> Dictionary operations (keys, values, items), Set operations (union, intersection, difference), <b>String Manipulation:</b> String slicing, methods (split(), join(), replace(), etc.), Regular expressions in Python, <b>File Handling:</b> Reading and writing text and binary files, File operations (open(), close(), read(), write()).	12
4	<b>Object-Oriented Programming (OOP) in Python: Classes and Objects:</b> Creating classes and objects, Instance and class variables, <b>Encapsulation, Inheritance, and Polymorphism:</b> Private and public attributes, Single and multiple inheritance, Method overloading and overriding: <b>Working with Modules and Packages:</b> Importing modules (math, random, datetime), Creating custom modules and packages.	12
5	<b>Advanced Python and Applications: Working with Libraries:</b> NumPy (Arrays and operations), Pandas (DataFrames and manipulation), Matplotlib (Basic plotting), <b>Database Connectivity:</b> Connecting Python with MySQL using sqlite3 or MySQLdb, Executing CRUD operations, <b>Introduction to Web Development with Flask/Django, Basic Introduction to Machine Learning,</b> Working with Scikit-learn and TensorFlow basics.	12

**Reference Books:**

1. Python Crash Course" – Eric Matthes
2. "Learning Python" – Mark Lutz

3. "Automate the Boring Stuff with Python" – Al Sweigart
4. "Python Programming: An Introduction to Computer Science" – John Zelle
5. "Fluent Python" – Luciano Ramalho

**WEB:**

1. Python Official Documentation – <https://docs.python.org/3/>
2. W3Schools Python Tutorial – <https://www.w3schools.com/python/>
3. Real Python (Advanced Concepts & Projects) – <https://realpython.com/>

<b>Title of the Subject: PYTHON PROGRAMMING LAB</b>	
<b>Course Code: 24MJCS5P</b>	<b>CIA Marks: 10 Marks</b>
<b>Semester: V Sem</b>	<b>SEE Marks: 40 Marks</b>
<b>Contact Hours(L:T:P): 0-0-4</b>	<b>Credits: 02 Credits</b>
<b>Duration of Exam: 03 Hrs</b>	<b>Total Contact Hours: 56 Hrs</b>

**Course Outcomes (COs): After completing this course satisfactorily, a student will be able to:**

- Have a strong understanding of Python syntax and programming fundamentals.
- Able to develop structured & modular Python programs. Apply object-oriented principles in Python.
- Work with data structures, file handling, and database operations.
- Apply object-oriented principles in Python.
- Utilize Python libraries for data science, web development, and automation.

### **PYTHON PROGRAMMING LAB**

1. Working with variables and basic data types.
2. Performing arithmetic and logical operations.
3. Implementing conditional statements (e.g., checking odd/even numbers).
4. Writing loops for pattern printing, Fibonacci series, prime numbers.
5. Creating functions with different argument types.
6. Implementing exception handling for division by zero.
7. Implementing CRUD operations on lists and dictionaries.
8. Writing programs to manipulate and process strings.
9. Reading from and writing to files.
10. Creating and using classes and objects.
11. Implementing inheritance and method overriding.
12. Using built-in and user-defined modules.
13. Writing Python programs using NumPy and Pandas.
14. Connecting and querying databases from Python.
15. Creating a basic web application using Flask.

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Title of the Subject: <b>SOFTWARE ENGINEERING</b>	
Course Code: <b>24ELCS5L</b>	CIA Marks: <b>10 Marks</b>
Semester: <b>V Sem</b>	SEE Marks: <b>40 Marks</b>
Contact Hours(L:T:P): <b>2-0-0</b>	Credits: <b>02 Credits</b>
Duration of Exam: <b>01½ Hrs</b>	Total Contact Hours: <b>28 Hrs</b>

**Course Outcomes (COs): After completing this course satisfactorily, a student will be able to:**

- Understand SDLC models
- Analyze software requirements
- Design software systems

### SOFTWARE ENGINEERING

Unit	Description	Hours
<b>1</b>	<b>Introduction to Software Engineering:</b> Definition of Software Engineering, Characteristics of Software, Software Crisis, Software Engineering Principles, Software Development Life Cycle (SDLC), Types of Software, Role of Software Engineer, Software Process Models- Waterfall Model, Incremental Model, Spiral Model.	<b>08</b>
<b>2</b>	<b>Software Requirements &amp; Analysis:</b> Requirement Engineering, Types of Requirements- Functional, Non-functional; Requirement Gathering Techniques, Software Requirement Specification (SRS), Feasibility Study- Technical, Economic, Operational; Data Flow Diagrams (DFD), Entity Relationship Diagrams (ERD).	<b>10</b>
<b>3</b>	<b>Software Design:</b> Design Concepts, Architectural Design, Modular Design, Cohesion and Coupling, Structured Design, UML Diagrams- Use Case Diagram, Class Diagram, Sequence Diagram.	<b>10</b>

#### Reference Books:

1. Software Engineering by Ian Sommerville, 10th Edition, Pearson.
2. Software Engineering: A Practitioner's Approach by Roger S. Pressman, Bruce R. Maxim, 8th Edition, 8th Edition
3. Fundamentals of Software Engineering by Rajib Mall, 5th Edition, PHI Learning.
4. Software Engineering by K.K. Aggarwal, Yogesh Singh, 3rd Edition, New Age International.
5. Software Engineering by Pankaj Jalote, 3rd Edition, Narosa Publishing.
6. An Integrated Approach to Software Engineering by Pankaj Jalote, 3rd Edition, Narosa Publishing.

Title of the Subject: <b>ELEMENTARY RESEARCH METHODOLOGY</b>	
Course Code: <b>24SKCS5L</b>	CIA Marks: <b>10 Marks</b>
Semester: <b>V Sem</b>	SEE Marks: <b>40 Marks</b>
Contact Hours(L:T:P): <b>2-0-0</b>	Credits: <b>02 Credits</b>
Duration of Exam: <b>01½ Hrs</b>	Total Contact Hours: <b>28 Hrs</b>

**Course Outcomes (COs):** After completing this course satisfactorily, a student will be able to:

- Identify research problems
- Collect and analyze data
- Use basic statistical tools
- Write research reports
- Follow research ethics

### ELEMENTARY RESEARCH METHODOLOGY

Unit	Description	Hours
<b>1</b>	<b>Introduction to Research:</b> Meaning of Research, <b>Importance of Research in Science</b> , Types of Research- Basic Research, Applied Research; Research Process, Characteristics of Good Research.	<b>05</b>
<b>2</b>	<b>Research Problem &amp; Objectives:</b> Identification of Research Problem, Selection of Research Topic, Formulation of Objectives, Research Questions, Hypothesis, Literature Review Basics.	<b>06</b>
<b>3</b>	<b>Data Collection Methods:</b> Types of Data- Primary Data, Secondary Data; Methods of Data Collection- Observation, Survey, Questionnaire, Interview; Sampling Techniques.	<b>06</b>
<b>4</b>	<b>Data Analysis &amp; Presentation:</b> Data Classification, Tabulation, Graphical Representation, Basic Statistical Tools- Mean, Median, Mode.	<b>05</b>
<b>5</b>	<b>Research Report Writing:</b> Structure of Research Report, Referencing & Citation, Writing Abstract, Conclusion & Recommendations, Ethical Issues in Research.	<b>06</b>

**Reference Books:**

1. Research Methodology: Methods and Techniques by C.R. Kothari, Gaurav Garg, 4th Edition, New Age International.
2. Research Methodology by R. Panneerselvam, 2nd Edition, PHI Learning.
3. Research Methodology: A Step-by-Step Guide for Beginners by Ranjit Kumar, 4th Edition, SAGE Publications.
4. Research Methods for Science by Michael P. Marder, Cambridge University Press.

**BCA/B.Sc Degree Examination,  
SEP – QP - Pattern**

**Time: 3 Hours**

**Max. Marks: 80**

**Section – A**

**Note: Answer all sub questions**

**Each question carries TWO mark.**

**(10 x 2 = 20)**

**1.**

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)

**Section – B**

**Note : Answer any Four questions**

**Each question carries FIVE marks.**

**(4 x 5 =20)**

- 2.**
- 3.**
- 4.**
- 5.**
- 6.**
- 7.**

**Section – C**

**Note : Answer any Four questions**

**Each question carries TEN marks.**

**(4 x 10 =40)**

- 8.**
- 9.**
- 10.**
- 11.**
- 12.**
- 13.**

**Note : 1. For Section –A , Two questions from each Unit.**

**2. For Section – B , One question from each Unit, and Q-7 must be from Unit 2 to 5.**

**3. For Section – C , One question from each Unit, and Q-13 must be from Unit 2 to 5.**

**BCA/B.Sc Degree Examination,  
SEP – Scheme for Practical Examination**

1. Writing Two Programs : **14 Marks ( for each 7 marks)**
  2. Execution of Two programs : **16 Marks ( for each 8 marks)**
  3. Practical record : **05 Marks**
  4. Viva Voce : **05 Marks**
- Total : **40 Marks**

BCA/B.Sc. Degree Examination,

Skill Enhancement Courses (SECs) Question paper pattern

Paper Code:

Paper Title:

Time: 1.5 Hours

Max. Marks: 40

There shall be Theory examinations of Multiple Choice Based Questions [MCQs] with Question Paper set of A, B, C and D Series at the end of each semester for SECs for the duration of 90 minutes. The Answer Paper is of OMR (Optical Mark Reader) Sheet.

\*\*\*\*\*END of V Sem\*\*\*\*\*

# **B.Sc. VI Semester**

Title of the Subject: <b>R PROGRAMMING</b>	
Course Code: <b>24MJCS6T</b>	CIA Marks: <b>20 Marks</b>
Semester: <b>VI Sem</b>	SEE Marks: <b>80 Marks</b>
Contact Hours(L:T:P): <b>4-0-0</b>	Credits: <b>04 Credits</b>
Duration of Exam: <b>03 Hrs</b>	Total Contact Hours: <b>56 Hrs</b>

### Course Outcomes (COs):

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

- Explain the fundamentals of R programming, including its environment, data types, operators, and control structures.
- Apply built-in and user-defined functions to perform computations and manipulate data structures in R.
- Analyze and manage different data structures such as vectors, matrices, lists, arrays, and data frames.
- Perform data importing, preprocessing, transformation, and statistical analysis using R.
- Create meaningful visualizations and interpret results using graphical functions in R.

### R Programming

Unit	Description	Hours
1	<b>Introduction to R:</b> What is R, Why R, Advantages of R over Other Programming Languages, R Studio, R Command Prompt, R Script File, Comments in R, Handling Packages in R, Installing R Packages, Basic Package Functions (installed.packages(), library(), help(), find.package()), Special Values in R (NA, Inf, -Inf).	10
2	<b>R Data Types and Control Structures:</b> Vectors, Lists, Matrices, Arrays, Factors, Data Frames, Variable Assignment, Data Types of Variables, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Decision Making Statements (if, if-else, switch), Looping Statements (repeat, while, for), Loop Control Statements (break, next).	12
3	<b>Functions and Data Structures in R:</b> Built-in Functions (mean(), sum(), min(), max(), seq()), User-defined Functions, Calling Functions with and without Arguments, String Manipulation Functions (substr(), strsplit(), paste(), grep(), tolower()), Vector Operations, Vector Sorting and Recycling, List Creation and Manipulation, Matrix Operations (Addition, Subtraction, Multiplication, Division), Array Manipulation, Factor Creation and Levels.	12
4	<b>Data Frames and Data Handling in R:</b> Creating Data Frames, Accessing and Modifying Data Frames, Data Frame Functions (dim(), nrow(), ncol(), str(), summary(), head(), tail()), Extracting and Expanding Data Frames, Adding and Deleting Rows and Columns, Joining and Merging Data Frames (rbind(), cbind(), merge()), Reshaping Data (melt(), cast()), Working Directory Functions (getwd(), setwd(), dir()), Reading and Writing CSV Files, Reading Excel Files.	12
5	<b>Descriptive Statistics and Data Visualization in R:</b> Data Range, Frequencies, Mean, Median, Mode, Correlation Analysis, Data Visualization Techniques, Pie Charts (Titles, Colors, Legends), Histograms and Density Plots, Bar Charts (Labels, Titles, Colors).	10

**References:**

1. Sandip Rakshit: R Programming for Beginners, McGraw Hill Education (India), 2017.
2. Seema Acharya: Data Analytics using R, McGraw Hill Education (India), 2018.
3. Andrie de Vries and Joris Meys: R for Dummies, 2nd Edition, John Wiley and Sons, 2015.
4. Norman Matloff: The Art of R Programming – A Tour of Statistical Software Design, No Starch Press, 2011.
5. Hadley Wickham and Garrett Golemund: R for Data Science, O'Reilly Media, 2017.

Title of the Subject: <b>R PROGRAMMING LAB</b>	
Course Code: <b>24MJCS6P</b>	CIA Marks: <b>10 Marks</b>
Semester: <b>VI Sem</b>	SEE Marks: <b>40 Marks</b>
Contact Hours(L:T:P): <b>0-0-4</b>	Credits: <b>02 Credits</b>
Duration of Exam: <b>03 Hrs</b>	Total Contact Hours: <b>56 Hrs</b>

**Practicals:**

1. Write a program to explore the R environment and perform basic arithmetic operations.
2. Write a program to install, load, and use R packages and demonstrate basic package functions.
3. Write a program to demonstrate the use of special values (NA, Inf, -Inf) and built-in functions in R.
4. Write a program to create and perform operations on vectors in R.
5. Write a program to create and manipulate lists, matrices, and arrays in R.
6. Write a program to define and call user-defined functions in R.
7. Write a program to perform string manipulation using built-in string functions in R.
8. Write a program to create and work with factors and display their levels.
9. Write a program to create, access, and modify data frames in R.
10. Write a program to perform data frame operations such as adding, deleting, and merging rows and columns.
11. Write a program to read and write CSV and Excel files in R.
12. Write a program to calculate descriptive statistics such as mean, median, mode, and correlation.
13. Write a program to generate data visualizations such as pie charts, bar charts, histograms, and density plots.
14. Write a R program to perform correlation analysis.
15. Write a R program to summarize dataset statistics.

Title of the Subject: <b>CYBER SECURITY</b>	
Course Code: <b>24ELCS6L</b>	CIA Marks: <b>10 Marks</b>
Semester: <b>V Sem</b>	SEE Marks: <b>40 Marks</b>
Contact Hours(L:T:P): <b>2-0-0</b>	Credits: <b>02 Credits</b>
Duration of Exam: <b>03 Hrs</b>	Total Contact Hours: <b>28 Hrs</b>

**Course Outcomes (COs): After completing this course satisfactorily, a student will be able to:**

- Identify cyber threats
- Understand network security
- Apply cryptographic techniques
- Recognize web vulnerabilities
- Understand cyber laws & policies

### CYBER SECURITY

Unit	Description	Hours
<b>1</b>	<b>Introduction to Cyber Security:</b> Introduction to Cyber Security, Cyberspace Overview, Need for Cyber Security, Types of Cyber Threats, Cyber Attacks – Malware, Phishing, Ransomware, DoS / DDoS; Cyber Security Principles – Confidentiality, Integrity, Availability.	<b>08</b>
<b>2</b>	<b>Network Security:</b> Basics of Network Security, Firewalls, Intrusion Detection Systems (IDS), VPN, Secure Communication, Network Attacks – Sniffing, Spoofing, Man-in-the-Middle.	<b>10</b>
<b>3</b>	<b>Cryptography:</b> Introduction to Cryptography, Encryption & Decryption, Types - Symmetric Encryption, Asymmetric Encryption; Hash Functions, Digital Signatures, Public Key Infrastructure (PKI).	<b>10</b>

#### Reference Books:

1. Cyber Security Essentials by Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, 1st Edition, Wiley.
2. Cryptography and Network Security by William Stallings, 7th Edition, Pearson.
3. Introduction to Cyber Security by Chuck Easttom, 2nd Edition, Springer.
4. Cyber Security and Cyber Laws by Alakh Prakash, Khanna Publishing.
5. Network Security Essentials by William Stallings, 6th Edition, Pearson.
6. Web Application Security by Andrew Hoffman, 1st Edition, O'Reilly.

Title of the Subject: <b>PROJECT</b>	
Course Code: <b>24PROJCS6P</b>	CIA Marks: <b>10 Marks</b>
Semester: <b>VI Sem</b>	SEE Marks: <b>40 Marks</b>
Contact Hours(L:T:P): <b>0-0-4</b>	Credits: <b>02 Credits</b>
Duration of Exam: <b>03 Hrs</b>	Total Contact Hours: <b>28 Hrs</b>

## PROJECT

### Group Project Rules and Guidelines

#### 1. Group Formation

1. Each project group must consist of **minimum 2 students and maximum 4 students**.
2. Students must form their groups at the **beginning of the semester**.
3. No student is allowed to be part of **more than one group**.
4. The group must select **one team leader** to coordinate the project activities.

#### 2. Project Selection

1. The project topic must be related to **Computer Applications / IT / Software Development**.
2. The project topic must be **approved by the project guide or department** before starting the work.
3. Students are encouraged to develop **real-world applications** such as:
  - Web applications
  - Mobile applications
  - Data analysis projects
  - Software tools

#### 3. Project Work Distribution

1. All members must **actively participate in the project development**.
2. Work should be **distributed equally among the group members**.
3. Each member must clearly explain **their contribution** during the project evaluation.

#### 4. Project Documentation

1. Each group must submit a **project report/documentation**.
2. The report should include:
  - Title page
  - Abstract
  - Introduction
  - System design
  - Implementation details
  - Screenshots / Results
  - Conclusion
3. The report must be **signed by the project guide** before submission.

#### 5. Project Demonstration

1. Each group must **demonstrate the working project** during the final evaluation.
2. All group members must be present during the **project presentation and viva**.
3. Each member should be able to **explain the project design and functionality**.

#### 6. Evaluation Criteria

The project evaluation may include:

- Project idea and innovation
- Implementation and functionality
- Documentation quality
- Presentation and demonstration
- Individual contribution

## 7. General Rules

1. **Plagiarism or copied projects are strictly prohibited.**
2. Projects must be **developed by the students themselves.**
3. Late submission of the project report may lead to **marks deduction.**
4. The decision of the **project guide / department will be final** in all matters related to project evaluation.

**BCA/B.Sc Degree Examination,  
SEP – QP - Pattern**

**Time: 3 Hours**

**Max. Marks: 80**

**Section – A**

**Note: Answer all sub questions**

**Each question carries TWO mark.**

**(10 x 2 = 20)**

**1.**

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)

**Section – B**

**Note : Answer any Four questions**

**Each question carries FIVE marks.**

**(4 x 5 =20)**

- 2.**
- 3.**
- 4.**
- 5.**
- 6.**
- 7.**

**Section – C**

**Note : Answer any Four questions**

**Each question carries TEN marks.**

**(4 x 10 =40)**

- 8.**
- 9.**
- 10.**
- 11.**
- 12.**
- 13.**

**Note : 1. For Section –A , Two questions from each Unit.**

**2. For Section – B , One question from each Unit, and Q-7 must be from Unit 2 to 5.**

**3. For Section – C , One question from each Unit, and Q-13 must be from Unit 2 to 5.**

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SEP – Scheme for Practical Examination**

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Paper Title:

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**\*\*\*\*\*THE END\*\*\*\*\***