B.Sc. COMPUTER SCIENCE

Course Structure and Syllabus

(For the candidates admitted from the academic year 2025-2026 onwards)

CHOICE BASED CREDIT SYSTEM- LEARNING OUTCOMES BASED CURRICULUM FRAME WORK (CBCS-LOCF)

THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)

(Nationally Re-Accredited by NAAC with A)

(Affiliated to Bharathidasan University, Tiruchirappalli)

ELAMBALUR, PERAMBALUR – 621 220

VISION:

- To be a Centre of excellence in education and research in the frontier areas of Computer Science

MISSION:

- To facilitate quality transformative education in Computer Science
- To promote quality research and innovation in technology for meeting global challenges
- To transform students to competent professionals to cater to the needs of the society.

Programme Outcomes (POs):

PO1: Computational Foundations: Apply the basic knowledge of computers, math and algorithms to solve real-world problems.

PO2: Problem Solving and Programming: Understand problems and solve them by writing code using different programming styles and tools.

PO3: Software Design and Development: Plan and build software systems using good methods and practices.

PO4: Teamwork: Work well in a team or lead a group to complete software projects successfully.

PO5: Creating and exploring new ideas: Try out new ideas, learn new technologies, and do small experiments to improve solutions.

PO6: Security and Ethics: Write code and build systems that are safe, protect user data, and follow ethical rules.

PO7: Using Modern Tools: Use the latest computer tools and technologies to write, test, and manage software.

PO8: Lifelong Learning: Keep learning new things to stay up to date with changes in computer science and technology.

Program Specific Outcomes (PSOs)

PSO1: Think in a critical and logical based manner

PSO2: Familiarize the students with suitable software tools of computer science and industrial applications to handle issues and solve problems in mathematics or statistics and real time application related sciences.

PSO3: Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of Computer science and Industrial statistics.

PSO4: Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in Computer Science or Applications or Information Technology and its allied areas on multiple disciplines linked with Computer Science.

PSO5: Develop a range of generic skills helpful in employment, internships& societal activities.

Thanthai Hans Roever College (Autonomous), Elambalur, Perambalur – 621 220.

B.Sc. Computer Science

Choice-Based Credit System – Learning Outcome-Based Curriculum Framework

(For the candidate admitted from the academic year 2025 -2026)

Semester	Part	Course Code	Title of the Course	Int. Hrs /Week	Credits	End Sem. Exam Hrs	Max. Marks		
							CIA	ESE	Total
I	I	25UT1/H1	Tamil / Hindi - I	6	3	3	25	75	100
	II	25UE1	English - I	6	3	3	25	75	100
	III	25UCS1CC1	Problem Solving Techniques using C	6	5	3	25	75	100
		25UCS1CP1	Problem Solving Techniques using C Lab	5	4	3	40	60	100
		25UMA1AC1	Mathematics Computing	5	4	3	25	75	100
	IV	25UVE	Value Education	2	2	3	25	75	100
		25UCSVA1	Value Added Course*	--	2*	3	50	50	100*
Total				**30**	**21**	**-**	**-**	**-**	**600**
II	I	25UT2/H2	Tamil / Hindi - II	6	3	3	25	75	100
	II	25UE2	English – II	6	3	3	25	75	100
	III	25UCS2CC2	Object Oriented Programming with Java	5	5	3	25	75	100
		25UCS2CP2	Object Oriented Programming with Java Lab	3	3	3	40	60	100
		25UMA2AC2	Statistical Computing	4	3	3	25	75	100
		25UMA2AP1	Statistical Computing Lab	2	2	3	40	60	100
	IV	25UCS2NME1	Fundamentals of Computer	2	2	3	25	75	100
		25UES	Environmental Studies	2	2	3	25	75	100
		25UCSVA2	Value Added Course*	--	2*	3	50	50	100*
Total				**30**	**23**	**-**	**-**	**-**	**800**
III	I	25UT3/H3	Tamil / Hindi - III	6	3	3	25	75	100
	II	25UE3	English – III	6	3	3	25	75	100
	III	25UCS3CC3	Python Programming	6	4	3	25	75	100
		25UCS3CP3	Python Programming Lab	3	3	3	40	60	100
		25UPH3AC3	Digital Electronics	5	4	3	25	75	100
	IV	25UCS3NME2	Internet Technologies	2	2	3	25	75	100
		25UCS3SE1	Introduction to Web Design	2	2	3	25	75	100
		25UCSVA3	Value Added Course*	--	2*	3	50	50	100*
				30	**21**	**-**	**-**	**-**	**700**

Semester	Part	Course Code	Title of the Course	Int. Hrs /Week	Credits	End Sem. Exam Hrs	Max. Marks		
							CIA	ESE	Total
IV	I	25UT4/H4	Tamil / Hindi - IV	6	3	3	25	75	100
	II	25UE4	English – IV	6	3	3	25	75	100
	III	25UCS4CC4	Database Management System	5	4	3	25	75	100
		25UCS4CP4	Database Management System Lab	3	3	3	40	60	100
		25UPH4AC4	Microprocessor	4	3	3	25	75	100
		25UPH4AP2	Microprocessor Lab	3	2	3	40	60	100
	IV	25UCS4SEP1	AI Tools Practical	2	2	3	40	60	100
		25UHW	Health and Wellness	1	1	--	--	--	100
		25UCSVA4	Value Added Course*	--	2*	3	50	50	100*
			Total	**30**	**21**	**-**	**-**	**-**	**800**
V	III	25UCS5CC5	Data Structures and Algorithms	5	4	3	25	75	100
		25UCS5CC6	Operating System	5	4	3	25	75	100
		25UCS5CC7	Cloud Computing	6	4	3	25	75	100
		25UCS5CP5	Cloud Computing Lab	4	4	3	40	60	100
		25UCS5DE11 25UCS5DE12	Artificial Intelligence / Neural Network	4	4	3	25	75	100
		25UCS5DE21 25UCS5DE22	Internet of Things / Cyber Security	4	4	3	25	75	100
	IV	25USS	Soft Skills	2	2	3	25	75	100
		25UC5SI	Summer Internship	--	2*	3	--	--	100*
		25UCSVA5	Value Added Course*	--	2*	3	50	50	100*
			Total	**30**	**26**	**-**	**-**	**-**	**700**
VI	III	25UCS6CC8	Data Communication and Networking	5	5	3	25	75	100
		25UCS6CC9	Web Application Development	5	5	3	25	75	100
		25UCS5CC10	Software Project Management	5	5	3	25	75	100
		25UCS6DE31 25UCS6DE32	Machine Learning / Mobile Computing	5	4	3	25	75	100
		25UCS6DE41 25UCS6DE42	Open Source Technologies / Data Mining using R	5	4	3	25	75	100
		25UCS6PW	Project Work	4	3	3	20	80	100
	V	25UGS	Gender Studies	1	1	3	25	75	100
			Extension Activity	--	1	--	--	--	--
		25UCSVA6	Value Added Course*	--	2*	3	50	50	100*
			Total	**30**	**28**	**-**	**-**	**-**	**700**
			Total	**180**	**140**				**4300**

Extra Credit Course which will not be included in the total CGPA

** Summer Internship after 4th semester during summer vacation -30 Hours and 2 credits will be included in the 5th semester.

* Value Added Course (Outside Instruction Hours: 30 Hours)

1. Part-wise Credits

Part	Course details	No. of Courses	Total Credits
I	Tamil	04	12
II	English	04	12
III	Core Course Theory	10	48
	Core Practical	05	16
	Project with Viva-Voce	01	03
	Allied Course Theory	04	12
	Allied Practical	02	04
	Discipline-Specific Electives	04	16
IV	Skill Enhancement Courses	03	06
	Non-Major Elective	02	04
	Value Education	01	02
	Environmental Studies	01	02
	Summer Internship	01	02*
V	Gender Studies	01	01
	Health and Wealth	01	01
	Extension Activity		01
		Total	**140**

2. List of Value-Added Courses

Course Code	Course Title
25UCSVA1	Data Science with Python
25UCSVA2	Data Visualization Tools
25UCSVA3	Microsoft Azure Fundamentals
25UCSVA4	Cyber Security Basics
25UCSVA5	Information Security Management
25UCSVA6	Basics of Natural Language Processing

3. Attendance

75% of attendance in each semester shall appear for the examination.

Attendance between 65% and 74% shall apply for **condonation** in the prescribed form with the prescribed fee.

Attendance between 50% and 64% shall apply for **condonation** in prescribed form **with** the prescribed fee along with the **Medical Certificate**.

Attendance below 50% are **not eligible to appear for the examination**. They shall re-do the semester(s) after completion of the Programme.

4. Question Paper Pattern of CIA I and CIA II Examinations

UG Programme		
Maximum Marks : 50		**Duration: 1 ½ Hours**
Section - A	**i) a-** (3 Questions for Multiple Choice) One question from each unit	3 x 1 = 03 Marks
	b- (3 Questions for Fill in the Blanks) One question from each unit	3 x 1 = 03 Marks
	ii) (2 short answer questions) One question from each unit	2 x 2 = 04 Marks
Section - B	**4 Questions** One set of questions from each unit	4 x 5 = 20 Marks
Section - C	**2 Questions** One question from each unit	2 x 10= 20 Marks

Question Paper Pattern of Pre-Semester and End Semester Examinations

UG Programme		
Maximum Marks : 75		**Duration: 3 Hours**
Section - A	**i) a-** (5 Questions for Multiple Choice) One question from each unit	5 x 1 = 05 Marks
	b- (5 Questions for Fill in the Blanks) One question from each unit	5 x 1 = 05 Marks
	ii) (5 short answer questions) One question from each unit	5 x 2 = 10 Marks
Section - B	**5 Questions** (Internal Choice: Either or) One set of questions from each unit	5 x 5 = 25 Marks
Section - C	**3 Questions** (Answer any 3 out of 5 Questions) One question from each unit	3 x10 = 30 Marks

5. The ratio of marks allotted to the continuous internal assessment and to the end semester examination

	Internal Marks	**External Marks**
Theory	25 Marks	75 Marks
Practical	40 Marks	60 Marks
Project	20 Marks	80 Marks

6. The Internal components of Theory course

	Maximum Marks
Maximum mark of CIA I & CIA II	Converted to 30 Marks
5 Assignments (5x5)	25 Marks
Seminar	10 Marks
Pre-Semester	Converted to 25 Marks
Library Assignment & Attendance	10 Marks
Total	100 Marks

100 marks converted to 25 marks.

7. The Internal components of Practical course

	Maximum Marks
Two Model Practical Exams	60 Marks
Record	10 Marks
Viva-Voce	10 Marks
Attendance	10 Marks
Overall Performance	10 Marks
Total	100 Marks

100 marks converted to 40 marks.

8. Passing Minimum for Theory

	Continuous Internal Assessment (CIA)	End Semester Examination (ESE)	CIA + ESE
Theory	40% out of 25 Marks [i.e. 10 Marks]	40% out of 75 Marks [i.e.30 Marks]	40 Marks
Practical	40% out of 40 Marks [i.e. 16 Marks]	40% out of 60 Marks [i.e.24 Marks]	40 Marks
Project	Viva-Voce 20 Marks 40% out of 20 Marks [i.e. 8 Marks]	Project Report 80 Marks 40% out of 80 marks [i.e. 32 marks]	40 Marks

9. UG Project Evaluation

Project Title Registration

Students must fill out the Final Year Project Title Registration Form. The Project Proposal Form should be submitted by the student to his/her supervisor before the commencement of the project. The form must include three project titles, the abstracts of the projects, objectives /aim (or goal), scope of the project, and proposed methodology. The first proposal **(Review 1)** is presented (seminar) before the project review committee for panel assessment.

Students should record project-related activity in a log. The log is a weekly record of the student's progress in meeting their objectives. Students should also record the meeting details with their supervisor in the log. Students should meet with their supervisor regularly, taking their log along to review progress. The complete log should be submitted as an appendix in the final report.

Review 1 – Project Proposal (20 Marks)

Present the abstracts of the projects, objectives /aim (or goal), scope of the project, and proposed methodology to the project review committee members.

The project review committee will assign the students a project, and the head of the department will assign them a supervisor.

a. Abstract of the proposed work.
b. Study of the Existing Systems. & drawbacks in the existing systems.
c. Objectives and scope of the proposed work.
d. Relation with current issues.
e. Methodology.
f. Presentation of proposed work.

Review 2 – Midterm Presentation (20 Marks)

a. Implemented modifications suggested in Review 1.
b. Timeframe work being followed.
c. Defined Objectives are achieved.
d. Individual or Team Contribution.

e. 75% of the Project Work is completed.

Review 3 - Final Presentation (30 Marks)

At the end of the final year project, students will be required to make a brief presentation on their project (UG: 6 minutes for each student). The presentation should cover the following:

a. Overview of the project (project objectives and scopes).
b. Methodology.
c. Result and discussion.
d. Conclusion and recommendation.
e. References.
f. Project demonstration (Optional) .

Project Report Evaluation (10 Marks)

a. The project report is in the specified format.
b. Results are presented in a very appropriate manner.
c. Project work is well summarized and concluded.
d. Future extensions in the project are well specified.
e. References and citations are appropriate and well-mentioned.

10. End Semester Exam Project Work Evaluation

S.No.	Register No	Name of the student	Title of the Project	PPT presentation / Demonstration (2)	Usage of the latest tools and/or methodology (3)	Result and Discussion (2)	Individual contribution (3)	Viva-Voce (10)	Total (20)

11. Guidelines for the Preparation of a Project Report

Arrangements of Contents:

The Project Report has to be organised in the following order**.**

1. Cover Page (Refer to Appendix 1)
2. Inside Title Page (Refer to Appendix 1)
3. Declaration Certificate (Refer to Appendix 2)
4. Bonafide Certificate (Refer to Appendix 3)
5. Acknowledgements
6. Abstract
7. Table of Contents
8. List of Figures
9. List of Tables
10. Abbreviations/ Notations/ Nomenclature (if any)
11. Report text content (Minimum 5 Chapters – Minimum 80 Pages)

Chapter 1
Chapter 2
…....
Chapter 5

12. References
13. Appendices (if any)

Sem.	Course Code	Credits	Title of the course	CC / AC/ DE / SE / GS / EVS VE / VAC	Category			Exam	Max. Marks		
					Lect. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25UCS1CC1	5	Problem Solving Techniques using C	Core Course	4	1		3 Hrs.	25	75	100

Pre-Requisite: Fundamental understanding of computers and basic logical problem-solving skills.

Course Objectives: The purpose of learning this course is:

1. To understand the evolution and classification of programming languages and their characteristics.
2. To learn the concepts of structured programming, algorithms, flowcharts, and pseudocode.
3. To develop proficiency in C programming including syntax, operators, and control structures.
4. To implement arrays, functions, pointers, and strings in C for effective data handling
5. To gain hands-on experience in file handling, memory management, and modular programming in C.

Course Outcomes:

CO1:Identify and differentiate between machine, assembly, and high-level languages, including translators.

CO2:Design algorithms, flowcharts, and pseudocode for solving programming problems.

CO3:Write, compile, and debug simple C programs using basic syntax and control statements.

CO4:Apply arrays, functions, and pointers in C to solve computational problems efficiently.

CO5:Implement file operations and understand memory management using pointers and structures in C.

Unit-I	**Language and Structured Programming**	12 Hrs.

Programming Languages - Machine Language Assembly language, High- level language,4 GL and 5GL-Features of good programming language.-Translators: Interpreters and Compilers-Structured Programming: Algorithm: Features of good algorithm-Benefits and drawbacks of algorithm.

Unit-II	**Algorithm, Flow Chart and Pseudo code**	12 Hrs.

Flowcharts: Advantages and limitations of flowcharts-when to use flowcharts-flowchart symbols and types of flowcharts.-Pseudo code: Writing a pseudo code-Coding-documenting and testing a program-Comment lines and types of errors.

Unit-III	**Introduction to C**	12 Hrs.

History and importance - Structure of a C program - Compilation and Execution – Constants-Variables and Data Types – Operators: arithmetic operator-relational operator-logical operator-bitwise operator-assignment operator- increment/decrement operator - Expressions - Managing Input and Output : getchar and putchar – getw and putw – printf and scanf statements.

Unit-IV	**Decision making statements and Array**	12 Hrs..

if statement-if-else statement-nested if statement-switch case statement. Looping Statements: Concept of Loop- while loop-do-while loop-for loop-Jumping in Loop-Break statement-continue statement-goto statements – simple programs – Arrays : Declaring and initializing one dimensional and two dimensional array – multidimensional arrays - Accessing array elements.

Unit-V	**Functions, Pointers and Files**	12 Hrs.

Function declaration-definition, Function with no argument no return value-Function with argument no return value-Function with argument and return value-nesting of function-recursive function - Storage classes (auto, extern, static, register) - Declaring and initializing strings-Standard library functions (strcpy, strlen, strcmp, strcat, etc.) – structure and union – Pointers : Pointer variables-call by value and call by reference-File Handling**:** Opening/closing files, Reading/writing and File modes.

Text Book(s):

1. Balagurusamy, E., *Programming in ANSI C*, 8th edition, McGraw Hill Education, 2019, ISBN: 9789353162344.
2. Kanetkar, Yashavant, *Let Us C*, 17th edition, BPB Publications, 2023, ISBN: 9789391392459.
3. Thareja, Reema, *Programming in C*, 2nd edition, Oxford University Press, 2021, ISBN: 9780199491403.
4. Kamthane, Ashok N., *Programming in C*, 4th edition, Pearson Education, 2020, ISBN: 9789353941772.
5. Venugopal, K. R., and Prasad, S. R., *Mastering C*, Revised edition, McGraw Hill Education, 2020, ISBN: 9789389949180.

Reference Book(s):

1. Hanly, Jeri R., and Koffman, Elliot B., *Problem Solving and Program Design in C*, 9th edition, Pearson Education, 2021, ISBN: 9780135182913.
2. Schildt, Herbert, *C: The Complete Reference*, 5th edition, McGraw Hill Education, 2022, ISBN: 9781260463415.
3. Forouzan, Behrouz A., and Gilberg, Richard F., *Computer Science: A Structured Programming Approach Using C*, 4th edition, Cengage Learning, 2020, ISBN: 9788131525295.
4. Kalicharan, Noel, *Learn to Program with C*, Updated edition, Apress, 2020, ISBN: 9781484254424.
5. Mittal, Ajay, *Programming in C: A Practical Approach*, Narosa Publishing House, 2021, ISBN: 9789389347788.

Web Resources:

1. https://www.geeksforgeeks.org.
2. https://www.programiz.com.
3. https://www.w3schools.com.
4. https://www.learn-c.org.
5. https://www.tutorialspoint.com

Course Outcome (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	2	2	2	1	1	3	2	1	2	2
CO2	3	3	2	2	1	3	2	2	3	2	2	1	1
CO3	3	3	2	3	2	2	2	1	2	3	2	2	2
CO4	3	2	2	2	2	3	2	2	3	2	1	2	1
CO5	3	3	2	3	2	2	1	2	2	3	2	2	2
	Overall CO – PO Mapping index = 2.2								**Overall CO – PSO Mapping index = 2.0**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	Core Course	Category			Exam.	Max. Marks		
					Lect. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25UCS1CP1	4	Problem Solving Techniques using C Lab		-	-	3	3 Hrs.	40	60	100

Pre-Requisite: Basic knowledge of C programming basics.

Course Objectives: The purpose of learning this course is:

1.To introduce the concept of programming languages and structured programming methodologies.

2.To develop skills in designing algorithms, flowcharts, and pseudocode for problem-solving.

3.To enable students to write and debug C programs using variables, operators, control structures, and loops.

4.To implement programs using arrays, functions, pointers, and structures effectively.

5.To provide hands-on experience in file handling operations in C for real-world applications.

Course Outcomes:

CO1:Identify and differentiate between machine, assembly, and high-level languages, including translators.

CO2:Apply arrays, functions, and pointers in C to solve computational problems efficiently.

CO3:Write, compile, and debug simple C programs using basic syntax and control statements.

CO4:Apply arrays, functions, and pointers in C to solve computational problems efficiently.

CO5:Implement file operations and understand memory management using pointers and structures in C.

List of Practical

List of C Programs

1. Write a Program to perform all arithmetic operations (+, –, *, /, %).
2. Write a Program to calculate simple interest.
3. Write a Program to find the largest among three numbers.
4. Write a Program to check whether a number is even or odd.
5. Write a find factorial Program using recursion.
6. Write a Program to perform matrix addition operation.
7. Write a Program to perform matrix multiplication operation.
8. Write a Program to count characters, words and lines in a text file.
9. Develop a Program to demonstrating *call by value* and *call by reference.*
10. Develop a Program to read and write data to a file using fopen, fprintf, and fscanf
11. Develop a Program to copy contents from one file to another
12. Develop a Program to write and read structure data into/from a binary file using fwrite and `fread`.

Course Outcomes (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	2	2	2	1	1	3	2	1	2	2
CO2	3	3	3	2	2	3	2	1	3	3	2	2	2
CO3	3	3	3	3	2	2	2	2	3	3	3	2	2
CO4	3	3	3	2	2	3	2	1	3	3	2	2	2
CO5	3	3	3	2	2	2	2	1	3	3	3	2	2
	Overall CO – PO Mapping index = 2.4								**Overall CO – PSO Mapping index = 2.4**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25UMA1AC1	4	Mathematical Computing	AC	4	1		3 Hrs.	25	75	100

Pre-Requisite: Fundamentals of calculus, linear algebra, and programming basics.

Course Objectives: The purpose of learning this course is:

1. Introduce the fundamental concepts of set theory, relations, and functions, and their applications in mathematics and computer science.
2. Develop logical reasoning skills through the study of propositional logic**,** logical equivalence**,** and mathematical induction**.**
3. Familiarize students with the basic concepts and operations of matrices**,** solutions of linear systems
4. Introduce graph theory, covering various types of graphs, trees, and applications such as spanning trees and shortest paths.
5. Teach the fundamental principles of finite probability, including conditional probability, independence, Bayes' theorem, and expected value

Course Outcomes:

CO1: Demonstrate understanding of set theory, relations, and functions, and apply them to solve related mathematical problems.

CO2: Apply principles of logic, truth tables, and mathematical induction to construct valid arguments and proofs.

CO3: Perform matrix operations, compute determinants and inverses.

CO4: Understand and apply key concepts in graph theory including Euler and Hamiltonian graphs, spanning trees, and graph traversal algorithms.

CO5: Apply probability rules and techniques to evaluate probabilities, use Bayes' theorem, and compute expected values in finite sample spaces.

Unit - I	Mathematical Logic	12 Hrs.

Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, Functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus.

Unit - II	Set theory	12 Hrs.

Basic Concepts of Set Theory, Relations and Ordering, The Principle of Inclusion Exclusion, Pigeon hole principle and its application, Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties.

Unit - III	**Matrices**	12 Hrs.

Singular matrices – Inverse of a non-singular matrix using adjoint method - Rank of a Matrix – Characteristic equation – Cayley Hamilton's Theorem (proof not needed)– Simple applications only

Unit - IV	**Solutions of Simultaneous Linear Algebraic Equations**	12 Hrs.

Gauss Elimination Method– Gauss Jordan Method - Gauss Jacobi - Gauss Seidel Method.

Unit - V	**Graph Theory**	12 Hrs.

Introduction - Representing Graphs - Operations on graphs, Directed Graphs - Graph Isomorphism, Paths – Cycles - Euler Graph - Hamilton Graph - Planar Graphs.

Trees (Basic Concepts Only): Introduction, Applications of Trees, Spanning Trees, Minimum Spanning Trees

Text Books:

1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education. (Unit – I & II)
2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002. (Unit – I & II)
3. T.K. Manickavasagam Pillai & Others, Algebra, Vol II, S.V Publications, Pvt.Ltd 2011.(Unit III)
4. S.S.Sastry, "Introductory Methods of Numerical Analysis", PHI Learning Pvt.Ltd, New Delhi 2010.

(Unit – IV)

5. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science". (Unit – V)

Reference Books:

1. J.P. Tremblay and R. Manohar Discrete Mathematical Structures with Applications to Computer Science", Mc Graw Hill Education,2015
1. Elements of Discrete Mathematics- C. L L IU
2. Discrete Mathematics- a) Semyour Lipschutz, Marc Lipson b) Vinay Kumar.
3. R.S.N. Pillai and Bagavathi, Practical statistics, Second Edition, 2013

Web Resources:

1. https://vemu.org/uploads/lecture_notes/17_02_2023_252595088.pdf
2. https://users.encs.concordia.ca/~doedel/courses/comp-232/slides.pdf
3. https://mis.alagappauniversity.ac.in/siteAdmin/dde-admin/uploads/5/__UG_B.Sc._Information%20Technology_129%2051%20Discrete%20Mathematics_BSc-IT_Sem%20V_8236.pdf
4. https://www2.cs.uh.edu/~arjun/courses/ds/DiscMaths4CompSc.pdf

Course Outcomes (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	2	1	2	2	2	3	3	2	2	3
CO2	3	3	1	1	2	2	2	1	3	3	1	1	3
CO3	3	3	3	2	1	1	2	2	3	3	2	1	3
CO4	3	3	3	2	3	1	3	2	3	3	2	2	3
CO5	3	3	3	1	2	3	3	1	3	3	1	2	3
	Overall CO – PO Mapping index =2.2								Overall CO – PSO Mapping index =2.44				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Exam.	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25UCS2CC2	5	Object Oriented Programming with Java	Core Course	4	1	-	3 Hrs.	25	75	100

Pre-Requisite: Basic computer literacy and understanding of programming fundamentals

Course Objectives: The purpose of learning this course is:

1. To introduce the fundamentals of object-oriented programming using Java.
2. To enable students to write Java programs using control structures, arrays, and methods.
3. To familiarize students with inheritance, interfaces, exception handling, and multithreading.
4. To develop skills in handling files, I/O streams, and string operations in Java.
5. To provide hands-on experience in designing GUI applications using AWT and event handling.

Course Outcomes:

CO1: Understand and apply object-oriented concepts to write structured Java programs.

CO2: Implement programs using arrays, control structures, constructors, and methods in Java.

CO3: Use inheritance, interfaces, and exception handling to build robust Java applications.

CO4: Develop multithreaded programs and perform file and console-based I/O operations.

CO5: Design and build basic GUI applications using AWT controls and handle user events.

Unit-I **Introduction** 12 Hrs.

Review of Object Oriented concepts – History of Java – Java buzzwords – JVM architecture - Data types - Variables - Scope and life time of variables- arrays - operators – control statements - type conversion and casting - simple java program - constructors – methods.

Unit-II **Inheritance** 12 Hrs.

Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword.

Unit-III **Packages** 12 Hrs.

Definition-Access Protection –Importing Packages. Interfaces: Definition– Implementation– Extending Interfaces. Exception Handling: try – catch- throw - throws – finally – Built- in exceptions.

Unit-IV **Multithreaded Programming** 12 Hrs.

Thread Class -Runnable interface –Synchronization–Using synchronized methods– Using synchronized statement- Inter Thread Communication –Deadlock. I/O Streams: Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling.

Unit-V **AWT Controls** 12 Hrs.

The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers.

Text Book(s):

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw-Hill Education, 2018, ISBN: 9781260440232

2. Cay S. Horstmann, "Core Java Volume I – Fundamentals", 11th Edition, Pearson Education, 2018, ISBN: 9780135166307

3. Bart Baesens, Aimee Backiel, Seppe vanden Broucke, "Beginning Java Programming: The Object-Oriented Approach", 1st Edition, Wiley, 2019, ISBN: 9781118739495

Reference Book(s):

1. Joshua Bloch, "Effective Java", 3rd Edition, Addison-Wesley, 2018, ISBN: 9780134685991

2.Mark Lassoff, "Java Programming for Beginners", 1st Edition, Tech Republic, 2020, ISBN: 9781945662088

3.Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Modern Java in Action", 2nd Edition, Manning Publications, 2018, ISBN: 9781617293566

4.Kathy Sierra, Bert Bates, "Head First Java", 2nd Edition, O'Reilly Media, Reprint 2019, ISBN: 9789352133151

Web Resources:

1. W3Schools – Java Tutorial
   https://www.w3schools.com/java/
2. GeeksforGeeks – Java Programming Language
   https://www.geeksforgeeks.org/java/
3. JavaTpoint – Java Tutorial
   https://www.javatpoint.com/java-tutorial
4. TutorialsPoint – Java Programming
   https://www.tutorialspoint.com/java/

Course Outcome (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	2	2	2	1	1	3	2	1	2	2
CO2	3	2	2	2	1	2	2	2	3	2	2	1	1
CO3	3	3	2	2	2	2	2	1	2	2	2	2	2
CO4	3	2	3	2	2	3	2	2	3	2	1	2	1
CO5	3	3	2	2	2	2	1	2	2	3	2	2	2
	Overall CO – PO Mapping index = 2.12								**Overall CO – PSO Mapping index = 1.96**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	Core Course	Category			Exam.	Max. Marks		
					Lect. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25UCS2CP2	3	Object Oriented Programming with Java Lab		-	-	3	3 Hrs.	40	60	100

Pre-Requisite: Basic knowledge of Java and programming basics.

Course Objectives: The purpose of learning this course is:

1. To understand the basic syntax, control structures, and data handling in Java.
2. To introduce object-oriented programming concepts like classes, objects, and exception handling.
3. To develop the ability to manipulate strings, arrays, and perform input/output operations.
4. To familiarize students with Java's multithreading and event-handling mechanisms.
5. To enable students to design basic GUI applications using Java AWT and layout managers

Course Outcomes:

CO1: Write Java programs using basic control structures, arrays, and data input/output.

CO2**:** Perform operations on strings and matrices using arrays and Java built-in methods.

CO3**:** Implement multithreading and handle runtime exceptions in Java programs.

CO4**:** Create GUI-based applications using frames, controls, and layout managers.

CO5: Handle mouse and keyboard events using Java's event-handling and adapter classes.

List of Practical

1. Write a Java program to print prime numbers for the given integer.
2. Write a Java program for addition of two given matrices.
3. Write a Java program that displays the number of characters, lines and words in a text.
4. Write a program to do String Manipulation using Character Array and perform the following string operations:
   a) String length.
   b.) Concatenating two strings.
   c. Search a substring
   d. Length of a string.
   e. Reverse a string.
5. Write a threading program which uses the same method asynchronously to print the numbers 1to10 using Thread1 and to print 90 to100 using Thread.
6. Write a program to demonstrate the use of following exceptions.
   a. Arithmetic Exception.
   b. Number Format Exception.
   c.ArrayIndexOutofBoundException.
   d.NegativeArraySizeException.
7. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).
8. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and symbols like +, -,*, % operations. Handle any possible exceptions like divide by zero in the calculator.

9. Write a program to accept a text and change font size, bold italic options. Use frames and controls.

10. Write a program to demonstrate frames and controls.

Course Outcome (COs)	Program Outcomes (**POs**)								Program Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	2	2	2	1	1	3	2	1	2	2
CO2	3	2	2	2	1	2	2	2	2	2	2	1	1
CO3	3	3	3	2	2	2	2	1	2	2	2	2	2
CO4	3	2	3	2	2	3	2	2	3	2	1	2	1
CO5	3	3	2	2	2	2	1	2	2	3	2	2	2
	Overall CO – PO Mapping index = 2.15								**Overall CO – PSO Mapping index = 1.92**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25UMA2AC2	3	Statistical Computing	AC	4	-	-	3 Hrs.	25	75	100

e-Requisite: Basic knowledge of statistics and programming fundamentals.

urse Objectives: The purpose of learning this course is:

1. Enable students to classify, tabulate, and represent data using diagrams and graphs.
2. Familiarize students with measures of central tendency and their applications.
3. Introduce measures of dispersion and their role in data analysis.
4. Explain the concepts of correlation and regression with real-life applications.
5. Develop analytical and interpretative skills to understand and apply statistical tools.

Course Outcomes:

CO1: Understand the basic concepts of statistics, types of variables, and sources of data and present data effectively through classification, tabulation, and graphical tools.

CO2: Calculate and interpret various measures of central tendency.

CO3:Compute and compare different measures of dispersion such as range, standard deviation, etc.

CO4: Analyze the relationship between two variables using correlation techniques.

CO5: Apply regression methods to predict values and understand the trend in data.

Unit - I	**Descriptive Statistics**	10 Hrs.

Definition of Statistics - Importance and Scope of Statistics - Limitations of Statistics - Frequency Distribution - Continuous Frequency Distribution - Graphic Representation of a Frequency Distribution – Histogram - Frequency Polygon.

Unit - II	**Measures of central tendency**	14 Hrs.

Arithmetic Mean - Properties of Arithmetic Mean - Merits and Demerits of Arithmetic Mean - Geometric Mean - Merits and Demerits of Geometric Mean - Harmonic Mean - Merits and Demerits of Harmonic Mean - Median - Merits and Demerits of Median - Mode – Merits and Demerits of Mode

Unit - III	**Measures of dispersion**	10 Hrs.

Range - Quartile Deviation - Mean Deviation - Standard Deviation - Coefficient of Variation - Merits and Demerits

Unit - IV	**Correlation**	14 Hrs.

Introduction – Meaning – Scatter Diagram – Karl Pearson's coefficient of correlation – Correlation coefficient for a Bivariate frequency distribution – Probable error of correlation coefficient - Rank correlation.

Unit - V	**Regression**	12 Hrs.

Introduction – Linear regression – Curvilinear regression – Regression curves.

Text Books:

1. S. C. Gupta, V. K. Kapoor, Fundamentals of Mathematical Statistics, Edition:2002, Sultan Chand & Sons publications, New Delhi. (ISBN 81-7014-791-3)

UNIT – I	Chapter – 1 & 2	Sections 1.2 to 1.4 &2.1 to 2.2
UNIT – II	Chapter – 2	Sections 2.3 to 2.9
UNIT – III	Chapter – 3	Sections 3.3 to 3.8
UNIT – IV	Chapter – 10	Sections 10.1 to 10.6
UNIT – V	Chapter – 10	Sections 10.7(10.7.1 to 10.7.5)

Reference Books:

1. S.P. Gupta, Statistical Methods, Revised Edition 2001.
2. R.S.N. Pillai and Bagavathi, Practical statistics, Second Edition, 2013.
3. T. Veerarajan, Probability, Statistics and Random processes, 3 rd Edition: 2012, TataMcGraw Hill Education Private Limited, New Delhi.
4. S.S.Sastry, "Introductory Methods of Numerical Analysis", PHI Learning Pvt.Ltd, New Delhi 2010

Web Resources:

1. https://byjus.com/maths/statistics/
2. https://www.msuniv.ac.in/images/distance%20education/learning%20materials/ug%20pg/ug//bsc_statistics/I%20Year%20-%20DJS1B%20-%20Descriptive%20Statistics.pdf
3. https://www.youtube.com/watch?v=nmIwSQJmX2M
4. https://www.teachmint.com/tfile/studymaterial/class-2nd/statisticalmethods/stat-231-full-printed-notespdf/137a97d0-48c1-4613-b674-d785e52a6e95
5. https://mu.ac.in/wp-content/uploads/2021/06/USIT204-Numerical-and-Statistical-methods.pdf

Course Outcomes (COs)	Program Outcomes (**POs**)								Programme Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	1	2	3	2	1	3	3	2	3	1
CO2	3	3	3	1	2	1	2	1	3	3	1	1	1
CO3	3	3	3	1	2	1	2	1	3	3	2	1	1
CO4	3	3	3	1	2	1	2	2	3	3	3	3	1
CO5	3	3	3	1	2	3	3	3	3	3	3	3	1
	Overall CO – PO Mapping index =2.2								Overall CO – PSO Mapping index =2.28				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE SE / GS / EVS VE / VAC	Category			Exam.	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25UCS2NME1	2	Fundamentals of Computer	NME	2	-	-	3 Hrs.	25	75	100

Pre-Requisite: Basic understanding of mathematics and logical reasoning.
No prior knowledge of computers is required, but general familiarity with digital devices is beneficial.

Course Objectives: The purpose of learning this course is:

1.**U**nderstand the fundamental concepts of computers

2.Identify and describe the functioning of various input

3.Explain different types of software

4.Understand the basics of data communication

5.Explore practical IT applications in real-world scenarios and understand emerging trends like IoT

Course Outcomes:

CO1: Define and explain the historical development, characteristics, and categories of computer systems.

CO2: Demonstrate knowledge of various I/O and storage devices and understand how data is represented in computer systems.

CO3: Distinguish between different software categories, describe OS functions, and identify common programming languages and translation tools.

CO4: Illustrate the principles of networking, identify types of networks and topologies, and utilize internet services like web browsing, email, and FTP.

CO5: Apply knowledge of IT tools in domains like e-commerce and e-learning, and demonstrate awareness of current trends and cybersecurity practices.

Unit-I	**Introduction**	6 Hrs.

Introduction to Computers : History and evolution of computers - Classification of computers (Analog, Digital, Hybrid) - Characteristics and applications of computers - Computer organization: Input Unit, Output Unit, Storage Unit, CPU - Computer architecture basics.

Unit-II	**Input and Output Devices**	6 Hrs.

Input devices: Keyboard, Mouse, Scanner, MICR, OCR, Joystick, Webcam - Output devices: Monitor (CRT, LCD, LED), Printers (Impact and Non-impact), Plotters - Storage devices: RAM, ROM, HDD, SSD, Optical Discs, USB.

Unit-III	**Software Concepts**	6 Hrs.

Definition and types of software: System Software, Application Software - Operating Systems: Windows, Linux, macOS – features and functions- Utilities: Disk Cleanup, Antivirus, Compression tools - Programming languages: Levels and examples (C, Java, Python) - Translators: Compiler, Interpreter, Assembler.

Unit-IV	**Data Communication and Computer Networks**	6 Hrs.

Basic concepts of data transmission and modulation - Network Types: LAN, MAN, WAN - Topologies: Bus, Ring, Star, Mesh, Hybrid - Internet basics: IP Address, DNS, ISP, Browsers, Search Engines - Email, FTP, WWW.

Unit-V	**IT Applications and Emerging Trends**	6 Hrs.

Basics of Database and DBMS - E-Governance, E-Learning, E-Commerce - Cybersecurity basics: Viruses, Phishing, Firewalls, Strong Passwords - Overview of IoT, Cloud Computing, and Artificial Intelligence.

Text Book(s):

1. V. Rajaraman**,** *"*Fundamentals of Computers*",* 6th edition, PHI Learning Pvt. Ltd., 2014, ISBN: 9788120350670
2. P.K. Sinha**,** Priti Sinha*, "*Computer Fundamentals*",* 6th edition, BPB Publications, 2020, ISBN: 9789389845162

Reference Book(s):

1. Peter Norton, "Introduction to Computers", 7th edition, McGraw-Hill Education, 2017, ISBN: 9780072978901:
2. Alexis Leon, Mathews Leon, "Fundamentals of Information Technology", 2nd edition, Vikas Publishing House, 2009, ISBN: 9788125912118
3. D.P. Nagpal, "Computer Fundamentals and Applications", 1st edition, S. Chand Publishing, 2011, ISBN: 9788121938969

Web Resources:

1.TutorialsPoint*, "*Computer Fundamentals Tutorial*",* Available at: https://www.tutorialspoint.com/computer_fundamentals/index.htm (Accessed: June 11, 2025)
2.GeeksforGeeks**,** *"*Basics of Computer Science*"*, Available at: https://www.geeksforgeeks.org/basics-of-computer-science/ (Accessed: June 11, 2025)
3**.J**avaTpoint**,** *"*Computer Fundamentals*",* Available at: https://www.javatpoint.com/computer-fundamentals (Accessed: June 11, 2025)
4. BYJU'S**,** "Input and Output Devices of Computer", Available at: https://byjus.com/govt-exams/input-and-output-devices-of-computer/ (Accessed: June 11, 2025)
5**.**Cisco Networking Academy**,** "Introduction to Cybersecurity*",* Available at: https://www.netacad.com/courses/cybersecurity/introduction-cybersecurity (Accessed: June 11, 2025)

Course Outcome (COs)	Program Outcomes (**POs**)								Programme Specific Outcomes (**PSOs**)				
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	2	2	2	1	1	3	2	1	2	2
CO2	3	2	2	2	1	2	2	2	2	2	2	1	1
CO3	3	2	3	2	2	2	2	1	2	2	2	2	1
CO4	3	2	3	2	2	3	2	2	3	2	1	2	1
CO5	3	3	2	2	2	2	1	2	2	3	2	2	2
	Overall CO – PO Mapping index = 1.88								**Overall CO – PSO Mapping index = 2.88**				

1 – Low Correlation 2 – Medium Correlation 3 – High Correlation

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25UCSVA1	2	**Data Science with python**	VAC	-	-	-	**3 Hrs.**	**50**	**50**	**100**

Pre-Requisite: Basic knowledge of Python programming, statistics, and data handling.

Course Objectives: The purpose of learning this course is:

1. To provide a comprehensive understanding of data science concepts using Python.
2. To explore data preprocessing, visualization, and analysis techniques.
3. To apply machine learning algorithms using Python libraries.
4. To introduce model evaluation, tuning, and deployment.
5. To prepare students for real-world data-driven decision-making.

Course Outcomes:

CO1: Understand the data science workflow and apply data preprocessing techniques using Python.

CO2: Perform data visualization and exploration using popular Python libraries.

CO3: Apply machine learning models for classification, regression, and clustering.

CO4: Evaluate and fine-tune models using cross-validation and metrics.

CO5: Develop and deploy data science applications with Python.

Unit-I	**Python for Data Science**	6 Hrs.

Introduction to data science and its applications – Python basics (data types, control structures, functions) – Working with Jupyter notebooks – NumPy for numerical computing – Pandas for data manipulation – Importing datasets – Basic data exploration.

Unit-II	**Data Cleaning and Visualization**	6 Hrs.

Handling missing values – Filtering and transforming data – Encoding categorical data – Feature scaling – Data visualization using Matplotlib and Seaborn – Histograms, box plots, scatter plots, heatmaps – Exploratory Data Analysis (EDA).

Unit-III	**Statistical Analysis and Probability**	6 Hrs.

Descriptive statistics – Mean, median, mode, standard deviation – Probability distributions (normal, binomial) – Correlation and covariance – Hypothesis testing – t-test, chi-square test – Introduction to p-values and confidence intervals.

Unit-IV	**Machine Learning with Scikit-learn**	6 Hrs.

Overview of supervised and unsupervised learning – Train/test split – Linear regression – Logistic regression – K-Nearest Neighbors – Decision Trees – Clustering with K-Means – Introduction to dimensionality reduction (PCA).

Unit-V	**Model Evaluation and Deployment**	6 Hrs.

Model performance metrics (accuracy, precision, recall, F1-score, ROC-AUC) – Cross-validation – Confusion matrix – Hyperparameter tuning with GridSearchCV – Saving/loading models (joblib, pickle) – Introduction to model deployment using Flask

Textbooks:

1. Joel Grus, *Data Science from Scratch: First Principles with Python*, 2nd Edition, O'Reilly Media, 2019, ISBN: 978-1492041139
2. Jake VanderPlas, *Python Data Science Handbook*, 1st Edition, O'Reilly Media, 2016, ISBN: 978-1491912058
3. Amit Kapoor, Bhargavi Ganesh, *Applied Data Science with Python*, 1st Edition, Packt Publishing, 2018, ISBN: 978-1789803475

Reference Books:

1. Sebastian Raschka, Vahid Mirjalili, *Python Machine Learning*, 3rd Edition, Packt Publishing, 2019, ISBN: 978-1789955754
2. Wes McKinney, *Python for Data Analysis*, 2nd Edition, O'Reilly Media, 2017, ISBN: 978-1491957660
3. Prateek Joshi, *Artificial Intelligence with Python*, 1st Edition, Packt Publishing, 2017, ISBN: 978-1786464396

Web Resources:

1. Kaggle – Hands-on projects, competitions, and datasets
2. Scikit-learn Documentation – Machine learning in Python
3. Pandas Documentation – Data handling library
4. Google Colab – Free Jupyter notebooks in the cloud
5. Towards Data Science (Medium) – Articles and practical tutorials

Prepared by Checked by HoD

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25UCSVA2	2	**Data Visualization Tools**	VAC	-	-	-	3 Hrs.	50	50	100

Pre-Requisite: Basic knowledge of data handling and programming in Python or R.

Course Objectives: The purpose of learning this course is:

1. To introduce the fundamentals of data visualization principles and tools.
2. To explore data visualization using Python libraries like Matplotlib and Seaborn.
3. To enable interactive dashboard development using tools like Tableau and Power BI.
4. To interpret data effectively using charts, plots, and maps.
5. To create data-driven stories for business and academic use.

Course Outcomes:

CO1: Understand the principles of effective data visualization.

CO2: Use Python libraries (Matplotlib, Seaborn, Plotly) to visualize datasets.

CO3: Create dynamic dashboards using Tableau and Power BI.

CO4: Apply geospatial and time-series visualizations for advanced insights.

CO5: Design compelling visual stories for business intelligence and presentations.

Unit-I	**Introduction to Data Visualization**	6 Hrs.

Data visualization basics – Importance and types of visualization – Choosing the right chart – Principles of effective visual design – Data types and visual encoding – Storytelling with data.

Unit-II	**Visualization with Python (Matplotlib, Seaborn)**	6 Hrs.

Overview of Matplotlib – Line, bar, pie, scatter plots – Customizing plots – Subplots and figure styling – Seaborn for statistical plots – Heatmaps, pair plots, box plots – Aesthetic control.

Unit-III	**Interactive Visualizations with Plotly and Dash**	6 Hrs.

ntroduction to Plotly – Line charts, bar charts, 3D plots – Dash framework for interactive web dashboards – Layouts and callbacks – Deployment of dashboards.

Unit-IV	**Data Visualization with Tableau and Power BI**	6 Hrs.

Getting started with Tableau – Connecting data sources – Creating worksheets and dashboards – Filters, parameters, and actions – Power BI: importing data, visualizations, DAX basics – Publishing dashboards to the web.

Unit-V	**Advanced Visualization and Case Studies**	6 Hrs.

Time-series visualization – Geospatial data mapping – Interactive storytelling – Real-world case studies in business, health, education – Project presentation using chosen tools.

Textbooks:

1. Kieran Healy, *Data Visualization: A Practical Introduction*, Princeton University Press, 2018, ISBN: 978-0691181622
2. Ben Jones, *Learning Tableau*, 3rd Edition, Packt Publishing, 2019, ISBN: 978-1789536397
3. Alexander Loth, *Visual Analytics with Tableau*, Wiley, 2021, ISBN: 978-1119560203

Reference Books:

1. Nathan Yau, *Data Points: Visualization That Means Something*, Wiley, 2013, ISBN: 978-1118462195
2. Alberto Cairo, *The Truthful Art: Data, Charts, and Maps for Communication*, New Riders, 2016, ISBN: 978-0321934079
3. Cole Nussbaumer Knaflic, *Storytelling with Data*, Wiley, 2015, ISBN: 978-1119002253

Web Resources:

1. Tableau Public – Create and share dashboards
2. Power BI Documentation – Official learning resources
3. Seaborn Gallery – Examples of statistical plots
4. Plotly Python Open Source Graphing Library – Interactive visualization
5. Data Visualization Catalogue – Reference for choosing the right chart type

Prepared by Checked by HoD