



**DR.MANMOHAN SINGH
BENGALURU CITY UNIVERSITY**

Syllabus of Fifth and Sixth Semesters for

**B.Sc. Computer Science
(CBCS Scheme)**

**Under
State Education Policy**

**Effective from the Academic Year
2026 – 2027**

Board of Studies in Computer Science for UG

No : BCU/BoS/Comp.Sci. & Appln.(PG & UG)/389/2024-25 dated 19/02/2025

1	Dr. Ashoka S B Director,School of Computer Science Maharani Cluster University Bengaluru-560001	Chairperson
2	Prof. Guru D S Department of Studies in Computer Science University of Mysore, Mysore-570006	Member
3	Prof. Aziz Makandar Department of Computer Science Karnataka State Akkamahadevi Women University, Jnanashakti Campus, Vijayapura-586109	Member
4	Prof. Suneetha Department of Computer Science, Karnataka State Open University, Muktha Gangothri Mysuru-570006	Member
5	Dr. Veena R Department of MCA, Seshadripuram College Seshadripuram, Bengaluru-560020	Member
6	Dr. Kiran Kumar M N Department of Computer Applications, BMS College of Commerce and Management, Bengaluru-560004	Member
7	Prof. Latha B Department of Computer Science Vijaya College, R V Road, Basavanagudi, Bengaluru-560004	Member
8	Prof. R Shanthi Krishna Department of Computer Applications, SSMRV College, Jayanagar, Bengaluru-560041	Member
9	Prof. Roopa H R Department of Computer Applications, Seshadripuram Institute of Commerce and Management, Seshadripuram, Bengaluru-560020	Member
10	Sri Seby Kallarakkal CEO-Nabler Web Solutions, Bengaluru-560052	Member

Name of the Degree Program : B.Sc. Computer Science
Discipline Course : Computer Science
Starting Year of Implementation: 2024-25 (I & II Semesters)
2025-26 (III & IV Semesters)
2026-27 (V & VI Semesters)

Programme Outcomes (POs)

PO 1	Apply knowledge of computer science to design and implement computational solutions.
PO 2	Identify, analyze, and solve structured and unstructured real-world problems using algorithmic thinking, data structures and efficient programming strategies.
PO 3	Create, Solve and apply tools of programming, networking, database and modern technology for solutions to significant problems.
PO 4	Design computer-based solutions for various technical problems.
PO 5	Demonstrate project management skills through projects and practical labs.
PO 6	Build software solutions using multiple paradigms in software development.
PO 7	Understand professional, ethical, legal and societal responsibilities in data usage, privacy, AI implementations and technological impact.
PO 8	Communicate effectively in both verbal and written formats through project reports, lab records presentations and document code.
PO 9	Function effectively as an individual and as a member or leader in diverse teams in multidisciplinary environments such as group projects.
PO 10	Recognize the need for continuous learning in a rapidly evolving tech world and demonstrate readiness to adopt innovations in AI for solving real-world challenges.

ASSESSMENT

Weightage for the Assessments (in percentage)

Type of Course	Formative Assessment/ I.A.	Summative Assessment (S.A.)
Theory	20%	80 %
Practical	20%	80 %

DETAILED STRUCTURE FOR BSc COMPUTER SCIENCE

Semester	Course Code	Paper Title	Teaching Hours / Week	Marks		Duration of Exam in Hours	Credits
				Exam	IA		
I	24BSC-CS-1	Problem Solving Techniques	4	80	20	03	03
	24BSC-CS-1P	Problem Solving Techniques Lab	4	40	10	03	02
II	24BSC-CS-2	Data Structures	4	80	20	03	03
	24BSC-CS-2P	Data Structures Lab	4	40	10	03	02
III	24BSC-CS-3	Database Management System	4	80	20	03	03
	24BSC-CS-3P	Database Management System Lab	3	40	10	03	02
	24BSC-CS-E1	Cyber Security	2	40	10	1.5	02
IV	24BSC-CS-4	Object Oriented Programming using Java	4	80	20	03	03
	24BSC-CS-4P	Java Lab	3	40	10	03	02
	24BSC-CS-E2	Software Testing	2	40	10	1.5	02
	24BSC-CS-SE1	HTML	2	40	10	1.5	02
V	24BSC-CS-5	Python Programming	4	80	20	03	03
	24BSC-CS-6	Operating System	4	80	20	03	03
	24BSC-CS-5P	Python Programming Lab	3	40	10	03	02
	24BSC-CS-SE2	Web Development	3	40	10	3	02
VI	24BSC-CS-7	Artificial Intelligence	4	80	20	03	03
	24BSC-CS-8	Computer Networks	4	80	20	03	03
	24BSC-CS-7P	Artificial Intelligence Lab	3	40	10	03	02
	24BSC-CS-SE3	Mini Project	3	40	10	03	02

Theory	24BSC-CS-5: Python Programming
Teaching Hours : 04 Hours/Week	Credits: 03
Duration of Exam: 03 Hours	Maximum Marks: 100 (Exam 80 + IA 20)

Course Outcomes

COs	Description
CO1	Understand the basic concepts of python and apply them to develop programs.
CO2	Demonstrate proficiency in handling Python's complex data structures and apply file handling for various formats.
CO3	Apply object-oriented programming concepts in Python and use libraries for efficient data manipulation and analysis.
CO4	Utilize Python packages and APIs for effective data visualization.

UNIT – I Introduction to Python

14 Hours:

Python Interpreter/Shell, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() function and is operator, Dynamic and Strongly Typed Language. Conditional blocks: if, else, elif, Nested if. Looping: while, for, range, loop manipulation using break, continue, else, pass. Functions: Function Definition and Calling, Built-In Functions, Return Statement, Default Parameters, Scope and Lifetime of Variables, Command Line Arguments. Strings: Creating and Storing Strings, String Operations, Slicing, Joining, String Methods.

UNIT – II Data Structures and File Handling

14 Hours

Lists: Creating Lists, Basic List Operations, Indexing and Slicing, List Methods, The del Statement. Dictionaries: Creating Dictionaries, Accessing and Modifying Key-Value Pairs, Dictionary Methods. Tuples: Creating Tuples, Tuple Operations, Indexing, Slicing, Tuple Methods, Relationships between Tuples, Lists, and Dictionaries. Sets: Creating Sets, Set Operations, Set Methods. File Handling: Types of Files, Reading and Writing Text and Binary Files, CSV File Handling.

UNIT – III Object-Oriented Programming and Data Handling Libraries 14 Hours

Classes and Objects in Python, Constructor Method, Multiple Objects, Encapsulation, Inheritance, Polymorphism. Introduction to Python Libraries for Data Handling: NumPy – Arrays and Operations, Pandas – Series and DataFrames.

UNIT – IV Data Analysis and Visualization

14 Hours

Importing and Exporting Data (CSV, JSON), Understanding and Formatting Data. Using Matplotlib and Plotly for Visualization, Generating and Plotting Data (Line Graphs, Bar Charts). Working with APIs.

TEXT BOOKS:

1. Mark Lutz, *Learning Python*, 6th Edition, O'Reilly Media, 2023.
2. Luciano Ramalho, *Fluent Python*, 2nd Edition, O'Reilly Media, 2022.

REFERENCE BOOKS:

1. Eric Matthes, *Python Crash Course*, 3rd Edition, No Starch Press, 2023.
2. Gowrishankar S, Veena A, *Introduction to Python Programming*, 1st Edition, CRC Press/Taylor & Francis, 2018.
3. Wes McKinney, *Python for Data Analysis*, 3rd Edition, O'Reilly Media, 2022.

Theory	24BCS-CS-6:Operating System	
Teaching Hours : 04 Hours/Week	Credits: 03	
Duration of Exam: 03 Hours	Maximum Marks: 100 (Exam 80 + IA 20)	

Course Outcomes

COs	Description
CO1	Understand the fundamental concepts of an Operating System.
CO2	Apply knowledge of process management, including process scheduling, and inter-process communication using shared memory and message passing techniques.
CO3	Analyze and evaluate different CPU scheduling algorithms and implement process synchronization techniques.
CO4	Demonstrate understanding of deadlocks and memory management techniques, and use basic Linux commands and programming concepts for system-level operations.

UNIT – I Introduction to Operating System

14 Hours

Definition, functions, Computer-System organization, Computer-System Architecture, Operating-System Operations, Operating-System Services, User and Operating-System Interface, System Calls, System Services.

UNIT – II Process Management

14 Hours

Process Concept; Process scheduling, Operations on Processes, Inter process communication, inter-process communication in Shared- Memory Systems, inter-process communication in Message-Passing Systems.

UNIT – III CPU Scheduling and Process Synchronization

14 Hours

Basic concepts: Scheduling Criteria, Scheduling Algorithms, Multiple-processor scheduling, Real-Time CPU Scheduling. Process synchronization: Critical Section Problem and Peterson's Solution, Semaphores, Classic Problems of Synchronization, Synchronization within the Kernel.

UNIT – IV Deadlocks, Memory Management & Linux Programming

14 Hours

Deadlocks: System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Detection. Memory Management: Contiguous Memory Allocation, Paging, Structure of the Page Table, Swapping. Linux system Architecture, Linux Command format, Linux Internal and External Commands, Directory Commands, File related commands, Disk related commands, General Utilities.

Text Books

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne; “Operating Systems Concepts”, 10th Edition, Wiley , 2018.
2. William Stallings, *Operating Systems: Internals and Design Principles*, 9th Edition, Pearson, 2018.

Reference Books

1. Andrew S. Tanenbaum, Herbert Bos, *Modern Operating Systems*, 4th Edition, Pearson, 2015.
2. D M Dhamdhere; operating systems - A concept Based Approach, 3'd Edition, Tata McGraw - Hill.
3. Sumitabha Das: "UNIX Concepts and Applications", 4th Edition,TataMcGraw Hill' 2006
4. M G Venkateshmurthy,"UNIX and Shell Programming",Pearson Edition Asia'2005

Lab	24BSC-CS-5P: Python Programming Lab	
Teaching Hours : 03 Hours/Week		Credits : 02
Duration of Exam : 3 Hours		Maximum Marks : 50 (Exam 40 + IA 10)

1. Write a Python program to perform arithmetic operations, and display results.
2. Write a Python program to print the first n Fibonacci numbers using for loop.
3. Implement a program that accepts a string and counts the number of vowels and consonants.
4. Create a program to store student details in a dictionary and retrieve details based on user input.
5. Demonstrate the use of break, continue, and pass in loops.
6. Write a program to create NumPy arrays, perform element-wise operations, and reshape arrays.
7. Create a Pandas Series and perform indexing, slicing, and querying operations.
8. Load a dataset into a Pandas Data Frame and perform sorting and filtering operations.
9. Write a program to count the occurrences of each word in a given string.
10. Implement a program to insert, delete, and update elements in a list.
11. Write a Python program to calculate the factorial of a number using recursion.
12. Plot a line graph and a bar chart using Matplotlib.

Practical: Skill Enhancement Course-II	24BSC-CS-SE2: Web Development
Teaching Hours : 02 Hours/Week	Credits : 02
Duration of Exam : 1 ½ Hours	Maximum Marks : 50 (Exam 40 + IA 10)

Course Outcomes

COs	Description
CO1	Design and develop basic web pages using HTML elements such as lists, tables, forms, frames, and multimedia components.
CO2	Apply CSS techniques (inline and basic styling) to enhance the presentation and layout of web pages.
CO3	Develop interactive web pages using JavaScript for performing operations and validating user inputs.
CO4	Create structured and visually appealing web interfaces by integrating HTML, CSS, and JavaScript concepts.

1. Create a class timetable using table tag.
2. Design Web Pages which includes Image, Audio, Video, GIFs etc.
3. Create a web page using frame.
4. Design web pages for your college containing college name and Logo, departments list using href, list tags.
5. Write a HTML code to design Student registrations form for your college Admission
6. Write HTML code to develop a webpage having two frames that divide the webpage into two equal rows and then divide the row into equal columns fill each frame with a different background color.
7. Write CSS code to use Inline CSS to format your ID Card.
8. Using HTML, CSS display the text "Incredible India " on top of an image of India- Map using an overlay.
9. Write a JavaScript Program to perform Basic Arithmetic operations.
10. JavaScript Program to Validate an Email Address.

Theory	24BSC-CS-7: Artificial Intelligence	
Teaching Hours : 04 Hours/Week		Credits : 03
Duration of Exam : 03 Hours		Maximum Marks : 100 (Exam 80 + IA 20)

Course Outcomes

COs	Description
CO1	Understand the fundamentals of Artificial Intelligence, intelligent agents, and apply various search techniques to solve problems.
CO2	Apply knowledge representation methods and reasoning techniques to solve AI problems.
CO3	Analyze planning, reasoning under uncertainty, and perception techniques in real-world scenarios.
CO4	Evaluate machine learning approaches, neural network models, and assess ethical issues related to AI systems.

UNIT – I Fundamentals of Artificial Intelligence and Search Techniques 14 Hours

Definitions, Applications, and Scope. Intelligent Agents: Agents and Environments, Concept of Rationality, Nature of the Environment, Structure of Agents. Knowledge-Based Agents: Introduction, The Wumpus World as an Example. Search Techniques: Uninformed Search Strategies – Depth First Search (DFS), Breadth First Search (BFS). Informed Search Strategies – Best First Search, A* Search, AO* Search. Two-Player Zero-Sum Games, Minmax Algorithm.

UNIT – II Knowledge Representation, Reasoning, and Learning Paradigms 14 Hours

Propositional Logic, First-Order Predicate Logic, Differences between Propositional and First-Order Inference. Inference Techniques: Unification and Lifting, Forward Chaining, Backward Chaining, Resolution, Truth Maintenance Systems. Decision Trees .

UNIT – III Planning, Reasoning and Perception 14 Hours

Introduction to Planning: Planning Problem, State-Space Search, The Blocks World Problem, STRIPS Representation. Handling Uncertainty: Non-Monotonic Reasoning, Probabilistic Reasoning, Introduction to Fuzzy Logic and Fuzzy Set Theory. Computer Vision – Image Classification, Object Detection. Natural Language Processing (NLP): Introduction, Syntactic Processing, Semantic Analysis.

UNIT – IV Machine Learning, Neural Networks, and AI Ethics 14 Hours

Types of Learning – Supervised, Unsupervised, and Reinforcement Learning. Neural Networks: Basics of Artificial Neural Networks (ANN), Deep Learning Concepts , Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Expert Systems: Architecture, Components, Legal and Ethical Issues in AI: Societal Impact, Bias, Privacy, and Accountability in AI Systems.

TEXT BOOKS:

1. M.C. Trivedi, *A Classical Approach to Artificial Intelligence*, Khanna Book Publishing Company, 2024 (AICTE Recommended).
2. Nilsson Nils J., *Artificial Intelligence: A New Synthesis*, Morgan Kaufmann Publishers Inc., ISBN: 978-1-55860-467-4.

REFERENCE BOOKS:

1. M.C. Trivedi, *Introduction to AI and Machine Learning*, Khanna Book Publishing Company, 2024.
2. Van Hirtum, A. & Kolski, C., *Constraint Satisfaction Problems: Algorithms and Applications*, Springer, 2020.
3. Elaine Rich, Kevin Knight, Shivasankar B. Nair, *Artificial Intelligence*, 3rd Edition, McGraw Hill, 2019.
4. Rajiv Chopra, *Machine Learning and Machine Intelligence*, Khanna Book Publishing Company, 2024.

Theory	24BSC-CS-8: Computer Networks	
Teaching Hours : 04 Hours/Week		Credits: 03
Duration of Exam: 03 Hours		Maximum Marks: 100 (Exam 80 + IA 20)

Course Outcomes

COs	Description
CO1	Understand the fundamentals of computer networks, network models, topologies, protocols, and their applications.
CO2	Understand the concepts of the physical layer, transmission media, switching techniques, and analyze data transmission performance.
CO3	Apply data link layer concepts including framing, error control, multiple access protocols, and evaluate wired and wireless LAN technologies.
CO4	Analyze transport and application layer protocols, implement reliable data transfer mechanisms, and understand key networking services such as DNS, HTTP, and FTP.

UNIT – I Introduction to Networking and Communication Principles 14 Hours

Definition, Goals, and Structure of Computer Networks, Broadcast and Point-to-Point Networks, Network Topologies: Types of Network Topologies and their Characteristics
Types of Networks: LAN, MAN, WAN, Network Software & Design Issues: Layered Architecture, Design Issues for Layers, Connection-Oriented vs Connectionless Services
Applications, Protocols & Standards: Applications of Computer Networks, Protocols and Standards, Reference Models: OSI Reference Model, TCP/IP Protocol Suite, Comparison between OSI and TCP/IP Models

UNIT – II: Physical Layer and Data Transmission 14 Hours

Functions of Physical Layer, Analog and Digital Signals, Transmission Impairments, Data Rate Limits and Performance, Transmission Media: Guided Media: Twisted Pair, Coaxial Cable, Fiber Optics, Magnetic Media, Power Lines, Unguided Media: Wireless Transmission, Electromagnetic Spectrum, Wireless Communication: Radio Transmission, Microwave Transmission, Infrared and Light Transmission, Data Transmission Techniques: Digital Modulation, Multiplexing, Public Network: Public Switched Telephone Network (PSTN)
Switching Techniques: Circuit Switching, Message Switching, Packet Switching

UNIT – III: Data Link Layer and LAN Technologies 14 Hours

Functions of Data Link Layer, Data Link Control: Framing, Flow Control, Error Control, Error Detection and Correction, Protocols: HDLC (High-Level Data Link Control), PPP (Point-to-Point Protocol), Channel Allocation: Channel Allocation Problem, Multiple Access protocols: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access: Reservation, Polling, Token Passing, Channelization: FDMA, TDMA, CDMA, LAN Technologies: Wired LAN: Ethernet Standards, FDDI, Wireless LAN: IEEE 802.11, Bluetooth

UNIT – IV: Transport and Application Layer 14 Hours

Functions of Transport Layer, Transport Protocol Elements: Addressing, Connection Establishment and Release, Flow Control and Buffering, Error Control, Multiplexing and

Demultiplexing, Crash Recovery, Protocols: User Datagram Protocol (UDP):User Datagram, Operations, Uses, Remote Procedure Call (RPC),Reliable Data Transfer: Principles of Reliable Data Transfer, Pipelined Protocols, Go-Back-N (GBN),Selective Repeat (SR),Application Layer: Functions of Application Layer, Application Layer Protocols: DNS, DHCP,WWW, HTTP, HTTPS,TELNET, FTP,SMTP, POP, IMAP

TEXT BOOKS

1. Behrouz A. Forouzan, “Data Communications and Networking”, 6th Edition, McGraw Hill Education, 2022.

REFERENCE BOOKS

1. Andrew S.Tanenbaum, David J. Wetherall, “Computer Networks”, 6th Edition, Pearson, 2021.
2. Larry L. Peterson and Bruce S. Davie, “Computer Networks-A System Approach”, 6th Edition, Morgan Kaufmann, 2021.
3. James F. Kurose, Keith W. Ross, “Computer Networking, A Top-Down Approach”, 8th Edition, Pearson, 2021.

Lab	24BSC-CS-7P: Artificial Intelligence Lab	
Teaching Hours : 03 Hours/Week		Credits : 02
Duration of Exam : 3 Hours		Maximum Marks : 50 (Exam 40 + IA 10)

1. Demonstrate basic problem-solving using Breadth-First Search on a simple grid.
2. Implement Depth-First Search (DFS) on a small graph.
3. Solve the Water Jug Problem using Breadth First Search (BFS).
4. Apply A* Search algorithm to find the shortest path in a 4x4 grid.
5. Implement the Minmax search algorithm for 2-player games.
6. Solve 4 Queen's problem.
7. Demonstrate propositional logic operations (AND, OR, NOT).
8. Construct a simple Decision Tree for decision making.

Project	24BSC-CS-SE3: Mini Project		
Teaching Hours : 03 Hours/Week		Credits: 2	
Duration of Exam : 3 Hours		Maximum Marks : 50 (Exam 40 + IA 10)	

PROJECT GUIDELINES

1. The project shall be either research-oriented or application-based in the emerging areas of Computer Technology.
2. Project work may be carried out individually or in a group consisting of a maximum of two students.
3. A hardbound project report must be submitted as part of the project work.
4. The use of open-source or licensed software tools is encouraged, and all such tools utilized must be properly acknowledged and cited in the report.

Formative Assessment		Summative Assessment	
Category	Marks Allotted	Category	Marks Allotted
Review Meeting-1	05	Writing	05
Review Meeting -2	05	Demonstration	20
-	-	Viva Voce	05
-	-	Report	10
Total Marks	10	Total Marks	40

BLUEPRINT FOR QUESTION PAPER						
FOR 03 CREDITS						
Marks	Unit I	Unit II	Unit III	Unit IV	Number of questions to be answered	Total
2	3	3	3	3	10	20
6	2	2	2	2	5	30
10	1	1	1	1	3	30
Total						80
FOR 02 CREDITS						
Marks	Unit I	Unit II	Number of questions to be answered			Total
2	3	3	5			10
5	3	3	4			20
10	1	1	1			10
Total						40

Formative Assessment - 03 Credits

Category	Marks Allotted
Tests	10
Assignments	10
Total Marks	20

Formative Assessment - 02 Credits

Category	Marks Allotted
Tests	5
Assignments	5