Bhavan's Vivekananda College of Science Humanities and Commerce

Sainikpuri, Secunderabad

Autonomous College – Affiliated to Osmania University

Department of Computer Science

BCA I Year

CBCS (Choice Based Credit System) w.e.f. 2026-2027

Scheme of Instruction and Examination

SEMESTER – I

Sl.No.	*Code*	*Paper Title*	*Course Type*	*PPW*			*Max. Marks*		*Max. Marks*		*Credits*	*Duration (Hrs.)*	
				TH	*T*	*PR*	*TH*	*TH-CIA*	*PR*	*PR - CIA*		*SEE*	*CIA*
1	BCA141	Mathematical Foundations of Computer Science	CC	3	1		70	30			3	3	1
2	BCA142	Computer Architecture	CC	3	1		70	30			3	3	1
3	BCA143	Programming in C	SEC	3	1		70	30			3	3	1
4	BCA144	Web Technologies	SEC	3	1		70	30			3	3	1
5	BCA145	Effective Communication	AEC	3	1		70	30			3	3	1
6	BCA142P	Computer Architecture Lab	CC			4			50	25	2	3	2
7	BCA143P	Programming in C Lab	SEC			4			50	25	2	3	2
8	BCA144P	Web Technologies Lab	SEC			4			50	25	2	3	2
Total				**15**	**5**	**12**	**350**	**150**	**150**	**75**	**21**	**-**	**-**

CC: Core Course
SEC: Skill Enhancement Course
AEC: Ability Enhancement Course

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Scheme of Instruction and Examination

SEMESTER – II

Sl.No.	*Code*	*Paper Title*	*Course Type*	*PPW*			*Max. Marks*		*Max. Marks*		*Credits*	*Duration (Hrs.)*	
				TH	*T*	*PR*	*TH*	*TH-CIA*	*PR*	*PR-CIA*		*SEE*	*CIA*
1	BCA241	Probability and Statistics	CC	3	1		70	30			3	3	1
2	BCA242	Data Structures	CC	3	1		70	30			3	3	1
3	BCA243	Operating Systems	CC	3	1		70	30			3	3	1
4	BCA244	Object Oriented Programming using Java	SEC	3	1		70	30			3	3	1
5	BCA245	Indian Constitution	VAC	3	1		70	30			3	3	1
6	BCA242P	Data Structures Lab	CC			4			50	25	2	3	2
7	BCA243P	Operating Systems Lab	CC			4			50	25	2	3	2
8	BCA244P	Object Oriented Programming using Java Lab	SEC			4			50	25	2	3	2
Total				**15**	**5**	**12**	**350**	**150**	**150**	**75**	**21**	-	-

CC: Core Course
SEC: Skill Enhancement Course
VAC: Value Added Course

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester I

Course: Mathematical Foundations of Computer Science **Hour** (45 Hrs.)/**Week:** 3 PPW
Course Code: BCA141 **Credits:** 3

Course Objectives: The objectives of this course are,

1. To introduce the fundamentals of logic, proof techniques, and set theory as a basis for mathematical reasoning and problem solving.
2. To understand relations, functions and counting principles including the pigeonhole principle and inclusion-exclusion principle.
3. To develop the ability to solve problems involving generating functions and recurrence relations.
4. To familiarize students with algebraic structures such as semigroups, monoids and groups and their applications.
5. To Provide a foundation in graph theory and tree, enabling analysis of structures and algorithms used in computer science.
6. To develop analytical and critical thinking skills for formulating and solving real-world problems using discrete mathematical concepts.

UNIT- I

Fundamentals of Logic: Basic Connectives and Truth Tables, Logical Equivalence, Logical Implication.
Set Theory and Properties of the Integers: Set and Subsets, Set Operations, and the Laws of Set theory, Counting and Venn Diagrams.
Division Algorithm (Statement and Basic Examples), Fundamental Theorem of Arithmetic (Statements).
IKS Topic: Classification Systems in Ayurveda (Charaka Samhita) and their relation to set theory concepts such as Sets and Subsets.
(Book 1: Chapters - 1.1, 1.2, 2.1, 2.2)

UNIT-II

Relations and Functions: Cartesian Product, Functions onto Functions, Special Functions, Composition and Inverse Functions. Pigeonhole Principle,
Properties of relations, Partial Ordering (Basic Definition), Equivalence Relations and Partitions.

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Principle of Inclusion and Exclusion: Principles of Inclusion and Exclusion, Generalization of Principle.
(Book 1: Chapters - 2.3,7.1,7.5, 7.6(Basic Definitions), 6.5, 5.2(Definition and Basic Examples))

UNIT–III

Generating Functions: Introductory Examples, Definition and Examples, Partitions of Integers.
Recurrence Relations: First-Order Linear Recurrence Relation, Second-Order Linear Homogenous Recurrence Relation with Constant Coefficients.
(Book 1: Chapters - 6.4 (Definition and Basic Examples), 6.2(No Theorem Proofs))

UNIT-IV

Algebraic Structures: Algebraic System-General Properties, Semi Groups, Monoids.
Groups: Definition, Examples and Elementary properties, Residue Arithmetic.
(Book 1: Chapters - 11.2, 11.3 (No Proofs of Theorems))

UNIT -V

Graph Theory: Definitions and examples, sub graphs, complements and graph Isomorphism, Vertex degree, Planar graphs, Hamiltonian paths and Cycles.
Trees: Definitions, properties and Examples, Rooted Trees, Spanning Trees and Minimum Spanning Trees.
(Book 1: Chapters - 8.1, 8.2,8.3, 8.5,8.7,9.1, 9.4(Definition),9.5 (No Theorem Proofs))

Course Outcomes: By the end of the course, the students will be able to,

BCA141.CO1: Apply logical reasoning, construct truth tables, and use set theory concepts in solving computational problems.
BCA141.CO2: Analyze and classify different types of functions and relations and apply combinatorial principles to count and organize data.
BCA141.CO3: Formulate and solve recurrence relations using generating functions for modelling and solving discrete problems.
BCA141.CO4: Demonstrate an understanding of algebraic structures and apply group theory concepts, including residue arithmetic in computational contexts.
BCA141.CO5: Model problems using graphs and trees, and apply algorithms to identify spanning trees, planar graphs and Hamiltonian paths.
BCA141.CO6: Apply discrete mathematical techniques to model, analyze, and solve real-world problems in computer science and related fields.

Books:

1. Kenneth H Rosen, Discrete Mathematics and it's Applications with Combinatorics and Graph Theory, 7th edition 25th reprint, McGraw Hill, 2019.
2. Bhavanari Satyanarayana, Tumurukota Venkata Pradeep Kumar and Shaik Mohiddin Shaw, Mathematical Foundation of Computer Science, BSP, 2016.
3. R.K.Bisht and H.S.Dhami, Discrete Mathematics, Oxford Higher Education, 2015.
4. Jr. P. Tremblay and R Manohar Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill, 1987.
5. Ralph P. Grimaldi, B.V. Ramana, Discrete and Combinatorial Mathematics, 5th Edition, Pearson, 2004. (An Applied Introduction).

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CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA141.CO1	3	3	1	2	2	1	1	1	1	2
BCA141.CO2	3	3	1	2	2	1	1	1	1	2
BCA141.CO3	3	3	1	3	2	1	1	1	1	2
BCA141.CO4	3	3	1	2	2	1	1	1	1	2
BCA141.CO5	3	3	1	3	2	1	1	2	1	2
BCA141.CO6	3	3	2	3	3	2	1	2	2	3

1- Low Correlation 2- Medium Correlation 3- High Correlation

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Department of Computer Science
Syllabus – BCA I Year
(w.e.f. academic year: 2026-27)
Semester I

Course: Computer Architecture
Course Code: BCA142

Hour (45 Hrs.)/**Week:** 3 PPW
Credits: 3

Course Objectives: The objectives of this course are,

1. Understand the fundamentals of digital systems, number systems, binary arithmetic, coding, and Boolean logic.
2. Apply K-Map techniques to design combinational and sequential circuits using basic components like adders, multiplexers, and flip-flops.
3. Comprehend the fundamentals of computer organization, including registers, counters, instruction cycle, basic computer, and accumulator-based design.
4. Understand CPU organization, including stack, registers, instruction formats, addressing modes, and data transfer and program control operations.
5. Impart knowledge on RISC architecture, compare RISC and CISC, and learn arithmetic and instruction pipelining techniques.
6. Analyze and apply concepts of I/O organization, data transfer methods, and memory hierarchy, including cache, virtual, and auxiliary memory systems.

UNIT-I

Fundamentals of Digital Systems and Number Representations Digital Principles: Definition for Digital signals, Digital logic, Digital computers, Von Neumann Architecture.
Number Systems: Decimal, Binary, Octal, Hexadecimal, Number System Conversions, Binary Arithmetic, Addition and subtraction of BCD, Octal Arithmetic, Hexadecimal Arithmetic, Binary Codes, Decimal Codes, Error detecting and correcting codes, ASCII, EBCDIC, Excess- 3 Code, The Gray Code. Boolean Laws and Theorems.
(Book 1: Chapters - 1, 2)

UNIT-II

K-Map: Truth Tables to K-Map, 2-variable, 3-variable and 4-variable K-Map, K-Map Simplifications, Don't Care Conditions, Sum-of-Products and Product-of-Sums.
Combinational Circuits: Half Adder and Full Adder, Subtractor, Decoders, Encoder, Multiplexer, De-multiplexer.
Sequential Circuits: Flip-Flops SR Flip- Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop.
(Book 2: Chapters - 1, 2)

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UNIT-III

Register: 4-bit register with parallel load, Shift Registers-Bidirectional shift register with parallel load. Binary Counters, 4-bit Synchronous and Asynchronous binary counter.

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator logic.

(Book 2: Chapters - 4, 5)

UNIT-IV

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC), RISC Vs CISC.

Pipeline: Arithmetic Pipeline and Instruction Pipeline.

(Book 2: Chapters - 8, 9)

UNIT-V

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor (IOP).

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory- Memory mapping methods, Virtual Memory.

(Book 2: Chapters - 11, 12)

Course Outcomes: By the end of the course, the students will be able to,

BCA142.CO1: Apply fundamental concepts of digital systems, including number systems, binary arithmetic, coding, and Boolean logic.

BCA142.CO2: Design and implement combinational and sequential logic components for digital components like adders, multiplexers, and flip-flops.

BCA142.CO3: Analyze the components of computer organization, covering registers, counters, instruction cycle, basic computer, and accumulator-based design.

BCA142.CO4: Interpret pipeline processing, memory systems, and input/output mechanisms used in modern computer architecture.

BCA142.CO5: Demonstrate the concepts of data transfer and manipulation, program control, RISC architecture, and arithmetic and instruction pipelining techniques.

BCA142.CO6: Apply principles of I/O organization and data transfer to understand memory hierarchy.

Books:

1. M.Morries Mano, "Digital Logic and Computer Design", Pearson Education India, 2017.
2. M.Morries Mano, "Computer Architecture", 3rd Edition, Pearson, 2017.
3. M.Morries Mano, "Computer System Architecture", 3rd Edition, Pearson Education India Pvt. Ltd., 2021.
4. William Stallings- "Computer Organization and Architecture", 7th Edition, Pearson/PHI, 2008.

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CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA142.CO1	3	3	2	2	1	1	1	2	1	2
BCA142.CO2	3	3	3	3	2	1	1	3	2	2
BCA142.CO3	3	2	2	2	1	1	1	2	1	2
BCA142.CO4	3	3	3	3	2	1	1	3	2	3
BCA142.CO5	3	3	3	3	2	1	1	3	2	3
BCA142.CO6	3	2	2	2	1	1	1	2	1	2

1- Low Correlation 2- Medium Correlation 3- High Correlation

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester I

Course: Computer Architecture Lab
Course Code: BCA142P

Hour (60 Hrs.)/**Week:** 4 PPW
Credits: 2

Course Objectives: The objectives of this course are,

1. To develop practical skills in identifying hardware, checking system specifications, troubleshooting issues, configuring BIOS, and upgrading memory.
2. To develop practical skills in understanding motherboard layout, assembling a PC, identifying ports, installing an operating system, and setting up and troubleshooting printers.
3. Develop skills in testing logic gates, designing flip-flops, and understanding basic digital circuits.
4. To acquire practical skills in designing, implementing, and testing combinational and sequential digital circuits using gates and ICs.

LABORATORY EXPERIMENTS:

HARDWARE:

1. Familiarize the computer system layout: marking positions of SMPS, motherboard, FDD, HDD, CD, DVD and add on cards.
2. Identify the Computer Name and Hardware Specification (RAM capacity, Processor type, HDD, 32bit/ 64 bit)
3. Identify and troubleshoot the problems of RAM, SMPS and motherboard
4. Configure BIOS settings- disable and enable USB and LAN
5. Adding additional RAM to the system. (expanding RAM size).
6. To Study motherboard layout of a system.
7. Demonstrate the assembly of a PC
8. Demonstration of various ports: CPU, VGA port, PS/2 (keyboard, mouse), USB, LAN, Speaker, Audio.
9. Install and configure windows OS
10. To study the installation of Printer and troubleshooting

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SOFTWARE:

1. Verify logic behavior of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates.
2. To study and verify NAND as a Universal Gate
3. To verify De-Morgan's theorem for 2 variables
4. Design and test of an S-R flip-flop using NAND/NOR gate.
5. Convert BCD to Excess-3 code using NAND gate
6. To Convert Binary to Grey Code
7. Verification of Truth Tables of J-K Flip-Flop using NAND/NOR gate
8. Realize Decoder and Encoder circuit using Basic Gates.
9. Design and implement the 4:1MUXusinggates.
10. Implementation of 4-Bit Parallel Adder Using7483IC.
11. Design and verify operation of half adder and full adder.
12. Design and verify operation of half subtractor.
13. Design and implement a 4bitshift register using Flip flops.
14. Implement Boolean function using logic gates in both SOP and POS
15. Design and implement a 4bit synchronous counter.
16. Design and verify 4bit asynchronous counter

Course Outcomes: By the end of the course, the students will be able to,

BCA142P.CO1: Identify hardware, check system specifications, troubleshoot problems, configure BIOS, and upgrade memory.
BCA142P.CO2: Troubleshoot and configure hardware settings including BIOS, RAM upgrades, USB, LAN, and peripheral installations.
BCA142P.CO3: Acquire the ability to practical skills in testing logic gates, designing flip-flops, and analyzing basic digital circuits.
BCA142P.CO4: Develop hands-on skills in designing, implementing, and testing combinational and sequential digital circuits using logic gates and ICs.

CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA142P.CO1	3	2	2	3	1	1	1	2	1	2
BCA142P.CO2	3	3	3	3	2	1	1	3	2	2
BCA142P.CO3	3	3	2	2	1	1	1	2	1	2
BCA142P.CO4	3	3	3	3	2	1	1	3	2	3

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester I

Course: Programming in C
Course Code: BCA143

Hour (45 Hrs.)/**Week:** 3 PPW
Credits: 3

Course Objectives: The objectives of this course are,

1. Explain fundamental concepts of computer systems and C programming, including data types, variables, expressions, and operators.
2. Apply control structures, functions, and recursion to develop logical and structured C programs.
3. Apply arrays and preprocessor directives to implement efficient searching and sorting algorithms.
4. Analyze and apply pointers, dynamic memory allocation, and strings in programming.
5. Implement structures, unions, and file operations for organized and persistent data handling.
6. Design and develop efficient, modular, and maintainable C programs for real-world applications.

UNIT–I

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, System Development, Flow charting. **Introduction to C Language**: Background, C Programs (Structure, comments), Identifiers, Data Types, Variables, Constants, Input / Output Statements. Expressions, Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.
Selection – Making Decisions: Logical Bitwise Operators, Logical Data and Operators-Evaluating Logical Expression, Comparative Operators. Two-Way Selection - Simplifying If, If-Else, Switch Statement and Examples. **(Book 1: Chapters - 1, 2, 3, 5, 13, Book 2 - Appendix C)**

UNIT–II

Repetition: Concept of a Loop, Pretest and Post-test Loop, Initializing and Updating. Loops in C - While, For, Do-While and Examples. Continue, Break statements.
Functions: Functions in C, User-Defined Functions, Inter-Function Communication, Scope (Global and Local). Recursion – Recursive Definition, Designing Recursive Functions. **Storage Classes:** Auto, Register, Static, Extern, Type Qualifiers(constant). **(Book 1: Chapters - 4, 6, 14, Appendix: E)**

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UNIT–III

Preprocessors: Preprocessor Commands: File inclusion, Macro definition- coding defined constants.

Arrays: Concepts, Using Arrays in C, Inter-Function Communication (Passing Arrays to Function), Linear and Binary Search, Selection and Bubble Sort, Two-Dimensional Arrays. - Declaration, Passing a Two-Dimensional Array.

(Book 1: Chapter - 8, Appendix: B)

UNIT–IV

Pointers: Pointer Declaration and Definition, Initialization of Pointer Variable, Pointers for Inter-Function Communication (Passing Address), Pointers to Pointers, Compatibility (Pointer Size Compatibility), Arrays and Pointers, Pointer Arithmetic and Arrays (Pointer and 1D Array, Arithmetic operator on pointer), Pointers to void.

Memory Allocation Functions: malloc, calloc, realloc, free.

Strings: Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions.

(Book 1: Chapters - 9, 10, Appendix: D)

UNIT–V

Structures: Structures Type Declaration and Initialization, Accessing Structures, Nested Structures (Declaration and Initialization), Arrays of Structures, Structures and Functions (Passing Structure Members to Functions), Unions (Referencing and Initializer, Type Definition (typedef), Enumerated Types.

Text Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/Output Functions, Character Input/Output Functions.

(Book 1: Chapter - 7, Book 2: Chapter - 11)

Course Outcomes: By the end of the course, the students will be able to,

BCA143.CO1: Understand basic computer concepts and construct simple C programs using data types, variables, operators, expressions, and conditional statements.

BCA143.CO2: Apply control structures such as decision-making and loops, and develop modular programs using functions and recursion.

BCA143.CO3: Implement arrays and utilize preprocessor directives to solve computational problems including searching and sorting algorithms.

BCA143.CO4: Analyze and apply pointers, dynamic memory allocation, and string handling techniques in solving real-time programming problems.

BCA143.CO5: Develop structured programs using structures, unions, and file handling techniques for efficient data storage and retrieval.

BCA143.CO6: Design, debug, and optimize C programs by applying logical thinking, modular programming principles, and best coding practices...

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Books:

1. B.A. Forouzan, Hassan Afyouni, Ed. D., A Structured Programming Approach in C, 4th Edition, Cengage Learning, 2023.
2. B.A. Forouzan and R.F. Gilberg, A Structured Programming Approach using C, 3rd Edition, Cengage Learning, 2019.
3. Kernighan BW and Ritchie DM, The C Programming Language, 2nd Edition, Prentice Hall of India, 2006.
4. Rajaraman V, The Fundamentals of Computer, 4th Edition, Prentice-Hall of India, 2006.

CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA143.CO1	3	2	1	2	2	1	1	1	1	2
BCA143.CO2	3	3	1	2	2	1	1	2	2	2
BCA143.CO3	3	3	1	3	2	1	1	2	2	2
BCA143.CO4	3	3	1	3	2	1	1	2	2	2
BCA143.CO5	3	3	1	3	2	1	1	2	2	2
BCA143.CO6	3	3	1	3	3	2	1	2	2	3

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester I

Course: Programming in C Lab
Course Code: BCA143P

Hour (60 Hrs.)/**Week:** 4 PPW
Credits: 2

Course Objectives: The objectives of this course are,

1. To develop basic programming skills using operators, control statements, and functions in C.
2. To enable problem-solving using arrays, recursion, and mathematical computations.
3. To introduce advanced concepts such as pointers, strings, and structures for efficient data handling.
4. To develop practical skills in file handling, command-line arguments, and modular program design.

Programs:

1. **Write programs on Operators in C**
   a. Assignment operator
   b. Arithmetic
   c. Logical
   d. Bitwise
   e. Ternary operators

2. **Implementation of Control Statements in C**
   a. Roots of a Quadratic Equation
   b. Reversing digits
   c. Finding sum of digit
   d. Printing multiplication tables
   e. Armstrong numbers
   f. Checking for prime
   g. Conversion of Decimal to Octal, Hexa and Vice versa
   h. Demonstrate Break, Continue and goto Statements

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3. **Programs on Functions in C**
    a. Illustrate any 3 functions under math.h and Random Numbers
    b. Create a user defined function to calculate square and cube of given number.
    c. Recursion:
        - Factorial
        - Fibonacci
        - GCD

4. **Programs on 1D arrays: Demonstrate the following on a given set of numbers**
    a. Maximum,
    b. Minimum,
    c. Average
    d. Reversing an array

5. **Demonstrate the following operations on a square matrix.**
    a. Matrix addition
    b. Multiplication
    c. Transpose.

6. **Write a C Program to create and display a Multidimensional Array.**
7. **Operations on Strings in C**
    a. String Inputting and Outputting
    b. String Manipulation functions
    c. Finding the No. of characters, words and lines of given text

8. **Programs on Pointers in C**
    a. Declare and initialize the pointer variable
    b. Array of Pointers
    c. Pointers to Functions
    d. Pointers to pointer

9. **Write a C program to accept and display Command-line Arguments**

10. **Demonstrate the following programs:**
    a. Create an employee structure
    b. Create Pointers to Structures
    c. Create a Self-Referential Structures
    d. Demonstrate Unions
    e. Demonstrate ENUM

11. **Write a C program to store student details in a file and generate a formatted student memo.**

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12. Case Study: Banking System

Develop a menu-driven C program to perform basic banking operations such as deposit, withdrawal, and balance inquiry. The program should allow users to deposit and withdraw money, display the current balance, and ensure sufficient balance before withdrawal.

13. Case Study: Student Record Management System

Develop a C program to manage student records using structures and file handling. The program should support adding, displaying, searching, and updating student details (ID, Name, Marks) using pointers and strings.

Course Outcomes: By the end of the course, the students will be able to,

BCA143P.CO1: Apply arithmetic, logical, bitwise, and ternary operators along with control flow constructs to develop C programs.

BCA143P.CO2: Implement mathematical computations, pattern generation, and recursion to solve programming problems.

BCA143P.CO3: Analyze and manipulate arrays, pointers, and matrices to perform data processing operations.

BCA143P.CO4: Develop C programs using strings, structures, command-line arguments, and file handling for real-world applications.

CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA143P.CO1	3	3	1	2	2	1	1	2	2	2
BCA143P.CO2	3	3	1	2	2	1	1	2	2	2
BCA143P.CO3	3	3	1	3	2	1	1	2	2	2
BCA143P.CO4	3	3	1	3	3	2	1	2	2	3

1- Low Correlation 2- Medium Correlation 3- High Correlation

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester I

Course: Web Technologies
Course Code: BCA144

Hour (45 Hrs.)/**Week:** 3 PPW
Credits: 3

Course Objectives: The objectives of this course are,

1. To introduce HTML5 fundamentals, tags, forms, and web page structure.
2. To explain CSS3 syntax, selectors, styles, and box model.
3. To teach responsive web design using media queries and grid systems.
4. To introduce JavaScript for dynamic and interactive web development.
5. To provide knowledge of TypeScript including interfaces, classes, and modules.
6. To develop practical skills in version control, debugging, and deployment.

UNIT–I

Introduction: World Wide Web, Web-Browsers, Web-Servers, BOM, DOM, HTTP.
HTML5: Introduction, HTML5 Tags, Document Type Definition, HTML Element, Head, Title, Meta and Body Elements, Heading Elements, Paragraph Element, Line Break Element, Blockquote Element, Structural Elements, Lists (Ordered, Unordered and Description List), Hyperlinks, Images, Tables, Creating Forms, Styling Forms. Id vs Class elements.
(Book 1: Chapters - 1, 2, Book 2: Chapter - 2)

UNIT–II

CSS3- Basics: Need and Benefit of CSS3, CSS3 Syntax, Comments, Including CSS3 in HTML Documents, Levels of Style Sheet (Inline, Embedded and External Style Sheets).
CSS3- Selectors: Universal Selector, Element Type Selector, Id Selectors, Class Selectors, Group Selectors.
CSS3-Styles: CSS Color, CSS Background, CSS Fonts, CSS Text, CSS Links, CSS List, CSS Tables.
CSS3-Box Model: Margin, Padding, Border, Outline, Visibility, Display, Multiple Columns.
(Book 1: Chapter - 3)

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UNIT–III

Responsive Web Design (RWD): Introduction, Viewport, Creating Responsive Websites, Responsive Images, Responsive Texts.

RWD-Media Queries: Introduction, Media Types, Device Breakpoints.

RWD-Grid View: Introduction, Grid-Row, Grid-Column.

(Book 3: Chapters – 1, 2, 3, 4)

UNIT–IV

Introduction to JavaScript, JavaScript and Forms, Variables, Functions, Operators, Conditional Statements and Loops, Arrays, DOM Methods, Strings, JavaScript Closures (Local and Global Variable), JSON. Events Handling (Mouse Events, Keyboard Events).

(Book 1: Chapter - 4)

UNIT–V

Introduction to TypeScript - Overview of Typescript, Interface, Classes, Functions – Function Declaration and Expression, Parameter Types (Required, Optional, Default, Rest), Arrow Functions, Generics, Enums, Adv Types, Modules, JSX Overview.

(Book 4: Chapters – 1, 3, 4, 13)

Course Outcomes: By the end of the course, the students will be able to,

BCA144.CO1: Create structured web pages using HTML5 elements and semantic tags.
BCA144.CO2: Apply CSS3 for styling and layout using selectors and box model.
BCA144.CO3: Design responsive web layouts using media queries and grid systems.
BCA144.CO4: Implement interactivity using JavaScript, DOM, events, and JSON.
BCA144.CO5: Build web applications using TypeScript features like classes and interfaces.
BCA144.CO6: Use version control, debugging, and deployment for web projects.

Books:

1. Robert W. Sebesta, Programming the World Wide Web, 8th Edition, Pearson, 2021.
2. Terry Felke-Morris, Web Development and Design Foundations with HTML5, 10th Edition, Pearson, 2022.
3. Ethan Marcotte, Responsive Web Design, 2nd Edition, A Book Apart, 2014.
4. Yakov Fain and Anton Moiseev, TypeScript Quickly, 1st Edition, Manning Publications, 2020.
5. Zak Ruvalcaba, Anne Boehm, and Mary Delamater, Murach's HTML and CSS, 6th Edition, Murach Books, 2024.
6. Jurgen Wolf, HTML and CSS – The Comprehensive Guide, 1st Edition, SAP Press, 2023.
7. Ben Frain, Responsive Web Design with HTML5 and CSS, 5th Edition, Packt Publishing, 2025.

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CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA144.CO1	3	2	2	1	1	1	1	1	1	1
BCA144.CO2	3	2	2	2	1	1	1	1	1	1
BCA144.CO3	2	2	2	3	1	1	1	1	1	1
BCA144.CO4	2	3	3	2	1	1	1	1	1	1
BCA144.CO5	3	3	3	3	1	1	1	2	1	2
BCA144.CO6	3	2	3	3	1	1	1	2	1	2

1- Low Correlation 2- Medium Correlation 3- High Correlation

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester I

Course: Web Technologies Lab
Course Code: BCA144P

Hour (60 Hrs.)/**Week:** 4 PPW
Credits: 2

Course Objectives: The objectives of this course are,

1. To impart knowledge on the usage of HTML, JavaScript, and Web Graphics.
2. To demonstrate the concepts of Cascading Style Sheets (CSS) for designing web pages.
3. To implement JavaScript concepts such as DOM manipulation and event handling to create interactive web pages.
4. To apply the concepts of TypeScript for developing structured and scalable web applications.

Programs:

1. Create a Webpage Layout using Semantic Elements.
2. Add Audio and Video Element to a Webpage.
3. Drawing 2D Graphics using Canvas.
4. Create and Format Tables in HTML.
5. Create an HTML Form with Different Input Types.
6. Demonstrate Placeholder, Inline and Block Elements.
7. Styling Text and Fonts using CSS3 Properties.
8. Styling Lists and Links using CSS3 Properties.
9. Styling Tables using CSS3 Properties.
10. Styling Webpage Backgrounds using CSS3 Properties.
11. Demonstrate CSS Box Model.
12. Create a Responsive Webpage using Media Queries.
13. Demonstrate Form Validation using JavaScript.
14. Demonstrate DOM Methods.
15. Demonstrate HTML Events.
16. Demonstrate Modern JavaScript Features (let, const, arrow functions, template literals).
17. Display JSON Data using JavaScript (Static Data).
18. Write TypeScript Programs to Demonstrate Basic Types, Functions and Interfaces.
19. Write TypeScript Programs using Classes and Generics.
20. Develop a Mini Responsive Web Application integrating HTML, CSS, and JavaScript.

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21. Develop a Responsive Online Food Ordering Website.
22. Develop a Simple Quiz Application.

Course Outcomes: By the end of the course, the students will be able to,

BCA144P.CO1: Develop simple web programs using HTML, JavaScript, and web graphics.
BCA144P.CO2: Apply the concepts of Cascading Style Sheets (CSS), event handling, and TypeScript.
BCA144P.CO3: Design and develop structured and responsive web pages using HTML5 elements and CSS3 properties.
BCA144P.CO4: Implement JavaScript and TypeScript programs to create interactive web applications.

CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA144P.CO1	3	3	3	3	1	1	1	1	1	2
BCA144P.CO2	3	3	3	3	1	1	1	1	1	2
BCA144P.CO3	3	3	3	3	1	1	1	1	1	2
BCA144P.CO4	3	3	3	3	1	1	1	1	1	2

1- Low Correlation 2- Medium Correlation 3- High Correlation

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester I

Course: Effective Communication
Course Code: BCA145

Hour (45 Hrs.)/**Week:** 3 PPW
Credits: 3

Course Objectives: The objectives of this course are,

1. to foster vocabulary skills and grammar proficiency
2. to enhance personal effectiveness and enable personality development
3. to strengthen verbal and non-verbal communication
4. to highlight the significance of LSRW skills and develop proficiency in writing and comprehension
5. to enable understanding of India's intellectual, cultural and scientific heritage
6. to promote effective cross-cultural communication and foster employability skills

UNIT-I

Effective Communication: Role and importance of communication; Features of human communication; Process of communication; Barriers to communication; Oral and Written Communication; Importance of listening, speaking, reading, and writing; Types of communication: Verbal – formal versus informal communication, one-way versus two-way communication, Non-Verbal communication.
(Books 1, 4, 5 & 7)

UNIT-II

Personality Development and Interpersonal Communication: Models of interpersonal development, Johari window, Knapp's model, Styles of communication, Time management, Emotional Quotient, Teamwork, Persuasion techniques.
(Books 1, 2, 5 & 7)

UNIT-III

Remedial English: Tenses, Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés. (Note: The focus is on appropriate usage)
(Books 1, 2, 3, 5 & 7)

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UNIT-IV

Vocabulary Building and Written Communication: Roots and affixes; Words often confused: Homonyms, Homophones, Homographs; One-word substitutes; Idiomatic usage: Idioms, Phrases, Phrasal Verbs; Synonyms; Antonyms; Paragraph writing; Précis writing; Essay writing; Official letters; E-mail etiquette; Technical report writing: Feasibility and Progress reports.

(Books 1, 2, 3, 4, 5 &7)

UNIT-V

Reading Comprehension: Passages on Indian Knowledge Systems - Educating Sciences of Life and Mind: Nature and Consciousness, Modern medicine and Indian wisdom: Mind and disease, Ayurveda as a knowledge system: Changing perceptions on the nature of Ayurveda, Social organization of knowledge in India - Folk and Classical Traditions: Creativity at the Grass Roots, Agriculture and Trade in India: Agriculture, Vision of Disaster Management in Kautilya's Arthasastra: Managing Flood and Managing Epidemic (Note: No descriptive questions to be set from this unit and only Reading Comprehension/s from unseen passages should be set in the Examination Question Papers)

(Book 6)

Course Outcomes: By the end of the course, the students will be able to,

BCA145.CO1: Apply language skills in academic, professional and everyday communication

BCA145.CO2: Exhibit self-awareness and positive behaviour in social and professional settings

BCA145.CO3: Demonstrate intrapersonal and interpersonal skills

BCA145.CO4: Display creativity, analytical thinking and employment readiness

BCA145.CO5: Apply insights from IKS in modern contexts

BCA145.CO6: Attain professional capability, social adaptability and readiness for diverse workplaces and globalized professional environments

Books:

1. E. Suresh Kumar, Engineering English, Orient Black Swan, 2014.
2. Board of Editors, Language and Life - A Skills Approach, Orient Black Swan, 2018.
3. Michael Swan, Practical English Usage, 4th Edition, Oxford University Press, 2017.
4. M Ashraf Rizvi and Priyadarshi Patnaik, Effective Technical Communication, 3rd Edition, McGraw Hill, 2024.
5. Meenakshi Raman and Sangeeta Sharma, Technical Communication: Principles and Practice, 4th Edition, Oxford University Press, 2022.
6. Kapil Kapoor and Awadhesh Kumar Singh, Indian Knowledge Systems: Vol. 1, Indian Institute of Advanced Study, Shimla and DK Printworld (P) Ltd. 2005.
7. C. Muaralikrishna and Sunita Mishra, Communication Skills for Engineers, 2nd Edition, Pearson, 2011

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CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA145.CO1	3	1	1	1	3	1	1	1	3	3
BCA145.CO2	1	1	3	2	3	3	3	2	3	3
BCA145.CO3	3	2	3	3	3	3	3	3	3	3
BCA145.CO4	3	3	3	3	3	3	3	3	3	3
BCA145.CO5	3	2	3	2	2	3	3	2	2	3
BCA145.CO6	3	3	3	3	3	3	3	3	3	3

1- Low Correlation 2- Medium Correlation 3- High Correlation

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester II

Course: Probability and Statistics
Course Code: BCA241

Hour (45 Hrs.)/**Week:** 3 PPW
Credits: 3

Course Objectives: The objectives of this course are,

1. To perceive the basic concepts in Statistics.
2. Calculate and interpret the various descriptive measures of centrality and dispersion.
3. Basic concepts of probability theory and apply concepts of various discrete and continuous probability distributions to various problems.
4. To explain the concepts of random variables and Probability Distributions.
5. The concept of association between two variables and forecasting future values using regression equations.
6. To understand the principles of hypothesis testing and apply small sample tests like t-test, F-test, and Chi-Square test for statistical inference.

UNIT-I

Introduction: Importance of Statistics, Concepts of Statistics, Population and a Sample; Quantitative and Qualitative Data; Collection of Primary and Secondary Data; Classification and Tabulation of Data. Construction of Univariate and Bivariate Frequency Distribution, Diagrammatic and Graphical Representation of Data.
(Book 1: Chapters - 1, 2, 14)

UNIT-II

Descriptive Statistics: Measures of Central Tendency: Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean; **Measures of Dispersion**: Range, Quartile Deviation, Mean Deviation, Standard Deviation. Definition of Moments; **Measures of Skewness**: Karl Pearson's Coefficient of Skewness, Bowley's Coefficient of Skewness; Kurtosis
(Book 1: Chapter - 2)

UNIT-III

Probability: Basic Terminology, Mathematical Probability, Statistical Probability, Axiomatic Approach to Probability, Addition Theorem of Probability, Conditional Probability, Multiplication Theorem of Probability, Independent Events, Pairwise/Mutually Independent Events, Bayes' Theorem (Concepts and Problems).
(Book 1: Chapters – 3, 4)

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UNIT-IV

Random Variable: Definition of a Random Variable, Discrete and Continuous Random Variables, Functions of Random Variables, Probability Mass Function, Probability Density Function, Mathematical Expectation of a Random Variable, and Properties of Expectation. **Probability Distributions:** Binomial, Poisson, and Normal Distribution (Concepts and Problems).

(Book 1 - Chapters - 5, 6, 8, 9)

UNIT-V

Correlation and Regression Analysis: Definition of Correlation, Scatter Diagram, Karl Pearson's Coefficient of Correlation; Partial and Multiple Correlation Coefficients (for three variables); Definition of Regression, Simple Linear Regression (for two variables). **Small Sample Tests:** Basic Definitions of Testing of Hypothesis; **t-Test:** t-test for Single Mean, t-test for Difference of Means, Paired t-test. **F-Test:** F-test for Equality of Two Population Variances. **CHI-SQUARE Test:** Test for Single Variance (Population Variance) and Test of Independence of Attributes.

(Book 1: Chapters - 10, 11, 12, 15, 16)

Course Outcomes: By the end of the course, the students will be able to,

BCA241.CO1: Develop skills in presenting quantitative and qualitative data using appropriate diagrams, tabulations, and the construction of frequency distributions

BCA241.CO2: Acquire knowledge of various type of data, their organization, and evaluation of summary measures such as measures of central tendency and dispersion.

BCA241.CO3: Calculate probabilities by applying probability laws and theoretical results, knowledge of important discrete and continuous distributions, and their interrelations with real-time applications.

BCA241.CO4: Acquire knowledge of random variables and probability distributions.

BCA241.CO5: Compute and interpret Correlation Analysis, regression lines, and multiple regression Analysis

BCA241.CO6: Formulate and evaluate statistical hypotheses using small sample tests, including t-test, F-test, and Chi-Square test, to draw valid conclusions about population parameters.

Books:

1. S.C. Gupta and V.K. Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, 2020.
2. A.M. Gun, M.K. Gupta, B.Dasgupta, "Fundamentals of Statistics", Vol. I, The World Press Pvt. Ltd., Kolakota.
3. William Mendenhall, Robert J. Beaver, Barbara M. Beaver, "Introduction to Probability and Statistics", 11th Edition, Thomson Brooks / Cole, 2003.
4. Richard A. Johnson, "Probability and Statistics for Engineers", 7th Edition, Prentice Hall of India, 2005.

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Osmania University,
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CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA241.CO1	3	2	1	2	3	1	1	2	1	2
BCA241.CO2	3	3	2	2	2	1	1	2	1	2
BCA241.CO3	3	3	3	2	2	1	1	3	1	2
BCA241.CO4	3	3	2	3	2	1	1	2	1	2
BCA241.CO5	3	3	3	3	2	1	1	3	2	2
BCA241.CO6	3	3	3	3	2	2	1	3	2	3

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester II

Course: Data Structures
Course Code: BCA242

Hour (45 Hrs.)/**Week:** 3 PPW
Credits: 3

Course Objectives: The objectives of this course are,

1. Understand fundamental concepts of data structures, algorithm analysis, and array operations, including searching and sorting techniques.
2. Learn dynamic data structures such as linked lists and their applications, along with hashing and collision resolution methods.
3. Study stack and queue data structures, their implementations, and applications in expression evaluation and problem-solving.
4. Understand recursion concepts and solve computational problems using recursive techniques.
5. Learn tree data structures, including binary trees, BSTs, and self-balancing AVL trees, along with their operations.
6. Understand graph representations and apply traversal algorithms such as BFS and DFS.

UNIT-I

Introduction to Data Structures: Introduction and Overview - Definition, Classification, and Operations of Data Structures, Algorithms - Complexity, Time-Space Trade-off.
Arrays: Definition and Classification of Arrays, Storing values in an Array. Operations - Traversing, Inserting, Deleting, Searching, Merging.
Searching: Linear Search, Binary Search, Comparison of Methods.
Sorting: Bubble Sort, Selection Sort, Insertion Sort, Two-Dimensional Arrays, Representation in Memory, Matrices and Sparse Matrices, Multi-Dimensional Arrays.
(Book 1: Chapters – 2, 3, 14)

UNIT-II

Linked Lists: Definition, Comparison with Arrays, Representation, Types: Singly Linked List, Doubly Linked List, Circular Linked List, Operations - Traversing, Inserting, Deleting, Searching.
Applications of Linked Lists: Addition of Polynomials.
Hashing and Collision: Hashing, Hash Tables, Hash Functions, Collision and Resolution Methods - Open Addressing, Chaining.
(Book 1: Chapters – 6, 15)

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UNIT-III

Stacks: Definition, Representation using Arrays and Linked Lists, Operations and Applications - Arithmetic Expressions, Polish Notation, Infix to Postfix Conversion, Postfix Evaluation

Recursion: Definition, Recursive Notation, Runtime Stack, Applications - Factorial, GCD, Fibonacci Series, Towers of Hanoi

Queues: Definition, Representation using Arrays and Linked Lists, Types - Simple Queue, Circular Queue, Double-Ended Queue, Priority Queue, Applications of Queues.

(Book 1: Chapters – 7, 8)

UNIT-IV

Trees: Definition, Terminology, Types of Trees, Binary Trees, Traversing a Binary Tree: In-order, Pre-order, Post-order and Level-order Traversal.

Binary Search Tree (BST): Operations on Binary Search Tree - Searching for a node in a BST, Inserting a new node in a BST, Deleting a node from a BST, Determining the Height of a BST, Determining the number of nodes, Finding the mirror image of a BST, Finding the smallest, largest node in a BST.

AVL Trees: Operations on AVL Trees.

(Book 1: Chapters – 9, 10, 11)

UNIT-V

Graphs: Introduction, Graph Terminology, Directed Graphs, Terminology of a Directed Graph.

Representation of Graphs: Adjacency Matrix Representation, Adjacency List Representation, Adjacency Multi-List Representation.

Graph Traversal Algorithms: Breadth-First Search Algorithm, Depth-First Search Algorithm.

Minimum Spanning Tree Algorithms: Prim's Algorithm, Kruskal's Algorithm.

Shortest Path Algorithm: Dijkstra's Algorithm.

(Book 1: Chapter – 13)

Course Outcomes: By the end of the course, the students will be able to,

BCA242.CO1: Analyze algorithm efficiency and perform operations on arrays, including searching and sorting.

BCA242.CO2: Implement linked lists and apply hashing techniques for efficient data storage and retrieval.

BCA242.CO3: Apply stacks and queues to solve problems such as expression evaluation and scheduling.

BCA242.CO4: Use recursion effectively to solve mathematical and computational problems.

BCA242.CO5: Implement tree structures, including BSTs and AVL trees, and perform their operations.

BCA242.CO6: Represent graphs and apply BFS and DFS algorithms for traversal and problem-solving.

Books:

1. Reema Thareja, "Data Structures Using C", 3rd Edition, Oxford University Press, 2023.
2. R.B. Patel, "Expert Data Structures with C", Khanna Book Publishing Company, 2023. (AICTE Recommended Textbook)
3. Yashwant Kanetkar, "Data Structures Through C", 4th Edition, BPB Publications, 2022.
4. Seymour Lipschutz, "Data Structures with C", Schaum's Outlines, Tata McGraw-Hill, 2011.
5. Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press, 2007.

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Suggested Links:

1. https://ds1-iiith.vlabs.ac.in/
2. https://ds2-iiith.vlabs.ac.in/
3. https://nptel.ac.in/courses/106102064

CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA242.CO1	3	2	1	3	1	1	1	1	1	2
BCA242.CO2	3	2	2	3	1	1	1	2	1	2
BCA242.CO3	3	3	2	3	1	1	1	2	1	2
BCA242.CO4	3	3	3	3	1	1	1	2	1	2
BCA242.CO5	3	3	3	3	1	1	1	3	1	3
BCA242.CO6	3	3	2	3	1	2	2	2	1	2

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Bharatiya Vidya Bhavan

Bhavan's Vivekananda College

of Science, Humanities & Commerce
Sainikpuri, Secunderabad
Autonomous College - Affiliated to Osmania University
Reaccredited with 'A' grade by NAAC

Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester II

Course: Data Structures Lab
Course Code: BCA242P

Hour (60 Hrs.)/**Week:** 4 PPW
Credits: 2

Course Objectives: The objectives of this course are,

1. Understand fundamental data structures such as arrays, linked lists, stacks, queues, trees, and their operations through practical implementation.
2. Develop problem-solving skills by implementing searching, sorting, and recursion-based algorithms.
3. Analyze and compare different data structure techniques for efficient data storage, retrieval, and manipulation.
4. Apply data structures to real-world scenarios such as playlist management and social media networks using appropriate models like arrays and trees.

Programs:

1. Write a program to search for an element in an array using Linear Search
2. Write a program to search for an element in an array using Binary Search.
3. Write a program to sort an array using Bubble Sort
4. Write a program to sort an array using Selection Sort
5. Write a program to sort an array using Insertion Sort.
6. Write a program to insert an element into a Singly Linked List:
   (a) At the beginning
   (b) At the end
   (c) At a specified position
7. Write a program to delete an element from a Singly Linked List:
   (a) At the beginning
   (b) At the end
   (c) A specified element
8. Write a program to perform the following operations in a Doubly Linked List:
   (a) Create
   (b) Search for an element
9. Write a program to perform the following operations in a Circular Linked List:
   (a) Create
   (b) Delete an element from the end
10. Write a program to implement stack operations using an array.

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11. Write a program to implement stack operations using a linked list.
12. Write a program to evaluate a postfix expression using a stack.
13. Write a program to implement simple queue operations using an array.
14. Write a program to implement circular queue operations using an array.
15. Write a program to implement circular queue operations using a linked list.
16. Write a program to perform the following operations on a Binary Search Tree:
    (a) Preorder Traversal
    (b) Inorder Traversal
    (c) Postorder Traversal
17. Write a program to perform insertion operation in a Binary Search Tree.
18. Write a program to perform Breadth-First Search (BFS) traversal of a graph.
19. Write a program to perform Depth-First Search (DFS) traversal of a graph.
20. Write a program to find Minimum Spanning Tree using Prim's Algorithm.

Case Studies:

21. A music streaming chatbot maintains a playlist of songs. Initially, the playlist contains the following songs:
["Song A", "Song B", "Song C", "Song D"]
The system needs to perform the following operations:
- Add a new song at the beginning
- Delete a song from the middle
- Display all songs

Explain how the playlist is implemented using an Array.
Perform the following operations using arrays:
- Insert "Song X" at the beginning
- Delete "Song C"
- Explain the limitations of arrays in this scenario.

22. An AI system represents followers of a user on Instagram in a hierarchical tree:
- Root = Main user
- Children = Direct followers
- Sub-children = Followers of followers

i. Draw a tree representing this hierarchy.
ii. Define:
    a. Root
    b. Parent
    c. Child
    d. Leaf Nodes

Course Outcomes: By the end of the course, the students will be able to,

BCA242P.CO1: Implement basic data structures and operations including arrays, linked lists, stacks, queues, and trees.
BCA242P.CO2: Apply searching and sorting algorithms to solve computational problems efficiently.
BCA242P.CO3: Design and develop programs using recursion and advanced data structures like binary search trees and linked structures.
BCA242P.CO4: Analyze real-world problems and select suitable data structures to provide optimized solutions (e.g., Playlist Management, Hierarchical Social Networks)

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CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA242P.CO1	3	3	2	3	1	1	1	2	2	2
BCA242P.CO2	3	3	3	3	1	1	1	3	2	2
BCA242P.CO3	3	3	3	3	1	1	1	3	2	3
BCA242P.CO4	3	3	3	2	2	2	1	3	3	3

1- Low Correlation 2- Medium Correlation 3- High Correlation

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester II

Course: Operating Systems
Course Code: BCA243

Hour (45 Hrs.)/**Week:** 3 PPW
Credits: 3

Course Objectives: The objectives of this course are,

1. To explain basic OS concepts, structures, services, and system architectures.
2. To understand process management, threads, scheduling, and inter-process communication.
3. To learn synchronization techniques, classical problems, and deadlock handling methods.
4. To describe memory management, paging, virtual memory, and replacement algorithms.
5. To understand file systems, I/O systems, disk scheduling, and storage structures.
6. To analyze protection mechanisms, access control, authentication, and basic cryptography.

UNIT-I

Introduction: What Operating Systems do- User View, System View, Defining Operating Systems, Computer -System Architecture- Single Processor Systems, Multiprocessor Systems, Clustered Systems

Operating System Structures: Operating-System Services, System Calls (Introduction), Operating System Structure- Monolithic Structure, Layered Approach, Microkernels, Modules.

Process: Process Concept- The Process, Process State, Process Control Block, Threads, Process Scheduling- Scheduling Queues, CPU Scheduling, Context Switch, Operations on Processes- Process Creation, Process Termination, Inter-process Communication.

Threads: Overview- Motivation, Benefits

CPU Scheduling: Basic Concepts- CPU-I/O Burst Cycle, CPU Scheduler, Scheduling Criteria, Scheduling Algorithms- First-Come First Serve Scheduling, Shortest-Job Scheduling, Round-Robin Scheduling, Priority Scheduling.

(Book 1: Chapters – 1, 2, 3, 4, 5)

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UNIT-II

Process Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Semaphores, Monitors- Monitor Usage

Synchronization Examples: Classic Problems of Synchronization- The Bounded-Buffer Problem, The Readers-Writers Problem, The Dining Philosophers Problem

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

(Book 1: Chapters – 6, 7, 8)

UNIT-III

Main Memory: Background- Basic Hardware, Contiguous Memory Allocation, Paging- Basic Method, Structure of the Page Table- Hierarchical Paging, Hashed Page Tables, Inverted Page Tables, Swapping- Standard Swapping, Swapping with Paging, Swapping on Mobile Systems.

Virtual Memory: Background, Demand Paging- Basic Concepts, Page Replacement- Basic Page Replacement, FIFO Page Replacement, Optimal Page Replacement, LRU Page Replacement, Allocation of Frames- Minimum Number of Frames, Allocation Algorithms, Thrashing- Cause of Thrashing.

Mass-Storage Structure: Overview of Mass-Storage Structure- Hard Disk Drives, HDD Scheduling- FSFC Scheduling, SCAN Scheduling, C-SCAN Scheduling, Storage Device Management- Drive Formatting, Partitions, and Volumes, Boot Block, Bad Blocks, Storage Attachment- Host Attached Storage, Network Attached Storage, Cloud Storage, Storage-Area Networks and Storage Arrays, RAID Structure- RAID Levels (RAID 0, RAID 1, RAID 0+1 and 1+0)

(Book 1: Chapters – 9, 10, 11)

UNIT-IV

I/O Systems: Overview, Application I/O Interface, Kernel I/O Subsystem- I/O Scheduling, Buffering, Caching, Spooling and Device Reservation, Error Handling, Transforming I/O Requests to Hardware Operations.

File-System Interface: File Concept- File Attributes, File Operations, File Types, File Structure, Internal File Structure, Access Methods, Directory Structure- Single-Level Directory, Two-Level Directory, Tree-Structured Directories, Acyclic-Graph Directories, Protection- Types of Access, Access Control.

File-System Implementation: File-System Structure, File-System Operations-Overview, Usage, Directory Implementation- Linear List Hash Tables, Allocation Methods- Contiguous Allocation, Linked Allocation Indexed Allocation, Efficiency and Performance- Efficiency, Performance.

(Book 1: Chapters – 12, 13, 14)

UNIT-V

Security: The Security Problem, Program Threats- Malware, Code Injection, Viruses and Worms, System and Network Threats- Attacking Network Traffic, Denial of Service, Port Scanning, Cryptography as a Security Tool, (Encryption:Introduction to Symmetric and Asymmetric Encryption), User Authentication- Passwords, Password Vulnerabilities, Securing Passwords, One-Time Passwords, Biometrics.

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Protection: Goals of Protection, Principles of Protection, Domain of Protection- Domain Structure, Access Matrix, Implementation of the Access Matrix- Global Table, Access Lists for Objects, Capability Lists for Domains, A Lock-Key Mechanism, Revocation of Access Rights, Role Based Access Control, Mandatory Access Control.

(Book 1: Chapters – 16, 17)

Course Outcomes: By the end of the course, the students will be able to,

BCA243.CO1: Apply OS concepts and analyze process management and scheduling techniques.
BCA243.CO2: Implement synchronization methods and evaluate CPU scheduling algorithms.
BCA243.CO3: Apply deadlock prevention, avoidance, detection, and recovery techniques.
BCA243.CO4: Evaluate memory management methods including paging and virtual memory.
BCA243.CO5: Analyze file systems, disk scheduling, RAID, and I/O performance.
BCA243.CO6: Assess security threats and apply protection, authentication, and cryptography techniques

Books:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, 10th Edition, John Wiley and Sons Publication, 2023.
2. A. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education, 2008.
3. William Stallings, Operating Systems, 5th Edition, Pearson Education, 2005.
4. Ida M. Flynn, Understanding Operating Systems, 6th Edition, Cengage, 2011.
5. D. M. Dhamdhere, Operating Systems: A Concept-Based Approach, 2nd Edition, McGraw-Hill, 2007.

CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA243.CO1	3	2	2	2	1	1	1	1	1	2
BCA243.CO2	3	3	2	3	1	1	1	1	1	2
BCA243.CO3	3	3	3	2	1	1	1	2	1	2
BCA243.CO4	3	2	2	3	1	1	1	1	1	2
BCA243.CO5	2	2	2	3	1	1	1	1	1	2
BCA243.CO6	2	2	3	2	2	3	1	1	1	2

1- Low Correlation 2- Medium Correlation 3- High Correlation

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester II

Course: Operating Systems Lab
Course Code: BCA243P

Hour (60 Hrs.)/**Week:** 4 PPW
Credits: 2

Course Objectives: The objectives of this course are,

1. To familiarize the Unix shell commands.
2. To understand core operating system concepts such as system calls, process management, and input/output operations.
3. Explore inter-process communication (IPC) mechanisms, particularly pipe-based communication.
4. To demonstrate the implementation of CPU Scheduling and Page Replacement Algorithms.

I: Unix Shell Commands- mkdir, finger, d, ls, cat, touch, rmdir, man, pwd, mv, cp, rm, cut, cal, date, factor, who, whoami, finger, wc, sort, grep, head, tail, ps, more, banner, mail, write, wall, kill, nice.

II: System Calls, CPU Scheduling and Page Replacement Algorithms:

1. Process System Calls.
2. IO System Calls.
3. IPC using Pipe Processing.
4. First Come First Serve Scheduling.
5. Shortest Job first Scheduling.
6. Priority Scheduling.
7. Round Robin Scheduling.
8. Simulate Page Replacement Algorithms FIFO.
9. Simulate Page Replacement Algorithms LRU.
10. Write a C Program to simulate FCFS Disk Scheduling Algorithm.

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Course Outcomes: By the end of the course, the students will be able to,

BCA243P.CO1: Apply the Unix shell commands.
BCA243P.CO2: Demonstrate the use of system calls for process control and I/O operations in an operating system environment.
BCA243P.CO3: Implement IPC using pipes to enable communication between processes effectively.
BCA243P.CO4: Simulate the CPU Scheduling and Page Replacement algorithms.

CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA243P.CO1	2	2	1	3	2	1	1	1	1	2
BCA243P.CO2	3	2	2	3	1	1	1	1	1	2
BCA243P.CO3	2	2	3	3	1	1	1	1	2	2
BCA243P.CO4	3	3	3	3	1	1	1	2	1	2

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester II

Course: Object Oriented Programming Using Java
Course Code: BCA244

Hour (45 Hrs.)/**Week:** 3 PPW
Credits: 3

Course Objectives: The objectives of this course are,

1. To introduce the fundamentals of Java programming, object-oriented principles, and how Java differs from C/C++.
2. To provide understanding of arrays, strings, inheritance, interfaces, and inner classes in Java.
3. To teach robust programming using exception handling and multithreading features in Java.
4. To enable the development of GUI-based applications using Swing, AWT, and applets, along with event handling.
5. To introduce file handling mechanisms in Java.
6. To impart knowledge in generics, and collection frameworks for effective data manipulation in Java.

UNIT-I

Introduction to Java: The History and Evolution of Java: Java's Lineage - The Birth of Modern Programming: C, C++: The Next Step, Creation of Java. Introduction to JDK and JRE, Features of Java (The Java Buzzwords), The Primitive Types, The Scope and Lifetime of Variables, Operators, Control Statements.

Introducing Classes: Class Fundamentals, Declaring Objects, Introducing Methods, Constructors, Overloading Methods, Overloading Constructors, Using Objects as Parameters, Understanding Static, Introducing final, The Object class, Using Command-Line Arguments.

(Book 1: Chapters - 1, 2, 3, 4, 5, 6, 7)

UNIT-II

Arrays, Strings in Java: Arrays - One-Dimensional Arrays, Multidimensional Arrays, String Handling - The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String; StringBuffer, StringTokenizer, Wrapper Classes (Primitive Type Wrappers).

Inheritance, Interfaces and Packages in Java: Inheritance - Inheritance Basics, Defining Super / Sub Classes, Method Overriding, Using Abstract Classes, Packages, Access Protection, Interfaces.

(Book 1: Chapters - 3, 8, 9, 15, 16, 18, 21)

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UNIT-III

Exception Handling: Exception Handling Fundamentals, Using try and catch, throw, throws, Creating Your Own Exception Subclasses, Difference between Checked vs Unchecked Exceptions, Error Vs. Exception.

Multithreaded Programming: Creating a Thread - Extending a Thread, Thread Lifecycle (Obtaining a Thread's State), Synchronization, Deadlock.

(Book 1: Chapters - 10, 11)

UNIT-IV

GUI Design & Event Handling: The Applet Class, Applet Architecture, Applet Skeleton, Simple Applet Application.

Introducing AWT - Component, Container, AWT Controls, Layout Managers - FlowLayout, BorderLayout, GridLayout, Events, Listeners - ActionListener Interface, The KeyListener Interface, MouseListener Interface, ItemListener Interface.

Introducing Swings - Swing Features, Components and Containers, JLabel, JTextField, JButton, CheckBoxes, RadioButtons.

(Book 1: Chapters - 25, 26, 27, 32, 33, Book 3: Chapter - 22)

UNIT-V

File Handling: Streams Classes – Byte Stream Classes - InputStream, OutputStream, FileInputStream, FileOutputStream, Character Stream Classes - Reader and Writer Classes, File - Directories.

Generics: What are Generics, A Generic Class with Two Type Parameters, The General form of Generic Class, Creating a Generic method.

Collections Framework: Collection Interfaces - Collection Interface, List Interface, Set Interface and Collection Classes - ArrayList, LinkedList, Vector.

(Book 1: Chapters - 14, 20, 22)

Course Outcomes: By the end of the course, the students will be able to,

BCA244.CO1: Develop Java programs using classes, objects, constructors, method overloading, and basic control structures.

BCA244.CO2: Implement arrays, string manipulations, inheritance, interfaces, and inner classes to promote reusability and modular design.

BCA244.CO3: Write robust and concurrent Java programs using exception handling and multithreading techniques.

BCA244.CO4: Create interactive GUI applications using Swing components and manage events and applet-based interfaces.

BCA244.CO5: Perform file I/O operations in Java

BCA244.CO6: Apply generics and collection frameworks like ArrayList and LinkedList for data management.

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Books:

1. Herbert Schildt, Java The Complete Reference, 13th Edition, Tata McGraw Hill Publications, 2024.
2. E. Balaguruswamy, Programming with Java, 7th Edition, Tata McGraw-Hill, 2023.
3. Herbert Schildt, Java The Complete Reference, 8th Edition, Tata McGraw Hill Publications, 2011.
4. John R. Hubbard, Programming with Java, Schaum's outline Series, 2nd Edition, Tata McGraw-Hill, 2007.
5. Timothy Budd, Understanding Object Oriented Programming with Java, Updated Edition, Pearson Education, 2007.

Suggested Links

1. http://free.aicte-india.org/Java-Programming.php
2. https://nptel.ac.in/courses/106105191
3. https://docs.oracle.com/javase/tutorial/

CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA244.CO1	3	3	2	2	1	1	1	2	2	2
BCA244.CO2	3	3	3	2	1	1	1	3	3	3
BCA244.CO3	3	3	3	3	1	1	1	3	2	3
BCA244.CO4	3	3	3	2	1	1	1	3	3	3
BCA244.CO5	3	2	3	2	1	1	1	2	2	3
BCA244.CO6	3	2	3	2	1	1	1	2	2	3

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester II

Course: Object Oriented Programming Using Java Lab **Hour**(60Hrs.)**/Week:** 4 PPW
Course Code:BCA244P **Credits:** 2

Course Objectives: The objectives of this course are,

1. Understand the fundamental control structures in programming such as conditional and looping statements.
2. Explore object-oriented programming concepts including classes, objects, methods, constructors, and arrays.
3. Develop programs using inheritance, method overloading/overriding, and abstract classes.
4. Interpret exception handling, multithreading, interfaces, and Java GUI using AWT for robust Java applications.

Programs:

1. Programs on if-else, if-else-if.
2. Program on switch.
3. Program on while.
4. Program on for loop.
5. Program on do-while.
6. Program to demonstrate class concept.
7. Program to demonstrate methods.
8. Program to demonstrate method overloading
9. Program to demonstrate constructors
10. Program to demonstrate constructor overloading.
11. Program to demonstrate an Array.
12. Program to demonstrate multidimensional array.

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20. Program to demonstrate packages.
21. Program to demonstrate inner classes.
22. Program to demonstrate exceptional handling.
23. Program to demonstrate creating a thread by extending Thread class.
24. Program to demonstrate creating a thread by implementing Runnable interface.
25. Program to demonstrate AWT controls.
26. Program to demonstrate Color class.
27. Program to demonstrate Layout Manager.
28. Program to demonstrate Events and Event Listeners
29. Program to demonstrate Icon interface.
30. Program to demonstrate Applets.

Course Outcomes: By the end of the course, the students will be able to,

BCA244P.CO1: Write Java programs using basic control flow constructs like if-else, loops, and switch statements.

BCA244P.CO2: Apply object-oriented concepts to develop modular and reusable Java programs.

BCA244P.CO3: Demonstrate usage of arrays, strings, inheritance, and polymorphism in Java applications.

BCA244P.CO4: Implement Java features such as exception handling, threads, interfaces, and Java GUI using AWT effectively.

CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA244P.CO1	3	3	2	2	1	1	1	2	2	3
BCA244P.CO2	3	3	3	2	1	1	1	3	2	3
BCA244P.CO3	3	3	3	3	1	1	1	3	3	3
BCA244P.CO4	3	3	3	3	1	1	1	3	3	3

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Department of Computer Science
Syllabus - BCA I Year
(w.e.f. academic year: 2026-27)
Semester II

Course: Indian Constitution
Course Code: BCA245

Hour (45 Hrs.)/**Week:** 3 PPW
Credits: 3

Course Objectives: The objectives of this course are,

1. Learn the basics of the constitution.
2. Understand the structure of the union government.
3. Comprehend the state government structure.
4. Gain insights into local administration.
5. Study about the election commission.
6. Develop awareness of constitutional values and responsible citizenship.

UNIT-I

The Constitution – Introduction, The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its Interpretation, Fundamental Rights and Duties and their interpretation, State Policy Principles.
(Book 1: Part I Chapters – 1, 3, 8, 14, 28)

UNIT-II

Union Government - Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha.
(Book 1: Part II Chapters – 11, 12)

UNIT-III

State Government - Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat.
(Book 1: Part III Chapters –13)

UNIT-IV

Local Administration - District Administration, Municipal Corporation, Zila Panchayat.
(Book 1: Part IV Chapter 16, Part V Chapters - 17, 18, 19)

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UNIT-V

Election Commission - Role and Functioning, Chief Election Commissioner, State Election Commission.

(Book 1: Part IX Chapter- 31, Part X)

Course Outcomes: By the end of the course, the students will be able to,

BCA245.CO1: Explain the basics of the constitution.
BCA245.CO2: Elucidate the structure of the union government.
BCA245.CO3: Elaborate the state government structure.
BCA245.CO4: Describe the local administration.
BCA245.CO5: Discuss the election commission.
BCA245.CO6: Analyze constitutional values and practice responsible citizenship.

Books:

1. Acharya Dr. Durga Das, Introduction to Indian Constitution of India, 26th edition, 2022.
2. D.D. Basu, Lexis Nexis, Introduction to the Constitution of India, 23rd Edition, 2018.
3. B.L. Fadia, Sahitya Bhawan, The Constitution of India, New Edition, 2017.
4. Rajeev Bhargava, Ethics and Politics of the Indian Constitution, Oxford University Press, New Delhi, 2008.

Suggested Links:

1. https://www.constitution.org/cons/india/const.html
2. http://www.legislative.gov.in/constitution-of-india
3. https://www.sci.gov.in/constitution
4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/

CO-PO Articulation Matrix

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
BCA245.CO1	3	2	2	1	2	3	2	1	1	2
BCA245.CO2	3	2	2	1	2	3	1	1	2	2
BCA245.CO3	3	2	2	1	2	3	1	1	2	2
BCA245.CO4	2	2	2	1	2	3	3	2	3	2
BCA245.CO5	3	3	2	1	2	3	2	2	2	2
BCA245.CO6	3	3	2	1	2	3	3	2	3	2

1- Low Correlation 2- Medium Correlation 3- High Correlation

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

CHAIRPERSON
BOS in Informatics
Bhavan's Vivekananda College
Sainikpuri