



BOARD OF STUDIES (BoS) MEETING – PROCEEDINGS

Department:	DEPARTMENT OF COMPUTER SCIENCE
Programme:	BCA (GENERAL)
Academic Year:	2025-26
Meeting No.:	01
Notification No:	246/2025-26
Date:	21ST Nov 2025
Time:	3.30 pm
Venue:	Seminar hall

Members Present

Sl. No.	Name	Designation
1	Prof.Pushpa N	Academic Dean
2	Prof.Ramya P	Chair Person
3	Dr. RaviKiran R K	University Nominee
4	Mr. Ravi Kiran S	Nominee (Industry)
5	Dr. Ambika N	Internal Nominee
6	Prof. Nirmala R	Internal Nominee

1. Agenda of the Meeting

Agenda 1:

Presentation of Course Matrix for 1st Semester BCA (2025-26)



Agenda 2:

Discussion on Scheme of Examination

Agenda 3:

Discussion on Question Paper Pattern

Agenda 4:

Identification and Approval of Question Paper Setters and Valuers

Agenda 5:

Approval of Value Added Courses

2. Proceedings of the Meeting

- BOS chair person, Industry expert, Academic Dean and other members of the department attended the meeting.

4.1 Review and Approval of Curriculum & Syllabus

- Course: BCA
- Proposed Change: NIL
- Resolution: Retaining BCU syllabus for the course without modification for the academic year 2025-26

4.2 Introduction of New Courses / Electives

- Course Title: NIL
- Rationale: NIL
- Resolution: NIL

4.3 Assessment & Evaluation Modifications

- Proposed Change: NIL
- Decision & Remarks: Following same pattern for the academic year 2025-26
- Resolution: Retaining the BCU Assessment and Evaluation system without change for the Academic year 2025-26

4.4 Value-Added / Certificate Courses

- Course Title: NIL
- Industry/Faculty Expert: NIL

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Campus:
15, Vasavi Temple Road
V.V. Puram, Bengaluru – 560 004
Ph. No: 080-46595200/201



- Duration & Credits: NIL
- Resolution: NIL

4.5 Industry Collaboration / MoU Proposals

- Proposed Partner: NIL
- Purpose: NIL
- Resolution: NIL

4.7 Internship / Project Guidelines

- Proposed Changes: NIL
- Resolution: NIL

4.8 Any Other Matter

- Issues Discussed: NA
- Resolution: NA

5. Suggestions

- The experts gave their opinions regarding the following-
 - To think of changing the internal assessment pattern from 20 to 40
 - To include external examiners from BCU
 - To implement many field visits relating to computer application domain.
 - To incorporate hackathon
 - Incorporating solid learning programs (with 3 years journey) instead of value-added programs like data science.
 - To have programs that help the student to enhance communication skill and improve their performance in interviews.
 - To get MOU with industry experts to provide good internships for the students.

6. Action Points (with Responsibility & Deadline)

Action Item	Responsible Person/Committee	Deadline
Courses that are industry driven - commence	Prof. Ramya P	December 2026

7. Conclusion

The meeting concluded at 4:30 pm with a vote of thanks to the Chair.

8. Signatures

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JAIN COLLEGE (AUTONOMOUS)
Affiliated to Bengaluru City University
Accredited with 'A+' Grade by NAAC
Recognized by UGC under 2(f)
ISO 21001:2018 Certified

Academic Dean, UG

Name: Pushpa N

Signature: [Handwritten Signature]

Chairperson

Name: Ramya P

Signature: [Handwritten Signature]

Members Present

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3	Dr. RaviKiran R K	University Nominee	[Handwritten Signature]
4	Mr. Ravi Kiran S	Nominee (Industry)	[Handwritten Signature]
5	Dr. Ambika N	Internal Nominee	[Handwritten Signature]
6	Prof. Nirmala R	Internal Nominee	[Handwritten Signature]

Proposed BOE (I Semester BCA) 2025 - 2026

SL No	Subjects	External 1	External 2	External 3	External 4	Internal
1	Discrete Structure	Prof. Beena Nair Mob: 9480428125 Vijaya College RV Road	Prof. Kalpana Chittor S Mob: 8296739521 Sri Krishna Degree College	Dr. Janarthanam S Mob: 9489038601 CMR University	Dr. Uma Devi Ramamurthy Mob: 7010989646 CMR University	Dr. Aparna Patil Mob: 9538030820
2	Problem Solving Techniques	Prof. Deepika H S Mob: 9900225169 Community Institute of commerce and management studies	Prof. Sowmya S Mob: 9980000233 Vijaya College	Dr. Chethana Sridhar Mob: 9620322337 SSMRV college	Prof. Sowbhagya Takappa Pujeri Mob: 9483023074 BMS college for women	Prof. Ramya P Mob: 8618848287
3	Computer Architecture	Prof. Swetha Mob: 9740072940 National College	Dr. Geetha S Mob: 9663742560 St. Francis college	Prof. Pavithra D Mob: 8123229929 VV Puram College of Science	Prof. Manjula S Mob: 9964706027 National College	Prof. Nirmala R Mob: 9943543353

Patil

Chittor

Uma Devi

Swetha

Geetha

Manjula

Proposed BOE (I Semester BCA) 2025 - 2026

SL No	Subjects	External 1	External 2	External 3	Internal
1	Office Automation Tools	Prof. Madhusudhan Reddy Mob: 9901581317 VV Puram College of Science	Prof. Prashanthi Mob: 9901735735 St. Joseph's University	Prof. Venugopal Mob: 8884925920 Seshadripuram College	Dr. Ambika N Mob: 9900966852
2	Problem Solving Techniques Lab	Prof. Shilpakala S Mob: 8861313904 Vijaya College	Prof. Lavanya V Mob: 9095079804 CMR University	Prof. Manjunath Mob: 9380287024 APSC college	Prof. Ramya P Mob: 8618848287
3	Computer Architecture Lab	Prof. Surendra H Mob: 9342157491 Vijaya College	Dr. Divya Shree D Mob: 7349189651 Presidency University	Prof. Bhanu Mob: 7204388629 St. Joseph's University	Prof. Nirmala R Mob: 9943543353

Ronika @

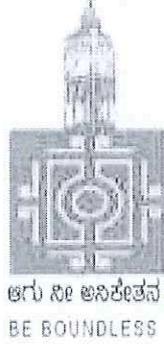
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BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM
(as per SEP 2024)

Syllabus for I & II Semester
BCA

2024-25

D. N. S.
Dr. N. S.
Ranjana

BENGALURU CITY UNIVERSITY
Department of Computer Science and Applications
Draft for BCA Course Structure
BCA (with specialization in Full Stack Development)
AS PER STATE EDUCATION POLICY

Sem	Course/ Paper Code	Title of the Paper	Teaching Hours / week	Semester End Exam	Internal Assessment	Total Marks	Credits
1	24BCA11	Discrete Structure	03	80	20	100	3
	24BCA12	Problem Solving Technique	03	80	20	100	3
	24BCA13	Computer Architecture	03	80	20	100	3
	24BCA12P	Problem Solving Technique Lab	04	40	10	50	2
	24BCA13P	Computer Architecture Lab	04	40	10	50	2
	24BCA1P	Office Automation Tools	4	40	10	50	2
	24BCAL11	Language L1	04	80	20	100	3
	24BCAL12	Language L2	04	80	20	100	3
	24BCACCI	The Constitution of India	02	40	10	50	2
2	24BCA21	Data Structure	03	80	20	100	3
	24BCA22	Object Oriented Programming Using JAVA	03	80	20	100	3
	24BCA23	Operating Systems	05	80	20	100	5
	24BCA21P	Data Structure Lab	04	40	10	50	2
	24BCA22P	Operating Systems Lab	04	40	10	50	2
	24BCA21P	LINUX and Shell Programming Lab	04	40	10	50	2
	24BCAL21	Language L1	04	80	20	100	3
	24BCAL22	Language L2	04	80	20	100	3

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Sem	Course/ Paper Code	Title of the Paper	Teaching Hours / week	Semester End Exam	Internal Assessment	Total Marks	Credits
	24BCACC2	Environmental Studies	02	40	10	50	2
3	24BCA31	Database Management System	03	80	20	100	3
	24BCA32	Probability and Statistics	03	80	20	100	3
	24BCA33	Artificial Intelligence	04	80	20	100	5
	24BCA31P	Database Management System Lab	04	40	10	50	2
	24BCA32P	Artificial Intelligence Lab using Python	04	40	10	50	2
	24BCAE1	Elective: I Web Programming – I	02	40	10	50	2
	24BCAL31	Language L1	04	80	20	100	3
	24BCAL32	Language L2	04	80	20	100	3
4	24BCA41	Computer Networks	03	80	20	100	3
	24BCA42	Design and Analysis of Algorithms	03	80	20	100	3
	24BCA43	Software Engineering	05	80	20	100	5
	24BCA41P	Computer Networks Lab	04	40	10	50	2
	24BCA42P	Design and Analysis of Algorithms Lab	04	40	10	50	2
	24BCAE2	Elective: II Web Programming – II	02	40	10	50	2
	24BCAL41	Language L1	04	80	20	100	3
	24BCAL42	Language L2	04	80	20	100	3
	24BCASEC1	Office Management Tools	02	40	10	50	2
Semester – V							
5	24BCA51	Frontend Design	03	80	20	100	3
	24BCA52	Backend Development	03	80	20	100	3

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Sem	Course/ Paper Code	Title of the Paper	Teaching Hours / week	Semester End Exam	Internal Assessment	Total Marks	Credits
	24BCA53	Cloud computing	05	80	20	100	5
	24BCA51P	Frontend Design Lab	04	40	10	50	2
	24BCA52P	Backend Development Lab	04	40	10	50	2
	24BCASEC2	Quantitative Techniques	02	40	10	50	2
Semester – VI							
6	24BCA61	Software Project Management	04	80	20	100	5
	24BCA62	Mobile Application Development	04	80	20	100	5
	24BCA63	Project Work	10	80	20	100	5
	24BCASEC3	Soft Skills	02	40	10	50	2

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Department of Computer Science and Applications
BENGALURU CITY UNIVERSITY, BANGALORE

Program Outcome

PO1	Computational Knowledge	Acquire in-depth computational and mathematical knowledge with an ability to abstract and conceptualise from defined problems and requirements.
PO2	Dynamic Problem-Solving Skill	Identify, formulate, and exhibit strong analytical and dynamic problem-solving skills to address evolving computational challenges.
PO3	Innovative System Analysis and Design/Development	Design and evaluate solutions for complex problems in Data Science, AI & ML, and Full Stack Development, considering societal, cultural, and environmental factors.
PO4	Investigate complex computing problem	Conduct literature surveys, analyze information, and design experiments using appropriate research methods to derive valid conclusions in relevant domains.
PO5	Use of modern tools/ Adaptive programming proficiency	Select, adapt, and apply modern IT tools and programming languages effectively in Data Science, AI & ML, and Full Stack Development to solve diverse computing challenges.
PO6	Knowledge Optimization	Modify algorithms or software systems to improve efficiency or resource utilization.
PO7	Life Long Continuous learning and Technology Adaptability	Pursue lifelong learning to stay updated with emerging technologies in Data Science, AI & ML, and Full Stack Development for sustained employability.
PO8	Soft skills and collaborative teamwork	Communicate effectively, enhance interpersonal skills, and collaborate in multidisciplinary teams essential for success in professional environments.
PO9	Cyber Security Proficiency	Understand cyber threats, develop secure software, and protect sensitive data in Data Science, AI & ML, and Full Stack Development applications.
PO10	Ethical and Professional Conduct	Adhere to ethical standards and professional practices in Data Science, AI & ML, and Full Stack Development roles and responsibilities.
PO11	Employability	Identify market trends, upgrade skills accordingly, and enhance employability in Data Science, AI & ML, and Full Stack Development careers.
PO12	Innovation and Entrepreneurship	Identify opportunities, innovate, and create value through Data Science, AI & ML, and Full Stack Development projects for personal growth and societal impact.

DISCRETE STRUCTURE

Course Outcome

- 1 Apply Set theory, Relations, Functions and Mathematical Induction for solving problems
- 2 Getting familiar with counting techniques and Mathematical Logic, and apply the same to address the real life problems
- 3 Learn different operations of a Matrix and apply them to solve real life problems.
- 4 Apply graph theory concepts to solve the problems of real world.

UNIT – I 11 Hours

Set Theory: Fundamentals of Set theory, Set Operations, Laws of Set Theory, Counting and Venn Diagrams, Cartesian Product, Relations, Types of Relations, Functions, Types of Functions, Function Composition, Inverse Functions. Mathematical Induction.

UNIT – II 11 Hours

Logic and Counting: Fundamentals of Logic, Propositional Logic, Logical Connectives and Truth Tables, Logic Equivalence, Tautology and Contradiction. Basics of counting, Counting Principles, Pigeonhole Principle, Permutation, Combinations.

UNIT - III 11 Hours

Matrices: Basics of Matrix, Types of Matrices, Operations on Matrices, Inverse of a matrix, Solution for system of linear equations, Determinant, Properties of Determinant, Cramer's Rule, Introduction to Eigen Values and Eigen Vectors.

UNIT - IV 12 Hours

Graph Theory: Graphs: Introduction, Representing Graphs, Operations on graphs, Directed Graphs Graph Isomorphism, Paths, Cycles, Euler Graph, Hamilton Graph, Planar Graphs. Trees: Introduction, Applications of Trees, Spanning Trees, Minimum Spanning Trees, Prim's and Kruskal's Algorithms.

Text Book

- 1 Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education.
- 2 Richard Bronson, Schaum's Outline of Matrix Operations, McGraw-Hill publications, 2nd Edition,

Reference Books

- 1 Gregory Hartman, Fundamentals of Matrix Algebra, Third Edition
- 2 Gary Haggard, John Schlipf, Discrete Mathematics for Computer Science, , Thomson Books

Course Articulation Matrix: Mapping of Course Outcomes(COs) with Program Outcomes(POs1-12)

Course Outcome(COs)	Program Outcomes(POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	2				1						
CO2	2	3		1			1					
CO3	2	1						1				
CO4	1	1	1									

Pedagogy: Lecture with the use of ICT/ Field Study / Assignment

Formative Assessment for Theory	
Assessment Occasion Type	Marks
C-1 Sessional Tests	5
C-1 Seminars/ Presentations	5
C-2 Sessional Tests	5
Case Study / Assignment / Project work etc.	5
Total	20 Marks
Formative Assessments as per SEP guidelines are compulsory	

PROBLEM SOLVING TECHNIQUE

Course Outcomes

Upon successful completion of the course, the student will be able:

- CO1 To understand algorithmic strategies for enhancing problem-solving proficiency
- CO2 Demonstrate problem solving tools and techniques using C.
- CO3 To analyze the given problems and use appropriate algorithms.
- CO4 To implement sorting and searching techniques to develop programs.

UNIT –I 12 Hours

Introduction: The Role of Algorithms in computing, Algorithms as a technology, analyzing algorithms, Designing algorithms, Growth of Functions, Asymptotic notation, Standard notations and common functions. Fundamental Algorithms: Exchanging the values of two variables, Counting, Summation of a set of numbers, Factorial Computation, Generating of Fibonacci sequence, Reversing the digits of an integer, Character to number conversion.

UNIT-II 11 Hours

C Programming: Getting Started, Variables, Operators and Arithmetic expressions. Input and Output: Standard input and output, formatted input and output. Selection statements: Statements and Blocks, If, If-else, if-else-if ladder, nested if, switch. Control Structure: while loop, for loop, do-while loop, break and continue, goto and labels. Pointers and Arrays: Pointers and address, Pointers and function arguments, One Dimensional array, Two-Dimensional array, Multidimensional array, Command line arguments.

UNIT - III 11 Hours

Factoring Methods: Finding the square root of a number, the smallest Divisor of an integer, the greatest common divisor of two integers, computing the prime factor of an integer, raising a number to a large power. Array Techniques: Array order reversal, Array counting, Finding the maximum number in a set, removal of duplicates from an ordered array, partitioning an array, finding the kth smallest element, multiplication of two matrices.

UNIT - IV 11 Hours

Sorting: Sorting by selection, sorting by exchange, sorting by insertion, sorting by diminishing increment, sorting by partitioning. Searching: Linear Search, Binary search, Hash search. Text processing and Pattern searching: Text line length adjustment, keyboard searching in text, text line editing, linear pattern searching.

Text Book

- 1 R. G. Dromey, "How to Solve it by Computer", Person Education India, 2008.
- 2 Brain M. Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd edition, Princeton Hall Software Series, 2012.
- 3 Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, The MIT Press Cambridge, Massachusetts London, England, 2008.

Reference Books

- 1 E. Balaguruswamy, "Programming In ANSI C", 4th edition, TMH Publications, 2007
- 2 Greg Perry and Dean Miller, "C programming Absolute Beginner's Guide", 3rd edition, Pearson Education, Inc, 2014.
- 3 Donald E. Knuth, "The Art of Computer Programming", Volume 2: Seminumerical Algorithms, 3rd Edition, Addison Wesley Longman, 1998.

Course Articulation Matrix: Mapping of Course Outcomes(COs) with Program Outcomes(POs1-12)

Course Outcome(COs)	Program Outcomes(POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	1	1	1	1	2	1	1	1	2	1
CO2	3	3	3	2	1	1	1	1	1	1	2	1
CO3	3	3	1	1	1	1	1	1	1	1	2	1
CO4	3	3	2	2	1	1	1	1	1	1	2	1

Pedagogy: Lecture with the use of ICT/ Field Study / Assignment

Formative Assessment for Theory	
Assessment Occasion Type	Marks

C-1 Sessional Tests	5
C-1 Seminars/ Presentations	5
C-2 Sessional Tests	5
Case Study / Assignment / Project work etc.	5
Total	20 Marks
Formative Assessments as per SEP guidelines are compulsory	

COMPUTER ARCHITECTURE

Course Outcome

- CO1 Understand various arithmetic and logical operations on different types of numbers to design an arithmetic and logic unit.
- CO2 Demonstrate Design and implement sequential logic circuits using ICs
- CO3 Analyze the basics of computer organization and its design and the basic processing unit
- CO4 Implement the instruction sets and to develop assembly language programming skills.

UNIT-1 [12Hours]

Number Systems: Decimal, Binary, Hexadecimal, Octal Number System Conversions, Binary Arithmetic, Complements- r 's complement, $(r-1)$'s complement, Addition and subtraction of BCD, Octal Arithmetic, Hexadecimal Arithmetic, Binary Codes, Decimal Codes, Error detecting and correcting codes, ASCII, EBCDIC, UNICODE, Digital Logic Circuits: Digital Computers, Logic Gates, Universal Gates, Boolean algebra, Map Simplification.

UNIT-2 [11Hours]

Combinational Circuits- Half Adder and Full Adder, Flip-Flops- SR Flip-Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop, Sequential Circuits- Flip-Flop input equations, State Table, State Diagram and problems. Digital Components: Integrated Circuits, Decoders-3-to-8-line decoder, NAND gate Decoder, Octal to Binary Encoder, Multiplexers- 4-to-1 line Multiplexer, Registers- 4 bit register with parallel load, Shift Registers- Bidirectional shift register with parallel load, Binary Counters-4-bit synchronous binary counter.

UNIT-3 [11Hours]

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

UNIT-4 [11Hours]

Introduction to 8085 Assembly language programming: Architecture of 8085, Pin Configuration, The 8085-programming model, Instruction classification, Instruction, data formats, and storage. How to write assemble and execute a simple program, overview of 8085 instruction set. Introduction to 8085 Instructions: Instruction classification of 8085 based on word length and functions, Data Transfer operations, Arithmetic operations, Logic Operations, Branch operations, Writing Assembly language programs, Addressing modes of 8085.

Text Book

- 1 M. Morris Mano- "Computer System Architecture", 3rd Edition Pearson India, 2019.
- 2 Ramesh Gaonkar- "Microprocessor Architecture, Programming and Applications with the 8085", 5th Edition, Penram International Publishing (India) Private Limited,2007
- 3 Andrew S. Tanenbaum, Todd Austin –"Structured Computer Organization", PHI /Pearson 6th Edition,2013.

Reference Books

- 1 William Stallings- "Computer Organization and Architecture", Pearson/PHI, 6th Edition,2007.
- 2 Andrew S. Tanenbaum-" Structured Computer Organization", PHI /Pearson 4th Edition,1998.
- 3 M.V .Subramanyam, "Switching Theory and Logic Design", Laxmi Publications (P) Ltd,2011.

Course Articulation Matrix: Mapping of Course Outcomes(COs) with Program Outcomes(POs1-12)

Course Outcome (COs)	Program Outcomes(POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	1	1	1	1	1	1	1	1	2	1
CO2	3	2	2	3	1	1	1	1	1	1	2	1
CO3	3	2	2	1	2	2	1	1	1	1	1	1

CO4	3	2	2	1	2	2	1	1	1	1	2	1
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Pedagogy: Lecture with the use of ICT/ Field Study / Assignment

Formative Assessment for Theory	
Assessment Occasion Type	Marks
C-1 Sessional Tests	5
C-1 Seminars/ Presentations	5
C-2 Sessional Tests	5
Case Study / Assignment / Project work etc.	5
Total	20 Marks
Formative Assessments as per SEP guidelines are compulsory	

PROBLEM SOLVING TECHNIQUE LAB

1. Write, and execute C Program for the following:
2. To read the radius of the circle and to find area and circumference.
3. To read the numbers and find the biggest of three.
4. To check whether the number is prime or not.
5. To find the root of quadratic equation.
6. To read a number, find the sum of the digits, reverse the number and check it for palindrome.
7. To read the numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers.
8. To read percentage of marks and to display appropriate message. If a percentage is 70 and above- Distinction, 60-69 – First Class, 50-59 – Second Class, 40-49 Pass, below 40 – Fail.(Demonstrate of if-else ladder)
9. To simulate a simple calculator with addition, subtraction, multiplication, division and it should display the error message for division of zero using switch case.
10. To read marks scored by n students and find the average of mark (Demonstration of single dimensional array)
11. To remove duplicate elements in a single dimensional array.
12. To find the factorial of a number.
13. To generate Fibonacci series.
14. To demonstrate string functions. (String Length, String Copy, String Concatenate, String Comparison)
15. To find the length of the string without using built-in function.
16. To read, display and add two n x m matrices using function.

17. To read a string and to find the number of alphabets, digits, vowels, consonants, space and special characters.
18. To swap two numbers using pointers.
19. To demonstrate student structure to read & display records of n students.
20. To demonstrate the difference between structure and union for the following Student name (String), Student roll no(integer), Student mark(float)
21. To design the following pattern using nested for loop:

```
      *
     *  *
    *  *  *
   *  *  *  *
  *  *  *  *  *
```

COMPUTER ARCHITECTURE LAB

1. Write an 8085 Program to swap two 8-bit numbers.
2. a. Write a Program to find the largest of two numbers
b. Write an 8085 Program to find the smallest of two numbers
3. Write an 8085 Program to find whether an 8-bit number is positive, negative or zero.
If positive display EE, if negative display FF, if zero display DD.
4. Write an 8085 Program to check whether 4th bit of a number is zero or one.
If 4th bit is 1 display FF, if 4th bit is 0 display DD.
5. Write an 8085 Program to calculate the sum of first ten natural numbers.
6. Write an assembly language program in 8085 microprocessors to find the sum of digits of an 8-bit number.
7. Write an 8085 Program to find the reverse of an 8-bit number
8. Write an 8085 Program to check whether 1-byte number is a palindrome or not. If it is a palindrome display FF otherwise display DD.
9. Write an 8085 Program to check whether a number is ODD or EVEN. If Even no. display DD, if odd no. display FF.
10. Write an 8085 program to count a number of ones in the given 8-bit number.
11. Write an 8085 program to find Addition & Subtraction of two 8-bit HEX numbers.
12. Write an 8085 program to find Addition of two 16-bit numbers.
13. Write an 8085 program to find Subtraction of two 16-bit numbers.
14. Write an 8085 program for Swapping of two 16-bit numbers.
15. Write an 8085 program to implement 2 out of 5 codes
16. Write an 8085 program to generate Fibonacci series
17. Write an 8085 program to find the first ten terms of odd and even numbers.
18. Write an 8085 program to find 4-Digit BCD addition.
19. Write an 8085 program to find Multiplication of 2-digit BCD numbers.
20. Write an 8085 program to find division of two 8-bit numbers.

DATA STRUCTURE

Course Outcome

- | | |
|-----|---|
| CO1 | Understand basic concepts of data structures. |
| CO2 | Analyzing and exploring various ways of storing data using Array and Linked list. |
| CO3 | Demonstrate stack and queue data structures and their applications |
| CO4 | Analyze and implement various non linear data structures. |

Introduction and Overview: Definition, Elementary data organization, Data Structures, data Structures operations, Abstract data types, algorithms complexity, time-space trade off. Preliminaries: Mathematical notations and functions, Algorithmic notations, control structures, Complexity of algorithms, asymptotic notations for complexity of algorithms. Introduction to Strings, Storing String, Character Data Types, String Operations, word processing, Introduction to pattern matching algorithms.

UNIT II

11 Hours

Arrays: Definition, Linear arrays, arrays as ADT, Representation of Linear Arrays in Memory, Traversing Linear arrays, Inserting and deleting, multi-dimensional arrays, Matrices and Sparse matrices, searching and sorting techniques using array. Linked list: Definition, Representation of Singly Linked List in memory, Traversing a Singly linked list, Searching in a Singly linked list, Memory allocation, Garbage collection, Insertion into a singly linked list, Deletion from a singly linked list; Doubly linked list, Header linked list, Circular linked list.

UNIT III

11 Hours

Stacks: Definition, Array representation of stacks, Linked representation of stacks, Stack as ADT, Arithmetic Expressions: Polish Notation, Conversion of infix expression to postfix expression, Evaluation of Post fix expression, Application of Stacks, Recursion, Towers of Hanoi, Implementation of recursive procedures by stack. Queues: Definition, Array representation of queue, Linked list representation of queues. Types of queue: Simple queue, Circular queue, Double-ended queue, Priority queue, Operations on Queues, Applications of queues.

UNIT IV

12 Hours

Binary Trees: Definitions, Tree Search, Traversal of Binary Tree, Tree Sort, Building a Binary Search Tree, Height Balance: AVL Trees, Contiguous Representation of Binary Trees: Heaps, Red Black Tree: Insertion and Deletion, External Searching: B-Trees, Applications of Trees. Graphs: Mathematical Back ground, Computer Representation, Graph Traversal. Hashing: Hash Table ADT, understanding Hashing, Components of Hashing, Hash Table, Hash Function, Hashing Techniques, collisions, collision resolution techniques.

Text Book

- 1 Seymour Lipschutz, "Data Structures with C", Schaum's outLines, Tata Mc Graw Hill, 2011.
- 2 Robert Kruse, C.L.Tondo, Bruce Leung, Shashi Mogalla, "Data Structures and Program Design using C", Pearson Education, 2009

Reference Books

- 1 Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2013

- 2 Forouzan, "A Structured Programming Approach using C", 2nd Edition, Cengage Learning India, 2008.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs12)

Course Outcome (COs)	Program Outcomes (POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	4	3	4	4	4	3	2	3	1	4	4
CO2	5	5	4	4	4	4	3	2	3	1	4	4
CO3	5	5	4	4	4	4	3	2	3	1	4	5
CO4	5	5	4	4	4	4	3	2	2	1	4	4

Pedagogy: Lecture with the use of ICT/ Field Study / Assignment

Formative Assessment for Theory	
Assessment Occasion Type	Marks
C-1 Sessional Tests	5
C-1 Seminars/ Presentations	5
C-2 Sessional Tests	5
Case Study / Assignment / Project work etc.	5
Total	20 Marks
Formative Assessments as per SEP guidelines are compulsory	

OBJECT ORIENTED PROGRAMMING USING JAVA

Total Teaching Hours:48

No. of Hours/ week:03

Course Outcome

CO1 - Understand object-oriented programming concepts

CO2 - Demonstrate the important feature of Object-oriented programming

CO3 - Examine event handling, String handling, and exception handling concepts

CO4 - Implement concepts to solve real-world problems

UNIT-1

[12 Hours]

Introduction: Basics of object-oriented programming, comparison of procedure-oriented and object-oriented programming paradigms; Difference between C and Java Programming languages; Features of Java; Objects and classes in Java, Structure of a Java program; Data Types, variables and operators in java; Control structures- Branching and looping; Methods & Constructors in java; Java Development Kit (JDK); Built-in classes in Java; Math, Character, String, String Buffer and Scanner; Wrapper classes; The abstract, static and final classes; Casting objects; The instance of operator; Usage of this keyword; Arrays in Java.

UNIT-2

[11 Hours]

Inheritance: Super and subclasses; visibility modifiers; Types of Inheritance- single, multiple, hierarchical and hybrid inheritance; the interface concept in Java, Polymorphism: Compile time and run time polymorphisms – Method overloading and method overriding. Package: Types of packages; the util, awt and swing packages; Creating and importing user-defined packages. I/O programming: Standard I/O streams in Java; Types of streams – Base3d on the type of Operations and the type of file.

UNIT-3

[11 Hours]

Event handling: Major events in Java; Two Event Handling mechanisms- Event classes and Event Listener Interfaces; Mouse and keyboard events; GUI: Panels; Frames; Layout managers – Flow, border and grid layouts; Buttons; Checkboxes; Radio buttons; Labels; Text fields; Text areas; Combo boxes; Scroll bars; Sliders; Menu, Dialog boxes. Applet programming: Comparison of applets and applications; Applet life cycle; Developing and running applets. String handling: String construction, string length, special string operations, character extraction, string comparison, modifying string and string buffers.

UNIT-4

[11 Hours]

Exception handling: Types of Java exception – checked and unchecked exceptions; Usage of try-catch-finally blocks. Multithreading: comparison of multithreading and multitasking; Life cycle of a thread; two ways of creating thread – by extending the Thread class and by implementing the Runnable Interface, Thread synchronization. Advanced concepts: Collections in Java; Introduction to JavaBeans and Java security manager, Importance of generic programming in java with examples.

Text Book

- 1 E. Balagurusamy, Programming with JAVA, McGraw Hill, New Delhi, 2007
- 2 Herbert Schildt, Java A Beginner's Guide – Create, Compile, and Run Java Programs Today, Sixth Edition, Oracle Press, 2014

Reference Books

- 1 Ken Arnold, James Gosling, "The Java Programming Language, Fourth Edition, Addison Wisely, 2005
- 2 R Herbert Schildt, 'The Complete Reference Java, 7th Edition, McGraw Hill, 2007

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs1-12)

Course Outcome (COs)	Program Outcomes (POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	4	3	2	2	3	2	3	2	2	2	4	2
CO2	4	3	3	3	4	4	3	2	3	3	4	3
CO3	4	4	3	3	4	3	3	2	3	3	4	4
CO4	4	4	4	3	4	4	3	2	3	3	4	4

Pedagogy: Lecture with the use of ICT/ Field Study / Assignment

Formative Assessment for Theory	
Assessment Occasion Type	Marks

C-1 Sessional Tests	5
C-1 Seminars/ Presentations	5
C-2 Sessional Tests	5
Case Study / Assignment / Project work etc.	5
Total	20 Marks
Formative Assessments as per EP guidelines are compulsory	

OPERATING SYSTEMS

Course Outcomes

CO1 To analyze the memory management and its allocation policies

CO2 To understand synchronization and deadlock conditions and their possible solutions

CO3 To discuss the storage management policies with respect to different storage

CO4 To evaluate the concept of the operating system with respect to Linux architecture and commands

UNIT – I

[11Hours]

Introduction: Computer System Organization, Architecture, Structure, Operations, Process Management, Memory Management, Storage Management. Operating System Structures: Services, System Calls, Types, Operating System Structure, System Boot. Processes: Process Concept, Scheduling, Operations, Inter-process Communication. Multithreaded Programming: Multithreading Models

UNIT-II

[12Hours]

Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples. Process Scheduling: Criteria, Scheduling Algorithms, Multi-Processor Scheduling, Real-time CPU Scheduling. Deadlocks: System model, Characterization, Methods for handling deadlocks, Deadlock Prevention, Avoidance, Detection and Recovery from deadlock.

UNIT – III

[11 Hours]

Memory Management Strategies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table. Virtual Memory Management: Demand Paging; Copy-on-Write, Page Replacement; Allocation of Frames, File System: File Concept, Access Methods, Directory and Disk Structure, Protection. File-system Implementation: Structure, File-System and Directory Implementation, Allocation Methods, Free Space Management. Mass-Storage Structure: Overview, Disk Scheduling, Disk Management.

UNIT – IV

[11Hours]

Introduction to Linux Programming: 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", 9th Edition, 2016 India, Wiley.
2. William Stallings, "Operating Systems and Design Principles", Pearson, 10th Edition, 2018

Reference Books

1. D M Dhamdhare; operating systems - A concept Based Approach, 3'd Edition, Tata McGraw - Hill.
2. Sumitabha Das: "I-INIX Concepts and Applications", 4th Edition, TataMcGraw Hill' 2006
3. MGVenkateshmurthy, "uNIXandShellProgramming", Pearson Edition Asia'2005

Course Articulation Matrix: Mapping of Course Outcomes(COs) with Program Outcomes(POs1-12)

Course Outcome(COs)	Program Outcomes(POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	4	3		4		2					4	2
CO2	4	2		3		2		3			2	2
CO3	3	3		4		2					2	2
CO4	3	2		2		2					4	2

DATA STRUCTURE LAB

NOTE: For all the programs write the output, flowchart and number of basic operations performed.

1. Write a program to search for an element in an array using binary and linear search.
2. Write a program to sort list of n numbers using Bubble Sort algorithms.
3. Perform the Insertion and Selection Sort on the input {75,8,1,16,48,3,7,0} and display the output in descending order.
4. Write a program to insert the elements {61,16,8,27} into singly linked list and delete 8,61,27 from the list. Display your list after each insertion and deletion.
5. Write a program to insert the elements {45, 34, 10, 63,3} into linear queue and delete three elements from the list. Display your list after each insertion and deletion.
6. Write a program to simulate the working of Circular queue using an array.
7. Write a program to insert the elements {61,16,8,27} into ordered singly linked list and delete 8,61,27 from the list. Display your list after each insertion and deletion.
8. Write a program for Tower of Hanoi problem using recursion.
9. Write recursive program to find GCD of 3 numbers.
10. Write a program to demonstrate working of stack using linked list.
11. Write a program to convert an infix expression $x^y/(5*z)+2$ to its postfix expression
12. Write a program to evaluate a postfix expression $5\ 3+8\ 2\ -\ *$.

13. Write a program to create a binary tree with the elements {18,15,40,50,30,17,41} after creation insert 45 and 19 into tree and delete 15,17 and 41 from tree. Display the tree on each insertion and deletion operation.
14. Write a program to create binary search tree with the elements {2,5,1,3,9,0,6} and perform inorder, preorder and post order traversal.
15. Write a program to Sort the following elements using heap sort {9,16,32,8,4,1,5,8,0}.
16. Given S1={"Flowers"} ; S2={"are beautiful"} I. Find the length of S1 II. Concatenate S1 and S2 III. Extract the substring "low" from S1 IV. Find "are" in S2 and replace it with "is" .
17. Write a program to implement adjacency matrix of a graph.
18. Write a program to insert/retrieve an entry into hash/ from a hash table with open addressing using linear probing.

OBJECT ORIENTED PROGRAMMING LAB

1. Java program to display "Hello World" and display the size of all the data types.
2. Java program to implement the usage of static, local and global variables.
3. Java program to implement string operations string length, string concatenate, substring
4. Java program to find the maximum of three numbers
5. Java program to check whether the number is odd or even.
6. Java program to implement default and parameterized constructors.
7. Java program to implement an array of objects.
8. Java program to implement Single Inheritance
9. Java program to implement Multiple Inheritance using Interface
10. Java program to implement the Life cycle of the applet
11. Java program to demonstrate a division by zero exception
12. Java program to add two integers and two float numbers. When no arguments are supplied give a default value to calculate the sum. Use method overloading.
13. Java program that demonstrates run-time polymorphism.
14. Java program to catch negative array size Exception. This exception is caused when the array is initialized to negative values.
15. Java program to handle null pointer exception and use the "finally" method to display a message to the user.
16. Java program to import user-defined packages
17. Java program to check whether a number is palindrome or not
18. Java program to find the factorial of a list of numbers reading input as command line argument.
19. Java program to display all prime numbers between two limits.
20. Java program to create a thread using Runnable Interface.

LINUX AND SHELL PROGRAMMING LAB

1. Write a shell script to print all the prime numbers between M to N ($M < N$).
2. Write a shell script to reverse a given number and check whether it is a palindrome.
3. Write a shell script to find the sum of digits of a given number using loops and without using loops.
4. Write a shell script to implement 10 Linux commands using case.
5. Write a Shell script that displays list of all the files in the current directory to which the user has read, write and execute permissions?
6. Write a shell script to copy a file within current directory
7. Write a shell script to copy file between two directories
8. Write a Shell script to create two data files and compare them to display unique and common entries.
9. Write a shell script to count the number of vowels in a string.
10. Write a shell script to convert uppercase characters to lowercase and vice versa.
11. Write a shell script to accept a word and perform pattern matching in a given file.
12. Write a shell script to find factorial of a number
13. Write a Menu driven program to demonstrate zombie process and orphan process.



BENGALURU CITY UNIVERSITY

Syllabus of Third and Fourth Semesters for

Bachelor of Computer Applications
(CBCS Scheme)

Under
State Education Policy

Effective from the Academic Year
2025 – 2026

Handwritten signatures and initials in blue ink:
D. N. I.
Ansa
Ranjitha
Ranjitha

Board of Studies in Computer Science for UG

No : BCU/BoS/Comp.Sci. & Appln.(PG & UG)/389/2024-25 dated 19-2-2025

1	Prof. Ramesh B Kudenatti Department of Mathematics Bengaluru City University,Bengaluru-560056	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. Suncetha Department of Computer Science, Karnataka State Open University, Muktha Gangothri, Mysuru-570006	Member
5	Prof. Veena R Department of MCA, Seshadripuram College, Seshadripuram, Bengaluru-560020	Member
6	Prof. 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 : Bachelor of Computer Applications (General)
Discipline Course : Computer Science
Starting Year of Implementation: 2024-25 (I & II Semesters)
2025-26 (III & IV Semesters)
2026-27 (V & VI Semesters)

Programme Outcome (PO):

PO 1	Apply knowledge of computing fundamentals, programming, and theoretical foundations to solve real-world problems in various domains of computer applications.
PO 2	Identify and analyze problems related to software and network systems. Apply standard algorithms to develop reliable computing solutions.
PO 3	Develop and implement efficient, secure and maintainable software solutions using programming languages.
PO 4	Use appropriate tools and techniques and open source platforms for programming, debugging and network management.
PO 5	Understand the importance of cyber safety, security threats and best practices to ensure responsible and secure use of digital technologies.
PO 6	Apply ethical principles and commit to professional responsibilities in the computing profession, including software licensing, privacy and user rights.
PO 7	Effectively document, present and communicate technical information and solutions to peers, stakeholders and clients.
PO 8	Function competently as an individual or as a part of team in software development, lab-based exercises and project environments.
PO 9	Recognize the need for continuous learning and adopt evolving technologies and methodologies to stay relevant in the IT industry.
PO 10	Gain foundational knowledge of emerging technologies and to explore interdisciplinary applications and career opportunities.

ASSESSMENT

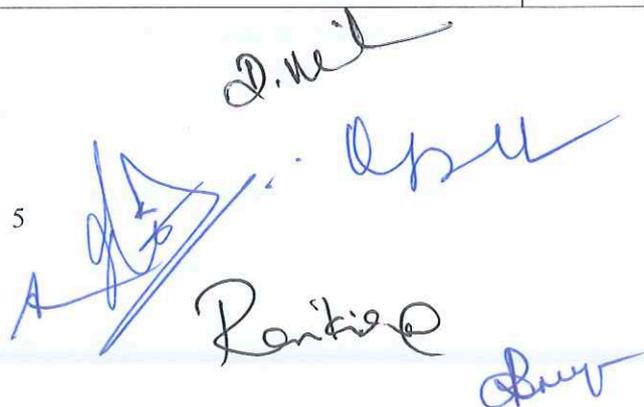
Weightage for the Assessments (in percentage)

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

Detailed Structure for BCA (General)

Semester	Course Code	Paper Title	Teaching Hours / Week	Marks		Duration of Exam in Hours	Credits
				Exam	IA		
I	24BCA11	Discrete Structure	03	80	20	03	03
	24BCA12	Problem Solving Technique	03	80	20	03	03
	24BCA13	Computer Architecture	03	80	20	03	03
	24BCA11P	Problem Solving Technique Lab	04	40	10	03	02
	24BCA12P	Computer Architecture Lab	04	40	10	03	02
	24BCA13P	Office Automation Tools	04	40	10	03	02
	24BCAL11	Language 1	04	80	20	03	03
	24BCAL12	Language 2	04	80	20	03	03
	24BCACV1	Constitutional Values - I	02	40	10	1.5	02
		Total Credits					23
II	24BCA21	Data Structures	03	80	20	03	03
	24BCA22	Object Oriented Programming Using Java	03	80	20	03	03
	24BCA23	Operating System	03	80	20	03	03
	24BCA21P	Data Structures Lab	04	40	10	03	02
	24BCA22P	Java Programming Lab	04	40	10	03	02
	24BCA23P	Unix & Shell Programming Lab	04	40	10	03	02
	24BCAL21	Language 1	04	80	20	03	03
	24BCAL22	Language 2	04	80	20	03	03
	24BCACV2	Constitutional Values - II	02	40	10	1.5	02
	24BCAES	Environmental Studies	02	40	10	1.5	02
		Total Credits					25

Semester	Course Code	Paper Title	Teaching Hours / Week	Marks		Duration of Exam in Hours	Credits
				Exam	IA		
III	24BCA31	Database Management System	04	80	20	03	03
	24BCA32	Python Programming	04	80	20	03	03
	24BCA33	Computer Networks	04	80	20	03	03
	24BCA34	Cyber Security	02	40	10	1.5	02
	24BCA31P	Database Management System Lab	03	40	10	03	02
	24BCA32P	Python Programming Lab	03	40	10	03	02
	24BCA33P	Computer Networks Lab	03	40	10	03	02
	24BCAL31	Language 1	04	80	20	03	03
	24BCAL32	Language 2	04	80	20	03	03
Total Credits							23
IV	24BCA41	Artificial Intelligence	04	80	20	03	03
	24BCA42	Design and Analysis of Algorithms	04	80	20	03	03
	24BCA43	Internet Technologies	04	80	20	03	03
	24BCA44	Ethical Hacking	02	40	10	1.5	02
	24BCA41P	Artificial Intelligence Lab	03	40	10	03	02
	24BCA42P	Design and Analysis of Algorithms Lab	03	40	10	03	02
	24BCA43P	Internet Technologies Lab	03	40	10	03	02
	24BCASE1	Probability and Statistics	02	40	10	1.5	02
	24BCAL41	Language 1	04	80	20	03	03
	24BCAL42	Language 2	04	80	20	03	03
Total Credits							25



 D. M. J.

 A. G. S.

 Rantia

 B. V.

Semester	Course Code	Paper Title	Teaching Hours / Week	Marks		Duration of Exam in Hours	Credits
				Exam	IA		
V	24BCA51	Web Programming	04	80	20	03	03
	24BCA52	Data Analytics	04	80	20	03	03
	24BCA53	Software Engineering	04	80	20	03	03
	24BCA54	Operations Research	04	80	20	03	03
	24BCA51P	Web Programming Lab	03	40	10	03	02
	24BCA52P	Data Analytics Lab	03	40	10	03	02
	24BCASE2	Quantitative Techniques	02	40	10	1.5	02
	24BCAPJ	Project	08	120	30	03	06
Total Credits							24
VI	24BCA61	Machine Learning	04	80	20	03	03
	24BCA62	Cloud Computing	04	80	20	03	03
	24BCA63	Data Mining	04	80	20	03	03
	24BCA64	Theory of Computation	04	80	20	03	03
	24BCA61P	Machine Learning Lab	03	40	10	03	02
	24BCAIS	Internship	--	80	20	03	06
Total Credits							20
Overall Total Credits							140

D. Nil

D. Nil

D. Nil

D. Nil

D. Nil

SEMESTER – III

Theory	24BCA31: Database Management 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 data, database systems, DBMS architecture, data models and the various types of DBMS along with their classifications.
CO2	Design high-level conceptual data models using the Entity-Relationship approach, apply design principles and understand physical storage structures, file organization, and indexing mechanisms.
CO3	Apply the relational model concepts, perform normalization using functional dependencies and write effective SQL queries to manage and manipulate data constraints and views.
CO4	Utilize relational algebra to query databases, analyze query processing and optimization techniques and explain transaction management, concurrency control and recovery mechanisms in DBMS. Basics of PL/SQL.

UNIT – I Fundamentals of Database Systems and Architecture

14 Hours

Introduction to Data and Database, History of Database. Characteristics of the Database Approach. Significance and Advantages of Database Management Systems. Actors on the Scene, Workers behind the Scene. System Structure: Instance and Schema, Data Models, Data Independence. Three Schema Architecture. Database Languages and Interfaces. The Database System Environment. Centralized and Client-Server Architecture. Classification of Database Management System.

UNIT – II Database Design and Storage Structures

14 Hours

High-Level Conceptual Data Models for Database Design. Entity Types, Entity Sets, Attributes and Keys. Relationship Types, Relationship Sets, Roles and Structural Constraints. Weak Entity Types. Extended ER Features. Refining the ER Design. Naming Conventions and Design Issues. ER to Relational Mapping. File Organization and Storage. Secondary Storage Devices. File Organization Techniques. Single-Level Ordered Index. Multi-Level Indexes. Indexes on Multiple Keys.

UNIT – III Relational Model, Normalization and SQL

14 Hours

Relational Model Concepts. Relational Model Constraints and Relational Database Schema. Update Operations and Dealing with Constraint Violations. Anomalies in a Database. Functional Dependency. Armstrong's Axioms. Closure of a Relation and Attributes. Lossless Join and Dependency Preservation. Normalization: 1NF, 2NF, 3NF, BCNF. Structure of Relational Databases. SQL: Data Definition and Data Types. Specifying Constraints in SQL. Schema Change Statements. Insert, Delete and Update Statements. Views (Virtual Tables). Assertions and Triggers.

UNIT – IV Query Processing, Transactions and PL/SQL**14 Hours**

Unary Relational Operations: SELECT and PROJECT. Relational Algebra Operations. Binary Relational Operations: JOIN and DIVISION. Additional Relational Operations. Query Processing and Optimization: Evaluation of Relational Algebra Expressions. Query Equivalence. Introduction to Transaction Processing. Transaction and System Concepts. States of a Transaction. Desirable Properties of Transactions (ACID). Concurrency Control Techniques: Two-Phase Locking Techniques. Backup and Recovery from Failures, Basics of PL/SQL Programming.

TEXT BOOKS:

1. Elmasri R. and Navathe S.B., *Fundamentals of Database Systems*, 7th Edition, Addison-Wesley, 2016.
2. Silberschatz A., Korth H.F., and Sudarshan S., *Database System Concepts*, 7th Edition, Tata McGraw Hill, 2019.
3. Ivan Bayross, *SQL, PL/SQL – The Programming Language of Oracle*, 4th Edition, BPB Publications.

REFERENCE BOOKS:

1. C.J. Date, A. Kannan, S. Swamynathan, *An Introduction to Database Systems*, 8th Edition, Pearson Education, 2009.
2. Raghuram Ramakrishnan and Johannes Gehrke, *Database Management Systems*, 3rd Edition, McGraw Hill, 2003.
3. Kevin Loney and George Koch, *Oracle 9i – The Complete Reference*, McGraw-Hill International Edition.

Theory	24BCA32: 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 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 and apply them in real-time data analysis projects.

UNIT – I Foundations of Python Programming

14 Hours

Introduction to Python: 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. Control Flow: 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 and Frozensets: Creating Sets, Set Operations, Set Methods. Iterators and Iterables. File Handling: Types of Files, Reading and Writing Text and Binary Files, CSV File Handling, Pickle Module.

UNIT – III Object-Oriented Programming and Data Handling Libraries

14 Hours

Object-Oriented Programming: Classes and Objects in Python, Constructor Method, Multiple Objects, Class vs Data Attributes, Encapsulation, Inheritance, Polymorphism. Introduction to Python Libraries for Data Handling: NumPy – Arrays and Operations, Pandas – Series and DataFrames, Indexing and Querying, Handling Missing Values, Data Aggregation, Grouping, and Summarization.

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), Random Walks, Dice Simulation, Working with APIs, Downloading Data and Visualizing Repositories using Plotly, Mapping Global Datasets with JSON.

TEXT BOOKS:

1. Wesley J. Chun, *Core Python Applications Programming*, 3rd Edition, Pearson Education, 2016.
2. Yashavant Kanetkar and Aditya Kanetkar, *Let Us Python*, 3rd Edition, BPB Publications.
3. Jeeva Jose & P. Sojan Lal, *Introduction to Computing and Problem Solving with Python*, Khanna Publishers, New Delhi, 2016.
4. Eric Matthes, *Python Crash Course – A Hands-On, Project-Based Introduction to Programming*, 2nd Edition, No Starch Press, 2019.
5. Gowrishankar S, Veena A, *Introduction to Python Programming*, 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN: 978-0815394372.

REFERENCE BOOKS:

1. Allen B. Downey et al., *How to Think Like a Computer Scientist: Learning with Python*, John Wiley, 2015.
2. John Zelle, *Python Programming: An Introduction to Computer Science*, 2nd Edition, Course Technology, Cengage Learning, 2013.
3. A.N. Kamthane & A.A. Kamthane, *Programming and Problem Solving with Python*, McGraw Hill Education, 2017.
4. Mark Lutz, *Learning Python*, 5th Edition, O'Reilly Publications, 2013. ISBN: 978-1449355739.
5. Ljubomir Perkovic, *Introduction to Computing Using Python – An Application Development Focus*, Wiley, 2012.

Theory	24BCA33: 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 basics of data communication
CO2	Explore data link layer protocols and understand channelization methods
CO3	Analyse the functioning of the network layer, routing algorithms and protocols
CO4	Comprehend transport layer protocols and application layer services

UNIT - I Introduction to Networking and Communication Principles 14 Hours

Introduction: Data Communications, Networks, Network Types, Internet History, Network Models: Protocol Layering, The OSI Model, TCP/IP Protocol Suite, Introduction to Physical Layer: The types of Transmission media, Transmission Impairments, Data Rate Limits, Performance.

UNIT - II Data Link Layer and MAC Techniques 14 Hours

Introduction to Data Link Layer: Link-Layer Addressing. Error Detection and Correction: Block Coding, Cyclic Codes, Checksum. Data Link Control: Data-Link Layer Protocols, HDLC, Point-To-Point (PPP), MAC sublayer, Logical Link Control Layer, Random access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA, Scheduling approaches to medium access control: Reservation systems, Polling, Token Passing rings, Comparison of Random access and Scheduling access control, Comparison of Random access and scheduling medium access control, Channelization: FDMA, TDMA, CDMA.

UNIT - III Network Layer Fundamentals and Routing Protocols 14 Hours

Introduction to Network Layer: Network-Layer Services, Packet Switching, Network-Layer Performance, IPV4 Addresses, Network Layer Protocols: Internet Protocol (IP), ICMPv4, Mobile IP, Unicast Routing: Routing Algorithms, Unicast Routing Protocols, Next Generation IP: IPv6 Addressing.

UNIT - IV Transport and Application Layer Protocols with QoS Mechanisms 14 Hours

Introduction to Transport Layer: Transport-Layer Protocols, User Datagram Protocol, Transmission Control Protocol: TCP Services, TCP Features, Segment, TCP Connection, TCP Congestion Control, Flow Control, Error Control, Application Layer: WWW, E-MAIL, Domain Name System (DNS), Quality of Service: Flow Control To Improves QoS, Integrated Services.

TEXT BOOKS

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill Education, 2013.

REFERENCE BOOKS

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Prentice Hall, 2011.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks A System Approach", 5th Edition, MKP, 2012.
3. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach", 5th Edition, Pearson, 2012.

Theory	24BCA34: Cyber Security
Teaching Hours : 02 Hours/Week	Credits : 02
Duration of Exam : 1.5 Hours	Maximum Marks : 50 (Exam 40 + IA 10)

Course Outcomes

COs	Description
CO1	Understand the fundamentals of cyber security, types of cyber threats and adopt safe internet practices and responsible digital behavior.
CO2	Understand the basic concepts of cryptography, encryption techniques, password security and secure communication protocols used for data protection.
CO3	Apply system and personal security measures to protect devices and data from threats, vulnerabilities and online attacks.

Unit I – Fundamentals of Cyber Security & Secure Communication **14 Hours**
Introduction to Cyber Security: Importance of cyber safety in the digital world, Common types of cyber threats: viruses, worms, trojans, phishing, ransomware, fake websites, social engineering, Real-life examples of cyber attacks. **Goals of Cyber Security:** Confidentiality, Integrity, Availability (CIA Triad), Difference between threats, vulnerabilities, and risks. **Security Concepts and Terminology:** Firewall, antivirus, malware, hacking. **Safe Internet Practices:** Responsible digital behaviour, Secure browsing and identifying fake/unsafe websites, Email safety: detecting phishing and spam, Use of public Wi-Fi and avoiding data leaks. **Introduction to Cryptography and Secure Communication:** Purpose of encryption and decryption, Difference between symmetric and asymmetric encryption, Role of HTTPS and SSL, Two-Factor Authentication (2FA), OTP-based logins, Importance of secure messaging and email

Unit II – System, Personal, and Device Security Practices **14 Hours**
System and Device Security Basics: Operating System security basics, User authentication and access control, Password policies and best practices, Antivirus and anti-malware software. **Web and App Security:** Common web security issues: SQL injection, XSS, CSRF (overview only), Mobile app security – permissions and safe usage, Safe use of mobile devices, laptops, and social media, Software updates and patch management. **Network and Online Protection:** Introduction to firewalls and VPNs, Risks of pop-ups, cookies, and online tracking, Safe and responsible data sharing online

TEXT BOOK:

1. Chirag Shah (2018). A Hands-On Introduction to Cybersecurity. Wiley.

REFERENCE BOOKS:

1. Nina Godbole & Sunit Belapure (2011). Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives. Wiley India.
2. Rao, U. & Nayak, P. (2014). Cyber Security. Cengage Learning.
- Moeti J. (2021). Cybersecurity for Beginners. Amazon Digital Services (for simple reading-level coverage).

Lab	24BCA31P: DBMS Lab	
Teaching Hours : 03 Hours/Week	Credits : 02	
Duration of Exam : 3 Hours	Maximum Marks : 50 (Exam 40 + IA 10)	

Part A

1. Create a table STUDENT with the following fields: RollNo, Name, DOB, Department, Marks.
 Insert at least 5 records
 Display all records
 Update marks for a specific student
 Delete a student record
2. Create a table COURSE with CourseID, CourseName, Credits.
 Alter the table to add a field Department
 Drop the field Credits
3. Create two tables EMPLOYEE1 and EMPLOYEE2 with the following attributes: (FNAME, MNAME, LNAME, SSN, BDATE, ADDRESS, SEX, SALARY, SUPERSSN, DNO). Perform UNION, INTERSECT, and MINUS operations on them.
4. Use the STUDENT table to perform Aggregate functions and Scalar functions
5. Using the STUDENT and COURSE tables,
 Find students who scored above average marks using a subquery.
 List students enrolled in 'Computer Science' using a subquery.
6. Create DEPARTMENT and STUDENT tables.
 Write queries to display student names along with their department names using JOIN operations.
7. Create a view to show student names and marks from the STUDENT table where Marks > 75.
 Query the view and update the view.
8. Demonstrate the use of GRANT and REVOKE on the STUDENT table.
 Use COMMIT and ROLLBACK after INSERT and DELETE commands.

Part B

9. Write a PL/SQL block to accept a number and check if it is even or odd.
10. Write a PL/SQL program to divide two numbers and handle the exception if the denominator is zero.
11. Use a parameterized cursor to display students based on department input.
12. Create a stored function to calculate grade based on marks:
 Above 80: Distinction
 60–79: First Class
 40–59: Second Class
 Below 40: Fail
13. Write a stored procedure to update the marks of a student given their RollNo and new marks.
14. Create a BEFORE INSERT trigger on STUDENT to ensure marks are not entered as negative.
15. Create a trigger to log changes into a table STUDENT_LOG whenever the marks are updated.
16. Use a cursor with a loop to count and display the number of students in each department.

Lab	24BCA32P: Python Programming Lab	
Teaching Hours : 03 Hours/Week	Credits : 02	
Duration of Exam : 3 Hours	Maximum Marks : 50 (Exam 40 + IA 10)	

Part A

1. Write a Python program to declare variables, perform arithmetic operations, and display results.
2. Create a program to check if a number is even or odd using if-else.
3. Write a Python program to print the first n Fibonacci numbers using a for loop.
4. Implement a program that accepts a string and counts the number of vowels and consonants.
5. Create a program to store student details in a dictionary and retrieve details based on user input.
6. Demonstrate the use of break, continue, and pass in loops.
7. Write a program to create NumPy arrays, perform element-wise operations, and reshape arrays.
8. Create a Pandas Series and perform indexing, slicing, and querying operations.
9. Load a dataset into a Pandas Data Frame and perform sorting and filtering operations.
10. Write a program to handle missing values by filling them with mean/median values.

Part B

2. String Operations: Write a program to count the occurrences of each word in a given string.
3. Implement a program to insert, delete, and update elements in a list.
4. Create a dictionary with employee details and perform CRUD operations.
5. Implement a program to generate prime numbers up to n using a generator function.
6. Write a Python program to calculate the factorial of a number using recursion.
7. Write a program to read and write student marks into a text file and display the contents.
8. Plot a line graph and a bar chart using Matplotlib.
9. Write a program to load a CSV file into Pandas and perform basic data analysis.
10. Implement a program to group a dataset by category and calculate summary statistics.
11. Load a dataset from Scikit-learn and display its basic properties.

Lab	24BCA33P: Computer Networks Lab	
Teaching Hours : 03 Hours/Week	Credits : 02	
Duration of Exam : 3 Hours	Maximum Marks : 50 (Exam 40 + IA 10)	

1. Execute the following commands: arp, ipconfig, hostname, netdiag, netstat, nslookup, pathping, ping route, tracert
2. Study of different types of network cables.
3. Practically implement the cross-wired cable and straight wired cable using crimping tool.
4. Study of network IP address configuration: (Classification of address, static and dynamic address)
5. Study of network IP address configuration: (IPv4 and IPv6 , Subnet, Supernet)
6. Study of network devices: (Switch, Router, Bridge)
7. Configure and Connect the computer in LAN.
8. Block the website using “Windows Defender Firewall” in windows 10.
9. Share the folder in a system and access the files of that folder from other system using IP address.
10. Share the printer in Network, and take print from other PC.
11. Configuration of wifi hotspot, and connect other devices (mobile / laptop).
12. Configuration of switches.
13. Configuration of I/O box fixing.
14. Making your own patch cord.
15. Configuration of VLAN using Packet Tracer/ GNS3.
16. Configuration of VPN using Packet Tracer/ GNS3

SEMESTER – IV

Theory	24BCA41: 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 fundamental concepts of Artificial Intelligence and problem-solving strategies.
CO2	Apply logical reasoning techniques, perform inferences, solve constraint satisfaction problems and basic learning methods.
CO3	Design AI systems using planning techniques and reasoning, interpret data using perception models.
CO4	Explore the application domains and evaluate ethical and societal implications of AI technologies.

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. Problem Solving: Problem-Solving Agents, Formulating Problems. Search Techniques: Uninformed Search Strategies – Depth First Search (DFS), Breadth First Search (BFS), Iterative Deepening Search. Informed Search Strategies – Best First Search, A* Search, AO* Search, Means-End Analysis. Adversarial Search and Games: Two-Player Zero-Sum Games, Minmax Algorithm, Alpha-Beta Pruning.

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. Constraint Satisfaction Problems (CSPs): Definition, Examples, Backtracking Search. Learning Concepts: Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples. Decision Trees and Winston's Learning Program.

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. Introduction to Perception: Computer Vision – Image Classification, Object Detection. Natural Language Processing (NLP): Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing.

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), Long Short-Term Memory (LSTM) Networks and their Applications. Expert Systems: Architecture, Components, and Role of Expert Systems with Two Case Studies. 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.
3. Dan W. Patterson, *Introduction to Artificial Intelligence & Expert Systems*, PHI Learning, 2010.
4. Rajiv Chopra, *Data Science with Artificial Intelligence, Machine Learning and Deep Learning*, Khanna Book Publishing Company, 2024.
5. Russell, S. and Norvig, P., *Artificial Intelligence – A Modern Approach*, 3rd Edition, Prentice Hall.

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	24BCA42: Design And Analysis of Algorithms	
Teaching Hours : 04 Hours/Week	Credits : 03	
Duration of Exam : 03 Hours	Maximum Marks : 100 (Exam 80 + IA 20)	

Course Outcome

COs	Description
CO1	Understand the fundamental principles of algorithm design and analyze algorithm efficiency.
CO2	Apply classical algorithm design paradigms to solve computational problems.
CO3	Employ optimization techniques to design efficient solutions for complex problems.
CO4	Analyze the computational complexity of problems and Problem-Solving Methods.

UNIT - I Fundamentals of Algorithm Design and Computational Efficiency 14 Hours
 Introduction: Algorithms, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental Data Structures. Fundamentals of the Analysis of Algorithm Efficiency: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms, Empirical Analysis of Algorithms.

UNIT – II Algorithm Design Techniques 14 Hours
 Brute Force Method: Selection Sort and Bubble Sort, Sequential Search, Brute-Force String Matching, Depth-First Search and Breadth-First Search. Decrease and Conquer: Insertion Sort, Topological Sorting, Algorithms for Generating Combinatorial Objects, Decrease by-a-Constant-Factor Algorithms. Divide and Conquer: Merge Sort, Quick Sort, Binary Tree Traversals and Related Properties.

UNIT - III Optimization Techniques 14 Hours
 Space and Time Tradeoffs: Sorting by Counting, Input Enhancement in String Matching, Hashing. Dynamic programming: Binomial Coefficient, Principle of Optimality, Optimal Binary Search Trees, Knapsack Problem and Memory Functions. Warshall's and Floyd's Algorithms. Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees.

UNIT – IV Understanding Algorithmic Complexity & Problem-Solving Methods 14 Hours
 Limitations of Algorithm Power: Lower-Bound Arguments, Decision Trees, P, NP and NP Complete Problems. Limitations of Algorithm Power, Backtracking: 4-Queens problem, Hamiltonian Circuit Problem, Sum of Subset Problem. Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesman Problem.

TEXT BOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson, 2012.
2. Horowitz, Sahni, Rajasekaran, "Fundamentals of Computer Algorithms", 2/e, Universities Press, 2007.

REFERENCE BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, The MIT Press, 2009.
2. A.V. Aho, J.E. Hopcroft, J.D. Ullmann, "The design and analysis of Computer Algorithms", Addison Wesley Boston, 1983.
3. Jon Kleinberg, Eva Tardos, "Algorithm Design", Pearson Education, 2006.

Theory	24BCA43: Internet Technologies	
Teaching Hours : 04 Hours/Week	Credits : 03	
Duration of Exam : 03 Hours	Maximum Marks : 100 (Exam 80 + IA 20)	

Course Outcome

COs	Description
CO1	Understand the fundamental concepts of the Internet, its services, applications, organizations and apply ethical practices in cyberspace.
CO2	Understand the workings of web technologies and basic concepts of web information retrieval.
CO3	Design and develop web applications.
CO4	Work with web application frameworks and databases and explore current research trends.

UNIT - I Internet Fundamentals, Services and Cyber Ethics 14 Hours

INTERconnected NETwork (Internet): The Giant Wide Area Network, Communicating over the Internet, Accessing the Internet, Internet Organisations, Cyber Ethics, Internet Applications: Internet services, Electronic Mail(E-Mail), File Transfer, Real-Time User Communication, Remote Login, Usenet, World Wide Web: Introduction, Working Web, Web Terminology, Web Architecture, World Wide Web Challenges.

UNIT - II Web Technologies and Evolution 14 Hours

Hypertext Transfer Protocol (HTTP): HTTP, HTTP Version, HTTP connections, HTTP Communication, Hypertext Transfer Protocol Secure, Hypertext Transfer Protocol State Retention: Cookies, Hypertext Transfer Protocol Cache, Evolution of Web: The Generations of Web, Web 1.0, Web 2.0, Web 3.0, Information Retrieval on the Web (Web IR): Web Information Retrieval, Web Information Retrieval Tools, Web Information Retrieval Architecture (Search Engine Architecture), Web Information Retrieval Performance Metrics, Web Information Retrieval Models.

UNIT - III Web Development Technologies and Architectures 14 Hours

Web Development: Basics of Web Development, Elements of Web Development, Client-Side and Server-Side Scripting, Model-View-Controller Architecture for Web Application Development, Client-Side Technologies: HTML, CSS, JavaScript, Bootstrap Framework, AngularJS Framework, Server-Side Technologies: Server-Side Scripting, Node.js.

UNIT - IV Frameworks and Databases for Web Applications with Research Insights 14 Hours

Web Application Frameworks: Django, Ruby on Rails, Structured Query Language: Relational Databases, Web Databases: NoSQL Databases, Non-relational and Distributed Data, Understanding Popular Databases. Research Trends on the Web: Contextual Information Retrieval, Web Mining.

TEXT BOOKS:

- 1.Rajkamal, "Internet and Web Technologies", Tata McGraw-Hill Education.
2. Robert W. Sebesta, "Programming the World Wide Web", Pearson, 8th Edition

REFERENCE BOOKS:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", Pearson
2. Valerie Lampkin, "Modern Web Development with HTML5 and CSS", Cengage Learning.

Theory	24BCA44: Ethical Hacking
Teaching Hours : 02 Hours/Week	Credits : 02
Duration of Exam : 1.5 Hours	Maximum Marks : 50 (Exam 40 + IA 10)

Course outcomes

COs	Description
CO1	Understand the scope, phases and legal aspects of ethical hacking and recognize various cyber attacks and the role of ethical hackers in cyber security.
CO2	Apply reconnaissance, scanning and enumeration techniques using tools to gather and analyze system and network information for vulnerability assessment.
CO3	Identify and explain common system hacking methods, malware types and social engineering attacks and suggest preventive strategies.
CO4	Understand web and network security threats, secure browsing practices and the use of firewalls, VPNs and IDS/IPS for ethical hacking and protection.

Unit-I Foundations of Ethical Hacking and Cyber Attacks

14 Hours

Definition and scope of ethical hacking, Difference between hacking and ethical hacking, Types of hackers – white hat, black hat, grey hat. Ethical hacking process and phases – planning, scanning, gaining access, maintaining access, clearing tracks. Common attack types – phishing, malware, password cracking, social engineering attacks such as phishing, baiting, and shoulder surfing. Introduction to attacks including Trojans, worms, viruses, and ransomware. Basics of keyloggers, spyware, backdoors, and rootkits. Introduction to sniffing and packet capturing. Role of ethical hacking in cyber security. Basic prevention strategies and the importance of user awareness.

Unit-II Footprinting, Scanning, Enumeration and System Exploitation

14 Hours

Introduction to reconnaissance and information gathering. Footprinting techniques – search engines, social networks, WHOIS, DNS, email tracking. Tools for passive and active footprinting. Scanning networks – IP scanning, port scanning, vulnerability scanning. Overview of common tools: Nmap, Angry IP Scanner. Enumeration basics: Windows and Linux enumeration, identifying users, shares, services and open ports, interpreting scan results and identifying risks. Basics of system hacking including password cracking, privilege escalation, keylogging, and techniques used to gain unauthorized access.

TEXT BOOK:

1. Bachaalani, P., & Mehta, N. (2020). *Fundamentals of Ethical Hacking*. BPB Publications.

REFERENCE BOOKS:

1. EC-Council (2019). *Ethical Hacking and Countermeasures: Attack Phases*. Cengage Learning.
2. Kimberly Graves (2010). *CEH: Official Certified Ethical Hacker Review Guide*. Wiley.
3. Jon Erickson (2008). *Hacking: The Art of Exploitation*. No Starch Press.

Lab	24BCA41P: 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. Implement a Hill Climbing search to find the peak in a numeric dataset.
5. Apply the A* Search algorithm to find the shortest path in a 4x4 grid.
6. Implement the Minmax search algorithm for 2-player games. You may use a game tree with 3 plies. .
7. Use constraint propagation to solve a Magic Square puzzle.
8. Apply optimization techniques to find the maximum value in a list.
9. Represent and evaluate propositional logic expressions.
10. Implement a basic rule-based expert system for weather classification.
11. Implement a basic AI agent with simple decision-making rules.
12. Implement a basic Rule-Based Chatbot.
13. Using Python NLTK, perform the following Natural Language Processing (NLP) tasks for text content.
 - a) Tokenizing b) Filtering Stop Words c) Stemming d) Part of Speech tagging
 - e) Chunking f) Named Entity Recognition (NER)

Lab	24BCA42P: Design and Analysis of Algorithms Lab	
Teaching Hours : 03 Hours/Week	Credits : 02	
Duration of Exam : 3 Hours	Maximum Marks : 50 (Exam 40 + IA 10)	

1. Write a program to implement linear search algorithm. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
2. Write a program to implement binary search algorithm. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
3. Write a program to solve towers of Hanoi problem and execute it for different number of disks
4. Write a Program to Sort a given set of numbers using selection sort algorithm. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
5. Write a program to find minimum and maximum value in a given array using divide and conquer.
6. Write a Program to Sort a given set of elements using quick sort algorithm. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
7. Write a Program to implement dynamic programming algorithm for the optimal binary search tree.
8. Write a Program to implement Floyd's algorithm and find the lengths of the shortest paths from every pair of vertices in a given weighted graph.
9. Write a Program to solve the string matching problem using Boyer-Moore approach.
10. Write a program to implement BFS traversal algorithm.
11. Write a program to find the minimum spanning tree of a given graph using Prim's algorithm.
12. Write a program to find the minimum spanning tree of a given graph using Kruskal's algorithm.
13. Write a Program to obtain the topological ordering of vertices in a given digraph. Compute the transitive closure of a given directed graph using Warshall's algorithm.
14. Write a program to implement backtracking algorithm for solving 4 queens problem.
15. Write a Program to Find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d. For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. A suitable message is to be displayed if the given problem instance doesn't have a solution.

Lab	24BCA43P: Internet Technologies Lab	
Teaching Hours : 03 Hours/Week	Credits : 02	
Duration of Exam : 3 Hours	Maximum Marks : 50 (Exam 40 + IA 10)	

1. Demonstrate E-Mail working (Sending ,Receiving, forward).
2. How to create, organize meeting in Zoom/ GoogleMeet.
3. Create a form by using various attributes of the input tags (text box, multiline textbox, option button, check box).
4. Create a simple HTML page by using some of the basic tags (hyperlink, marquee, image).
5. Create a web page with multiple types of style sheet used in a single page.
6. Write a CGI sample program to send output back to the user.
7. Create Time-Table using table tag.
8. Creation of Frames in browser window using HTML.
9. Write a java script program to create dialogue boxes using alert, confirm and prompt methods.
10. Write a java script program on Form Validations.
11. Write a java script program to perform four arithmetic operations: Addition, Subtraction, Multiplication and Division on two numbers.
12. Create a web site of your College.

Theory : Skill Enhancement Course-I	24BCASE1: Probability and Statistics
Teaching Hours : 02 Hours / Week	Credits : 02
Duration of Exam : 1.5 Hours	Maximum Marks : 50 (Exam 40 + IA 10)

Course Outcomes

COs	Description
CO1	Knowledge to conceptualize the probabilities of events including frequent and axiomatic approach. Simultaneously, they will learn the notion of conditional probability.
CO2	Knowledge related to concept of discrete and continuous random variables and their probability distributions including expectation and moments
CO3	Knowledge related to concept of random variable, Probability mass function and probability density function.

UNIT - I Fundamentals of Probability and Theorems

14 Hours

Introduction to Probability: Basic concepts of Probability, random experiment, trial, outcome, sample space, event, mutually exclusive event, equally likely events. Conditional probability, Independent events, Addition and multiplication theorems of probability for 2 events (Statement without proof) and problems, Addition and multiplication theorems of probability for n events (Statement without proof) and problems, Bayes' theorem Statement and its applications.

UNIT - II Random Variables and Probability Distributions

14 Hours

Random variable: Definition of Random variable, discrete and continuous random variables, functions of random variable, probability mass function, probability density function, distribution function and its properties. For a given probability mass function calculation of mean and variance. For a given probability density function calculation of mean and variance. Mathematical Expectation of random variable and function of random variable.

TEXT BOOKS:

1. S.P.Gupta, "Statistical Methods" Sultan Chand and Sons Publishers, 2020
2. S.C. Gupta & V.K.Kapoor "Fundamentals of Mathematical statistics", Sultan Chand and Sons Publishers, 2020.

REFERENCE BOOKS:

1. Sambavyatha – "Fundamentals of statistics", Goon, Gupta and Das Gupta, 2010

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
Total Marks	10

BCA (1ST:2ND AND 3RD YEAR)
Course Title: MS Excel
Total Contact Hours:30
No. of Teaching Hours/Week:2
Duration of ESA/Exam:1 Hours

Course Objective:

- Create an Excel spreadsheet and learn how to maneuver around the spreadsheet for data entry.
- Create simple formulas in an Excel spreadsheet to analyze data.

Learning Outcomes:

- Receive training on MS Excel
- Gain hands-on experience solving real-world job tasks using excel
- Build confidence using the latest tools and technologies

Unit	Content of Course	30 Hours
Unit-I	<p>Create Charts and Objects</p> <p>Create Charts ▪ Create a new chart ▪ Add additional data series ▪ Switch between rows and columns in source data ▪ Analyze data by using Quick Analysis</p> <p>Format Charts ▪ Resize charts ▪ Add and modify chart elements ▪ Apply chart layouts and styles ▪ Move charts to a chart sheet</p> <p>Insert and Format Objects ▪ Insert text boxes and shapes ▪ Insert images ▪ Modify object properties ▪ Add alternative text to objects for accessibility</p>	15 Hours
Unit-II	<p>Apply Custom Data Formats and Layouts</p> <p>Apply Custom Data Formats and Validation ▪ Create custom number formats ▪ Populate cells by using advanced Fill Series options ▪ Configure data validation</p> <p>Apply Advanced Conditional Formatting and Filtering ▪ Create custom conditional formatting rules ▪ Create conditional formatting rules that use formulas ▪ Manage conditional formatting rules</p> <p>Create and Modify Custom Workbook Elements ▪ Create custom color formats ▪ Create and modify cell styles ▪ Create and modify custom themes ▪ Create and modify simple macros ▪ Insert and configure form controls</p> <p>Prepare a Workbook for Internationalization ▪ Display data in multiple international formats ▪ Apply international currency formats ▪ Manage multiple options for +Body and +Heading fonts</p>	15 Hours

Perkins

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Pratik Patel
Ray

Suggested Readings:

1. <https://www.w3schools.com/EXCEL/index.php>
2. Microsoft Excel Formulas and Functions (Office 2021 and Microsoft 365), 1st Edition, by Paul McFedries

Digital Content Writing

BCA (1 ST ,2 ND AND 3 RD YEAR)
Course Title: DIGITAL CONTENT WRITING
Total Contact Hours:30
No. of Teaching Hours/Week:2
Duration of ESA/Exam:1 Hours

Course Objective:

The course intends to develop proficiency in SEO techniques and develop strong writing skills suitable for digital platforms. The program aims to enhance skills in creating engaging and relevant content that resonates with target audiences, fostering increased interaction and loyalty. To train students to effectively incorporate multimedia elements to enhance content engagement and effectiveness.

Learning Outcomes:

After completing this course students will be able to:

- To create effective digital content that meets organizational objectives.
- Creates understanding of SEO techniques to enhance content .

Unit	Content of Course	30 Hours
Unit-I	INTRODUCTION: Overview of Digital Content Writing, Understanding audience and purpose, Importance of SEO in Content Writing, Fundamentals of Writing for the Web: Writing clear and concise content, Formatting techniques for online readability, Best practices for web writing. SEO Basics for Content Writers: Introduction to Search Engine Optimization(SEO),keyword search and usage, Writing SEO-friendly headlines and meta descriptions	15 Hours

Ranking

Dr. Nil
Bany

Unit-II	WRITING DIFFERENT TYPES OF DIGITAL CONTENT: Blog posts and articles, Social media content, Product description and reviews, Editing and Proof Reading: Importance of editing in digital content, techniques for self-editing, Using tools for grammar and style checking, Content Promotion and Distribution: Strategies for promoting content, Understanding social media platforms, Email marketing basics, Content Analytics and Performance Measurement: Introduction to content analytical tools , key metrics to track for content performance, Interpreting data and making improvements	15 Hours
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Suggested Readings:

1. "Content Strategy for the Web" by Kristina Halvorson and Melissa Rach
2. "SEO 2022: Learn Search Engine Optimization with Smart Internet Marketing Strategies" by Adam Clarke