

Uttar Pradesh Rajarshi Tandon Open University, Prayagraj
Assignment Paper for Bachelor of Computer Application (BCA)
 School of Sciences

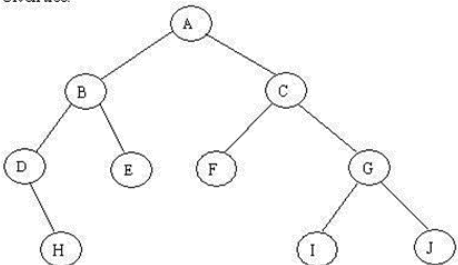
General Note: Assignment papers for course codes AECEG, AECHD, AECHRD, AECHH, AECEA, AESWM, AECNC, and AECDM are available under the Graduate Programme section of the same assignment session.

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-1.1	Course Name: C Programming

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Write a program in C language to generate the given series upto terms less than 200. 1 - 4 + 9 - 16 + 25	2
2.	Design an algorithm and the corresponding flowchart for finding the sum of the numbers 2, 4, 6, 8, ..., n	2
3.	Write a C Program for reversing the digits of an integer. Also check whether it is palindrome or not?	2
4.	What is a library function? What are its uses in C programming?	2
5.	Write a program to count number of words, characters, blanks, punctuation marks in a file.	2
6.	Define a suitable data structure to store the information like student name, roll number, enrolment centre and marks of five different subjects. Write a 'C' function to insert sufficient data in your data structure and function to print the name of the student and the total obtained marks who have secured highest total marks for each and every enrolment centre.	2
SECTION -B		6*3=18 marks

Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	What is an operator? Explain the arithmetic, relational, logical and assignment operators in C language with appropriate example.	6
8.	(a) Write a C program to implement linear linked list, showing all the operations that can be performed on a linked list. (b) Write a C program to check whether the given matrix is symmetric or not	6
9.	(a) Discuss the applications of searching techniques. Write a C program to implement a binary search. (b) What are control statements? Explain different loop control statements with examples.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-1.2	Course Name: Data Structures

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Explain advantages of pointers over arrays.	2
2.	Define “Graph”. When can it be said that two vertices of a Graph are connected?	2
3.	Write a function to return sum of first N natural number.	2
4.	Write in-order, pre-order and post-order traversal of following binary tree. Given tree:  <pre> graph TD A((A)) --> B((B)) A --> C((C)) B --> D((D)) B --> E((E)) D --> H((H)) C --> F((F)) C --> G((G)) G --> I((I)) G --> J((J)) </pre>	2
5.	Sort the sequence 33, 11, 64, 58, 94, 62, 76, 15 using quick sort.	2
6.	Write a program for evaluating nC_r for the given value of n and r using recursive procedure.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Differentiate between stack and queue with appropriate example. (b) Explain linked list with suitable example. What are the differences between a singly linked list and a doubly linked list?	6

8.	Describe the minimum spanning tree with an example? Explain the applications of Breadth First Search and Depth First search?	6
9.	(a) What are the various applications of searching techniques? How is binary search different from sequential search? b) Describe various types of sorting techniques. Explain the advantages of Quick sort over Bubble sort.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-1.3	Course Name: Basic Mathematics

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Evaluate $\int (x+1)e^x(xe^x+5)^4 dx$	2
2.	Evaluate $\lim_{x \rightarrow 0} \sqrt[3]{1+x} - 1$	2
3.	Find $\frac{dy}{dx}$, if $y = x^{x^x}$	2
4.	Trace the curve $y = x^3 - 8x^2 + x + 42$.	2
5.	Find the angle between the lines $2x+3y=7$ and $4x+5y=14$.	2
6.	Find the cartesian forms of the equations (a) $r^2 = 3r \sin \theta$. (b) $r = a(1-\cos \theta)$, where a is a constant.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	State and prove Lagrange's mean value theorem	6
8.	a) Integrate $\int \cos(x)^5 \sin(x)^7 dx$ b) Show that Every differentiable function is continuous but converse is not true.	6
9.	a) Prove that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$. where A, B, C are non-empty sets. b) Find the Value of x: $(x^2 + 2x + 3)^{1/2} = (2x + 5)$	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-1.4	Course Name: Numerical Analysis

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	If $\pi = 22/7$ is approximated as 3.14, find the absolute error and relative error respectively.	2
2.	Find a root of $3x^3 - x^2 + 3x - 1 = 0$ near $x_0 = 0.2$ in two iterations by Birge-Vieta method.	2
3.	Solve $\sin x = x/2$ by Newton-Raphson method.	2
4.	Find the inverse of the matrix $A = \begin{bmatrix} 5 & -2 & 4 \\ -2 & 1 & 1 \\ 4 & 1 & 0 \end{bmatrix}$	2
5.	Apply Gauss- Jordan Reduction to solve the equations: $2x - 3y + z = -1,$ $x + 4y + 5z = 25,$ $3x - 4y + z = 2$	2
6.	Solve the following equation by Gauss-Seidel method: $27x + 6y - z = 85$ $x + y + 54z = 110$ $6x + 15y + 2z = 72$	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	Apply Gauss elimination method to solve the equations: $2x + 2y + z = 12,$ $3x + 2y + 2z = 8,$	6

	$5x + 10y - 8z = 10$	
8.	What do you mean by Simpson's 1/3 rd and 3/8 th rule. Find the value of $\int \frac{1}{\sqrt{1-x^2}} dx$ by Simpson's 1/3 rd rule.	6
9.	Use the Jacobi method to approximate the solution of the following system of linear equations. $5x_1 - 2x_2 + 3x_3 = 1$ $-3x_1 + 9x_2 + x_3 = 2$ $2x_1 - x_2 - 7x_3 = 3$ Continue the iterations until two successive approximations are identical when rounded to three significant digits.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-2.1	Course Name: Design And Analysis Of Algorithm

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Define an algorithm and list the essential properties it must satisfy. Distinguish between an algorithm and pseudocode with a suitable example.	2
2.	Explain the concept of asymptotic notation. Differentiate between Big-O, Omega, and Theta notations, giving one example of each.	2
3.	Compare Counting Sort and Radix Sort with respect to their working principle, time complexity, and suitability for different types of input data.	2
4.	State the general strategy of the Greedy method. Explain, with a brief example, why the greedy approach does not always guarantee an optimal solution.	2
5.	Differentiate between Breadth First Search (BFS) and Depth First Search (DFS) with respect to the data structure used, order of traversal, and one application of each.	2
6.	What is meant by an NP-Complete problem? Explain the significance of the Satisfiability (SAT) problem in the theory of NP-Completeness.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Solve the following recurrence relation using the Master Method and state which case applies: $T(n) = 4T(n/2) + n^2$ (b) Write the Quick Sort algorithm using the Divide and Conquer strategy. Trace its execution on the array: [38, 27, 43, 3, 9, 82, 10], showing the partitioning steps at each stage, and derive its worst-case time complexity.	6

8.	A company wants to fill a knapsack of capacity $W = 15$ kg using the following items, where fractional quantities are <i>not</i> allowed: Item Weight (kg) Value (₹) <table> <tr> <td>1</td><td>3</td><td>25</td></tr> <tr> <td>2</td><td>4</td><td>24</td></tr> <tr> <td>3</td><td>5</td><td>15</td></tr> <tr> <td>4</td><td>6</td><td>20</td></tr> </table> Using the Dynamic Programming approach for the 0/1 Knapsack problem, construct the DP table, determine the maximum value obtainable, and identify the items selected. Also explain why the Dynamic Programming approach is preferred over the Greedy approach for this variant of the knapsack problem.	1	3	25	2	4	24	3	5	15	4	6	20	6
1	3	25												
2	4	24												
3	5	15												
4	6	20												
9.	(a) Describe the Backtracking method as a general problem-solving strategy, and explain how a state-space tree is used to prune infeasible solutions. (b) Apply the Backtracking technique to solve the 4-Queens problem. Show the state-space tree (or the sequence of placements and backtracks) leading to at least one valid solution, and represent the final solution on a 4×4 chessboard.	6												

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-2.2	Course Name: Discrete Mathematics

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Define a tautology with a suitable example. Using a truth table, verify whether the statement $(p \rightarrow q) \leftrightarrow (\neg p \vee q)$ is a tautology.	2
2.	State the Principle of Duality in Boolean Algebra. Write the dual of the Boolean expression: $(a + b) \cdot (a + c) = a + (b \cdot c)$	2
3.	Let $A = \{1, 2, 3, 4\}$ and define a relation R on A by $R = \{(1,1), (2,2), (3,3), (4,4), (1,2), (2,1)\}$. Verify whether R is reflexive, symmetric, and transitive, and state whether R is an equivalence relation.	2
4.	Distinguish between a Permutation and a Combination with one example each. In how many ways can 3 books be selected from 8 different books?	2
5.	State the Pigeonhole Principle. Using this principle, prove that if 13 people are present in a room, at least two of them must have their birthday in the same month.	2
6.	Define an Onto (Surjective) function. Give an example of a function $f: A \rightarrow B$, where $ A = 3$ and $ B = 2$, that is onto, and justify your answer.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Test the validity of the following argument using the Rules of Inference: <i>If it rains, the match will be cancelled. It is raining. Therefore, the match will be cancelled.</i> Symbolize the argument and identify the rule of inference applied. (b) Minimize the following Boolean function using a Karnaugh Map (K-Map) and draw the simplified logic circuit:	6

	$F(A, B, C, D) = \Sigma(0, 1, 2, 5, 6, 7, 8, 9, 10, 14)$	
8.	(a) State and prove De Morgan's Laws for sets using an appropriate method (Venn diagram or element-wise proof), for sets A and B. (b) In a class of 60 students, 25 students play Cricket, 20 students play Football, and 8 students play both games. Using the Principle of Inclusion-Exclusion, find: (i) the number of students who play at least one of the two games, and (ii) the number of students who play neither game.	6
9.	(a) Using the Principle of Mathematical Induction, prove that for all positive integers n: $1^2 + 2^2 + 3^2 + \dots + n^2 = n(n+1)(2n+1)/6$ (b) Find the general term and the middle term in the binomial expansion of $(2x - 3/x)^9$, and hence determine the middle term explicitly.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-2.3	Course Name: C++ and Object-oriented programming

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Compare Object-Oriented Programming with Procedural Programming on the basis of data security, program structure, and code reusability.	2
2.	Distinguish between Encapsulation and Abstraction with a suitable real-life example for each.	2
3.	What is meant by dynamic binding (late binding)? How does it differ from static (early) binding in C++?	2
4.	Explain the purpose of a friend function in C++. State any two characteristics of friend functions with respect to class access rights.	2
5.	Differentiate between a Constructor and a Destructor with respect to invocation, overloading capability, and purpose, giving one example of each.	2
6.	Define a virtual function. Explain, with a short example, why virtual functions are essential for achieving run-time polymorphism.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	Q7. (a) Explain the concept of static data members and static member functions in a class. Write a C++ program using a static data member to count the number of objects created for a class <code>Student</code>. (b) Explain constructor overloading with an example. Write a C++ program for a class <code>Rectangle</code> having a default constructor, a parameterized constructor, and a copy constructor, and demonstrate their invocation in <code>main()</code>.	6
8.	(a) What is operator overloading? State the rules for overloading operators in C++. (b) Write a C++ program to overload the binary + operator to add two complex	6

	numbers (represented using a class <code>Complex</code> with real and imaginary parts as data members), and display the result.	
9.	(a) Explain the different types of inheritance supported in C++ (single, multilevel, multiple, hierarchical, and hybrid), with a class diagram for each type. (b) Explain the concept of virtual base classes and the problem of ambiguity they resolve in multiple inheritance, using a suitable example involving classes A, B, C, and D (diamond problem).	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-2.4	Course Name: Data Base Management System

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	List any four characteristics of the Database Approach that distinguish it from the traditional file-based system.	2
2.	Differentiate between a Weak Entity Type and a Strong Entity Type in the ER Model, with a suitable example.	2
3.	What is a Relational Database Schema? Distinguish between an intension (schema) and an extension (instance) of a relation with an example.	2
4.	Define a Trigger in SQL. Explain, with a short example, one practical situation where a trigger would be used in a database application.	2
5.	State the closure of a set of Functional Dependencies. If $F = \{A \rightarrow B, B \rightarrow C\}$, determine whether $A \rightarrow C$ is implied by F, using Armstrong's Axioms.	2
6.	Define Serializability of a schedule. Distinguish between Conflict Serializability and View Serializability.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) A University wants to maintain a database with the following requirements: Each Student (roll_no, name, dept) can enroll in multiple Courses (course_id, title, credits); each Course can have multiple Students enrolled, and the enrollment records the semester and grade obtained. Each Course is taught by exactly one Faculty (faculty_id, name), and a Faculty can teach multiple Courses. Draw an ER diagram for the above scenario, clearly indicating entity types, attributes, primary keys, relationship types, and cardinality constraints. (b) Convert the above ER diagram into an equivalent set of relational tables,	6

	clearly specifying primary keys and foreign keys.	
8.	Consider the following relational schema: Employee (Emp_ID, Emp_Name, Dept_ID, Salary) Department (Dept_ID, Dept_Name, Location) Write SQL statements for the following: (i) Create the two tables with appropriate primary key and foreign key constraints. (ii) Retrieve the names of employees who work in the 'Sales' department. (iii) List department-wise average salary, displaying only departments with an average salary greater than 50,000. (iv) Increase the salary of all employees in the 'IT' department by 10%. (v) Create a view showing Employee Name, Department Name, and Salary by joining the two tables. (vi) Delete the record of an employee whose Emp_ID is 105.	6
9.	(a) Explain the concept of Normalization and the problems (insertion, deletion, and update anomalies) that arise in an unnormalized relation, with a suitable example. (b) Consider the relation R(A, B, C, D) with the following functional dependencies: $F = \{A \rightarrow B, B \rightarrow C, C \rightarrow D\}$ Determine the highest normal form satisfied by R with respect to the given functional dependencies, and decompose R into a set of relations that satisfy the Boyce-Codd Normal Form (BCNF), showing all intermediate steps.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-3.1	Course Name: Operating System

SECTION -A		2*6=12 marks						
Q. No.	Short answer type question (approx. 200 -300 words)	Marks						
1.	Distinguish between Multiprogramming and Time-Sharing operating systems with a suitable example of each.	2						
2.	What is a Process Control Block (PCB)? List any four pieces of information typically stored in a PCB.	2						
3.	Differentiate between Preemptive and Non-Preemptive scheduling, giving one example of a scheduling algorithm belonging to each category.	2						
4.	Define a Semaphore. Explain the difference between a Binary Semaphore and a Counting Semaphore.	2						
5.	State the four necessary conditions for a deadlock to occur in a system.	2						
6.	Differentiate between Internal Fragmentation and External Fragmentation, with reference to memory allocation techniques.	2						
SECTION -B		6*3=18 marks						
Q. No.	Long answer type question (approx. 500 -800 words)	Marks						
7.	(a) Explain the Producer-Consumer (Bounded Buffer) problem as a classical problem of process synchronization. Give its solution using semaphores, clearly writing the <code>wait()</code> and <code>signal()</code> operations used. (b) Consider the following set of processes with their arrival time and burst time: <table> <tr> <th>Process</th><th>Arrival Time</th><th>Burst Time</th></tr> <tr> <td>P1</td><td>0</td><td>5</td></tr> </table>	Process	Arrival Time	Burst Time	P1	0	5	6
Process	Arrival Time	Burst Time						
P1	0	5						

	P2 1 3 P3 2 8 P4 3 6 Compute the average waiting time and average turnaround time using the Shortest Remaining Time First (SRTF) scheduling algorithm. Draw the Gantt chart.																
8.	Consider a system with 4 processes (P0, P1, P2, P3) and 3 resource types (A, B, C), with the following state: <table> <thead> <tr> <th>Process</th><th>Allocation (A B C)</th><th>Max (A B C)</th></tr> </thead> <tbody> <tr> <td>P0</td><td>0 1 0</td><td>7 5 3</td></tr> <tr> <td>P1</td><td>2 0 0</td><td>3 2 2</td></tr> <tr> <td>P2</td><td>3 0 2</td><td>9 0 2</td></tr> <tr> <td>P3</td><td>2 1 1</td><td>2 2 2</td></tr> </tbody> </table> Total resources available in the system: A = 10, B = 5, C = 7. Using Banker's Algorithm, determine the Available vector, and check whether the system is in a safe state. If safe, give a safe sequence.	Process	Allocation (A B C)	Max (A B C)	P0	0 1 0	7 5 3	P1	2 0 0	3 2 2	P2	3 0 2	9 0 2	P3	2 1 1	2 2 2	6
Process	Allocation (A B C)	Max (A B C)															
P0	0 1 0	7 5 3															
P1	2 0 0	3 2 2															
P2	3 0 2	9 0 2															
P3	2 1 1	2 2 2															
9.	(a) Explain the concept of Demand Paging and the occurrence of a Page Fault, with the help of a diagram. (b) A system uses the following page reference string: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2 with 3 page frames available. Calculate the number of page faults using: (i) FIFO page replacement algorithm (ii) LRU (Least Recently Used) page replacement algorithm Show the frame contents at each step for both algorithms.	6															

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-3.2	Course Name: Software Engineering

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	List any four characteristics of software that distinguish it from a hardware product.	2
2.	Differentiate between the Waterfall Model and the Prototyping Model of software development, stating one situation where each is preferably used.	2
3.	Distinguish between Size-Oriented Metrics and Function-Oriented Metrics in software measurement, with one example of each.	2
4.	Define Software Quality Assurance (SQA). State any two objectives of a Formal Technical Review (FTR).	2
5.	Differentiate between Cohesion and Coupling in software design, stating whether high or low values are desirable for good modular design.	2
6.	Distinguish between Alpha Testing and Beta Testing with respect to the location of testing and the persons involved.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Explain the Spiral Model of software process, describing its four quadrants with the help of a diagram. State two advantages of the Spiral Model over the classical Waterfall Model. (b) A proposed software project is estimated to have 32,000 lines of code (KLOC = 32). Using the Basic COCOMO Model for an <i>organic</i> type project (with coefficients $a = 2.4$, $b = 1.05$, $c = 2.5$, $d = 0.38$), calculate: (i) Estimated Effort (in Person-Months) (ii) Development Time (in Months) (iii) Number of persons required Show all formulae and calculation steps used.	6

8.	(a) Explain the process of Risk Analysis and Management in software projects. Describe, with examples, the steps of Risk Identification, Risk Projection, and Risk Mitigation for a typical software project. (b) What is a Software Requirement Specification (SRS)? Explain the key characteristics of a good SRS document, and outline the essential sections it should contain.	6
9.	(a) Explain the different levels of Software Testing — Unit Testing, Integration Testing, and System Testing — describing the Top-Down and Bottom-Up approaches to Integration Testing with a suitable diagram. (b) Explain the concept of Software Reengineering. Distinguish between Reverse Engineering, Restructuring, and Forward Engineering, and explain the role of CASE tools in supporting these activities.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-3.3	Course Name: Computer Networks

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Differentiate between LAN, MAN, and WAN with respect to geographical coverage, ownership, and typical data transfer speed.	2
2.	Compare the OSI Reference Model and the TCP/IP Model in terms of the number of layers and their approach to standardization.	2
3.	Distinguish between Circuit Switching and Packet Switching, stating one advantage of packet switching over circuit switching.	2
4.	Explain the Stop-and-Wait protocol used in the Data Link Layer. State one limitation of this protocol.	2
5.	Differentiate between a Switch and a Router with respect to the OSI layer at which they operate and their primary function.	2
6.	Define Congestion Control. State any two open-loop congestion control policies used in networks.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Explain the working of the CSMA/CD (Carrier Sense Multiple Access with Collision Detection) protocol used in Ethernet (IEEE 802.3), with the help of a flowchart. (b) Explain the Sliding Window Flow Control protocol used in the Data Link Layer. Describe how the Go-Back-N mechanism handles the retransmission of frames when an error occurs, using a suitable timing diagram.	6
8.	(a) Given the IP address 192.168.10.0 with a subnet mask of 255.255.255.192 , determine: (i) The number of subnets created (ii) The number of usable host addresses per subnet	6

	(iii) The valid range of host addresses for the first subnet Show all calculation steps. (b) Explain the Dijkstra's Shortest Path Routing Algorithm used in the Network Layer. Illustrate its working on a sample network of five nodes, showing the shortest path tree construction.	
9.	(a) Explain the TCP (Transmission Control Protocol) three-way handshake mechanism used for connection establishment, with a suitable diagram. Also explain how TCP achieves reliable data transfer through flow control and error control. (b) Explain the working of the Domain Name System (DNS) with the help of a diagram showing the hierarchy of DNS servers. Also briefly describe the architecture of an Email system, including the roles of MTA (Mail Transfer Agent) and MUA (Mail User Agent).	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-3.4	Course Name: Java Programming

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Differentiate between Method Overloading and Method Overriding in Java, with one example of each.	2
2.	Explain the use of the this keyword in Java with a suitable example.	2
3.	Distinguish between an Interface and an Abstract class in Java, stating one situation where an interface is preferred over an abstract class.	2
4.	What is Exception Handling? Explain the purpose of the try, catch, and finally blocks with a short example.	2
5.	Define Multithreading. Explain the difference between the Thread class and the Runnable interface for creating a thread in Java.	2
6.	Differentiate between the String class and the StringBuffer class in Java, with respect to mutability and performance.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Explain the concept of Inheritance in Java. Write a Java program demonstrating multilevel inheritance using three classes: <code>Employee</code> (name, id), <code>Manager</code> (extends <code>Employee</code>, adds department), and <code>SeniorManager</code> (extends <code>Manager</code>, adds number of teams handled). Include a <code>main()</code> method to create an object of <code>SeniorManager</code> and display all details. (b) Explain the concept of Packages in Java. Describe the steps to create a user-defined package and access its members in another class, with a suitable example.	6

8.	(a) Explain the different types of Exceptions in Java (checked and unchecked), and describe how to create and use a user-defined exception subclass with a suitable example. (b) Write a Java program to create two threads using the <code>Thread</code> class — one printing even numbers and the other printing odd numbers from 1 to 20 — and explain how synchronization can be used to control their execution order.	6
9.	(a) Explain the life cycle of an Applet in Java, describing the purpose of the <code>init()</code>, <code>start()</code>, <code>paint()</code>, <code>stop()</code>, and <code>destroy()</code> methods, with the help of a diagram. (b) Explain the architecture of a client-server application using TCP/IP Sockets in Java. Write the essential code segments for creating a simple <code>Socket</code> (client side) and <code>ServerSocket</code> (server side) connection for exchanging a message.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-4.1	Course Name: Windows Programming

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Differentiate between Traditional (Procedural) Programming and Event-Driven Programming, giving one example of an event in Windows programming.	2
2.	Define a Handle in Windows Programming. Explain the purpose of a Device Context with a short example.	2
3.	Distinguish between a Modal Dialog Box and a Modeless Dialog Box, stating one situation where each is used.	2
4.	What is the Microsoft Foundation Class (MFC) library? Explain briefly the purpose of the Document-View architecture.	2
5.	Differentiate between Single Document Interface (SDI) and Multiple Document Interface (MDI), giving one example application of each.	2
6.	Define Open Database Connectivity (ODBC). State any two advantages of using ODBC for database access in an application.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Explain the concept of Windows Messages and the Message Loop in event-driven Windows programming. Describe, with a suitable example, how a Windows application responds to a mouse-click event. (b) Explain the various programming resources used in Windows applications — Menus, Dialog Boxes, Icons, and Toolbars — describing the role of each with a suitable example.	6
8.	(a) Explain the different types of controls available in Visual Basic (the Intrinsic Controls). Describe the properties, events, and methods associated with a Command Button control and a TextBox control with a suitable	6

	example. (b) Design a Visual Basic form for a "Customer Database Input Screen" containing fields for Customer Name, Address, Phone Number, and a Submit button. Explain, step by step, how the data entered would be validated and saved to a database using ADO/Data Control and Recordset concepts.	
9.	(a) Explain the Component Object Model (COM) and its role in Windows application development. Distinguish between COM, COM+, and DCOM (Distributed Component Object Model). (b) Explain the concept of Windows Sockets (Winsock) for network programming. Describe the sequence of steps involved in creating a socket-based client-server connection in a Windows application.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-4.2	Course Name: Computer Organization

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Convert the hexadecimal number $(2F3)_{16}$ to its equivalent binary and octal forms, showing all steps.	2
2.	State De Morgan's Theorems. Verify one of the theorems using a truth table for two variables A and B.	2
3.	Differentiate between a Multiplexer and a Demultiplexer, stating the number of select lines required for an 8-input multiplexer.	2
4.	Distinguish between a J-K Flip-Flop and a D Flip-Flop with respect to their characteristic tables and the "invalid state" problem.	2
5.	Differentiate between Direct Addressing and Indirect Addressing modes with a suitable example instruction for each.	2
6.	Differentiate between RAM and ROM with respect to volatility, and briefly explain the difference between EPROM and EEPROM.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Simplify the following Boolean function using a Karnaugh Map (K-Map) and draw the simplified logic circuit using basic gates: $F(A, B, C, D) = \Sigma(1, 3, 4, 5, 6, 7, 9, 11, 13, 15)$ (b) Design and explain a Full Adder circuit. Draw its logic diagram, truth table, and derive the Boolean expressions for Sum and Carry outputs.	6
8.	(a) Explain the Instruction Cycle of a computer system, describing the Fetch, Decode, and Execute phases with the help of a flowchart, and explain the role of the Control Unit in this process. (b) Explain the following addressing techniques with a suitable example	6

	instruction for each: Immediate Addressing, Relative Addressing, and Indexed Addressing. Also explain the purpose of the Program Counter, Stack Pointer, and Memory Buffer Register in instruction execution.	
9.	(a) Explain the memory hierarchy of a computer system, describing the roles of Cache Memory and Virtual Memory. Explain briefly how Cache Memory improves overall system performance. (b) Explain the architecture of the 8085 microprocessor with the help of a block diagram, describing the functions of its major components (ALU, registers, accumulator, flags). Also distinguish between a Microprocessor and a Microcontroller with two points of difference.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-4.3	Course Name: Introduction to Mobile Architecture

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Differentiate between a Mobile Application and a Web-Based Application with respect to connectivity requirement and access to device hardware.	2
2.	List the major components of a Mobile Client Application, and briefly explain the role of any two of them.	2
3.	State any four basic functions performed by a Mobile Operating System.	2
4.	Differentiate between Volatile Memory and Non-Volatile Memory in a mobile phone, with one example of each used in mobile devices.	2
5.	Explain the working principle of an Accelerometer sensor. State one application of an accelerometer in a mobile application.	2
6.	Differentiate between NOR Flash Memory and NAND Flash Memory with respect to access speed and typical use case.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Explain the overall architecture of a Mobile Application, describing the Mobile Client Application layer and the Mobile Support Infrastructure layer, with the help of a block diagram. (b) Discuss the key design considerations and best practices to be followed while designing the User Interface (UI) of a Mobile Application. Include a checklist covering usability, power consumption, and synchronization aspects.	6
8.	. (a) Explain the Architecture of Android Operating System, describing each of its layers (Linux Kernel, Libraries, Android Runtime, Application Framework, and Applications) with a labelled diagram.	6

	(b) Compare Android, iOS, and Windows Mobile operating systems on the basis of architecture, multitasking capability, and application development environment.	
9.	(a) Explain the ARM processor architecture and its key features. Differentiate between ARM and x86 processors with respect to instruction set design, power consumption, and typical area of application. (b) Describe the Instruction Execution Cycle of a processor. Explain the role of the following sensors in a smartphone: Gyroscope, Proximity Sensor, and Compass, with one application of each.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-4.4	Course Name: Introduction to Cyber Security

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Define Malware. List any four types of malware, briefly stating how each affects a computer system.	2
2.	Differentiate between Encryption and a Digital Signature, stating the primary purpose of each in cyber security.	2
3.	What is Computer Forensics? State any two reasons why a cyber crime incident should be reported to the concerned authorities.	2
4.	State any four guidelines for generating and maintaining a secure password.	2
5.	Explain the concept of Two-Step Verification. How does it enhance account security beyond a simple password?	2
6.	How can a user identify whether a website is secure before making an online purchase? State any two indicators.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Explain the concept of a Firewall and its role in network security. Describe the steps involved in configuring and enabling the Windows Firewall with Advanced Security on a Windows 7 system. (b) Explain the concept of Steganography and how it differs from Encryption. Discuss briefly how Antivirus software helps in detecting and preventing malware infections on a computer system.	6
8.	(a) Discuss the major cyber security initiatives undertaken by the Government of India to counter cyber crime, describing the role of at least three such initiatives/agencies.	6

	(b) A student wants to browse the internet safely and shop online securely. Prepare a set of guidelines covering: (i) safe browsing practices, (ii) tips for safe online shopping, and (iii) the importance of clearing browser cache regularly.	
9.	(a) Explain the major security issues associated with Wireless LAN (WLAN). Discuss the best practices for securing a home Wi-Fi network. (b) A user is highly active on social networking sites and frequently shares personal photos, location, and status updates. Explain the potential security risks involved and provide a comprehensive set of safe social media usage guidelines to mitigate these risks, along with basic email security tips.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-5.1	Course Name: Python Programming

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Differentiate between a List and a Tuple in Python with respect to mutability and syntax, giving one example of each.	2
2.	Explain the difference between <code>*args</code> and <code>**kwargs</code> in a Python function definition, with a short example of each.	2
3.	Distinguish between the <code>import module_name</code> statement and the <code>from module_name import *</code> statement in Python.	2
4.	Differentiate between an Error and an Exception in Python, giving one example of each.	2
5.	What is the purpose of the <code>self</code> variable in a Python class? Explain with a short example.	2
6.	Differentiate between Supervised Learning and Unsupervised Learning in Machine Learning, giving one example algorithm/application of each.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Explain List Comprehension in Python with a suitable example. Write a Python program using list comprehension to generate a list of squares of all even numbers between 1 and 20. (b) Write a Python program to implement a Stack using a list, with functions <code>push()</code>, <code>pop()</code>, and <code>display()</code>. Demonstrate the operations by pushing the elements 10, 20, 30 and then popping one element.	6
8.	(a) Explain the concept of Inheritance in Python with method overriding. Write a Python program demonstrating single inheritance using a base class <code>Shape</code> (with a method <code>area()</code>) and a derived class <code>Circle</code> that overrides the <code>area()</code>	6

	method to compute the area of a circle. (b) Explain Exception Handling in Python using <code>try</code>, <code>except</code>, <code>else</code>, and <code>finally</code> blocks. Write a Python program that accepts two numbers from the user, divides them, and handles the <code>ZeroDivisionError</code> and <code>ValueError</code> exceptions appropriately, including a user-defined exception for negative input.	
9.	(a) Explain the basic concepts of Unit Testing in Python. Write a simple test case using the <code>unittest</code> module to test a function <code>add(a, b)</code> that returns the sum of two numbers. (b) Explain the concept of Simple Linear Regression in Machine Learning. Describe, with a suitable example dataset (features and labels), the steps involved in fitting a simple linear regression model to predict an output variable from a single input variable.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-5.2	Course Name: Multimedia

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Define Multimedia. List any four essential elements of a multimedia application.	2
2.	Differentiate between ADPCM (Adaptive Differential Pulse Code Modulation) and MPEG Audio Compression with respect to their compression approach.	2
3.	Explain the concept of Frame Grabbing in video capture. State one practical application where frame grabbing is used.	2
4.	Differentiate between Real-Time Animation and Frame-by-Frame Animation, giving one example of each.	2
5.	What is a Hot-Spot Editor in a multimedia authoring tool? Explain its use with a short example.	2
6.	State any four factors that must be considered while designing multimedia applications for delivery over a LAN or the Internet.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Explain the process of digitizing sound, describing the concepts of sampling rate, sample size, and quantization. Explain briefly the working of Wave Table Synthesis and MIDI in generating music on a sound card. (b) Explain the need for Video Compression. Discuss any two standards used for video compression and decompression (e.g., MPEG, H.26x), describing their key features and typical areas of application.	6
8.	(a) Explain the concept of 3D Object Modeling and Motion Control in multimedia animation. Describe the roles of Texture Mapping, Shadows, and Anti-Aliasing in producing realistic 3D animations.	6

	(b) Explain the various components of a Multimedia Authoring Tool — Project Editor, Topic Editor, and Hot-Spot Editor. Describe the typical steps involved in developing a multimedia title using an authoring tool.	
9.	(a) Discuss the challenges involved in delivering multimedia content over a LAN and the Internet. Explain the role of high-speed digital networks and fast modems in enabling smooth multimedia transmission. (b) Explain the working of Video Conferencing over the Internet, describing the essential hardware and software components required. Discuss briefly the future directions of interactive multimedia applications on the Internet.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-5.3	Course Name: Soft Computing

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Define State Space Representation in Artificial Intelligence. Formulate the initial state and goal state for the classic 8-Puzzle problem.	2
2.	Differentiate between Monotonic Reasoning and Non-Monotonic Reasoning, giving one example of each.	2
3.	Differentiate between a Crisp Set and a Fuzzy Set, with a suitable example of a membership function for the fuzzy set "Tall person."	2
4.	Define Defuzzification. State any two commonly used defuzzification methods in a Fuzzy Inference System.	2
5.	Differentiate between the Perceptron Learning Rule and the LMS (Widrow-Hoff) Learning Rule used in Artificial Neural Networks.	2
6.	Define Crossover and Mutation operators in a Genetic Algorithm. State the primary purpose each operator serves in the search process.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Explain Bayes' Theorem and its role in handling uncertainty in AI systems. Describe, with a suitable example, how a Bayesian Network represents dependencies among random variables. (b) Solve the Water Jug Problem using a state-space search approach: given a 4-litre jug and a 3-litre jug (no markings), describe the sequence of states required to measure exactly 2 litres of water. Represent the solution as a state-space search tree/table.	6
8.	(a) Explain the architecture and working of a Fuzzy Inference System (FIS), describing the roles of Fuzzification, Rule Base, Inference Engine, and	6

	Defuzzification, with a block diagram. (b) Consider two fuzzy sets defined on the universe $X = \{1, 2, 3, 4\}$: $A = \{0.2/1, 0.5/2, 0.8/3, 1.0/4\}$ $B = \{0.9/1, 0.6/2, 0.3/3, 0.1/4\}$ Compute the Fuzzy Union ($A \cup B$), Fuzzy Intersection ($A \cap B$), and Complement of A, using standard fuzzy set operations.	
9.	(a) Explain the Backpropagation Learning Algorithm for training a Multi-Layer Feedforward Neural Network. Describe the role of the Generalized Delta Rule and discuss any two limitations of the Backpropagation algorithm. (b) Explain the working principle of a Genetic Algorithm with the help of a flowchart, describing the steps of Population Initialization, Fitness Evaluation, Selection, Crossover, and Mutation. Illustrate the Single-Point Crossover operation using two sample chromosomes of length 8.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-EA	Course Name: Web Technology

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Differentiate between SMTP and POP3 protocols with respect to their role in email communication.	2
2.	What is MIME (Multipurpose Internet Mail Extensions)? Explain its purpose in email systems with a short example.	2
3.	Differentiate between Client-Side Scripting and Server-Side Scripting, giving one example language of each.	2
4.	Explain the concept of Event Bubbling in the JavaScript Event Model with a short example.	2
5.	What is a Cookie in the context of session tracking? Differentiate between a Cookie and a Session Object.	2
6.	Differentiate between HTML and XML with respect to their purpose and structure.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Explain the concept of Object-Based Scripting in JavaScript. Write a JavaScript program that defines a <code>Student</code> object with properties <code>name</code>, <code>roll_no</code>, and <code>marks</code>, and a method <code>displayDetails()</code> to print the details, and demonstrate its use. (b) Explain the JavaScript Event Model, describing the <code>onLoad</code>, <code>onClick</code>, and <code>onSubmit</code> events with a suitable example of a form validation script that checks whether a text field is left empty before submission.	6
8.	(a) Explain the architecture of ASP (Active Server Pages) and describe the built-in ASP objects — <code>Request</code> , <code>Response</code> , <code>Session</code> , and <code>Application</code> —	6

	stating the purpose of each with an example. (b) Explain how a database can be accessed from an ASP page using ADO (ActiveX Data Objects). Describe, with a code outline, the steps involved in connecting to a database, executing a SQL query, and displaying the retrieved records on a web page.	
9.	(a) Explain the architecture of a Servlet and describe how it handles HTTP <code>GET</code> and <code>POST</code> requests. Differentiate between a Servlet and a JSP (Java Server Page) with respect to development approach and ease of use. (b) Explain the basic structure of an XML document, describing the roles of Elements, Attributes, and Namespaces. Briefly discuss the emerging trends in Web 2.0 technologies and the concept of the Semantic Web.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-EB	Course Name: Client Server Technology

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Differentiate between File Server computing and Client/Server Database computing, giving one advantage of the latter.	2
2.	Explain the role of the Common Language Runtime (CLR) in the .NET Framework.	2
3.	Differentiate between HTML Controls and Web Controls in ASP.NET, giving one example of each.	2
4.	Distinguish between a <code>DataSet</code> and a <code>DataReader</code> in ADO.NET with respect to connection state and data access mode.	2
5.	Differentiate between Session State and Application State in ASP.NET, giving one example use case for each.	2
6.	What is AJAX? Explain the role of the <code>UpdatePanel</code> control in an ASP.NET AJAX application.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Explain the fundamentals of Client-Server Application Design, describing the "division of labor" between client and server. Discuss the various communication techniques and protocols used for client-server interaction. (b) Explain the Life Cycle of an ASP.NET Page, describing the sequence of events from <code>Page_Init</code> to <code>Page_Unload</code>. Explain the purpose of the <code>IsPostBack</code> property with a suitable example.	6
8.	(a) Explain the architecture of ADO.NET, describing the roles of .NET Framework Data Providers, Connection, Command, DataAdapter, and DataSet objects, with a diagram showing connected and disconnected data access.	6

	(b) Write the essential C# code segments (using ASP.NET server controls) to connect to a database table <code>Students(RollNo, Name, Marks)</code> , retrieve all records using a DataSet, and bind and display them in a GridView control on a Web Form.	
9.	(a) Explain ASP.NET State Management techniques, describing Cookies and Session Variables stored in a database, and discuss the advantages of storing session state in a database over in-process session state. (b) Explain the concept of ASP.NET Web Services, describing the steps involved in creating and invoking a simple web service (e.g., a service that returns the sum of two numbers). Also explain the role of ASP.NET Login Controls in implementing web-based authentication.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-6.1	Course Name: Information and Network Security

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Define the three key security services stated in the X.800 model: Confidentiality, Integrity, and Availability, with one example threat that violates each.	2
2.	Differentiate between Substitution Techniques and Transposition Techniques in classical cryptography, with one example of each.	2
3.	Differentiate between a Symmetric Key Cryptosystem and a Public Key Cryptosystem with respect to the number of keys used and one example algorithm of each.	2
4.	Define a Hash Function. State any two desirable properties (e.g., collision resistance, one-way property) that a cryptographic hash function must satisfy.	2
5.	Differentiate between a Virus and a Worm with respect to their mode of propagation.	2
6.	Differentiate between a Packet Filtering Firewall and an Application-Level Gateway Firewall, stating one advantage of each.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Encrypt the plaintext "COMPUTER SCIENCE" using a Caesar Cipher with a key (shift) of 5. Show the resulting ciphertext, and briefly explain why the Caesar Cipher is considered cryptographically weak. (b) Explain the working of the Data Encryption Standard (DES) algorithm, describing its Feistel structure with the help of a block diagram. State the key size and block size used in DES, and briefly explain why DES is now considered insecure for modern applications.	6

8.	(a) Explain the RSA Public Key Cryptosystem algorithm. Given two prime numbers $p = 7$ and $q = 11$, compute the public and private key pair, and demonstrate the encryption of the plaintext message $M = 9$ using the generated public key. Show all calculation steps. (b) Explain the Diffie-Hellman Key Exchange algorithm with the help of a suitable numerical example, showing how two parties arrive at a shared secret key over an insecure channel.	6
9.	(a) Explain the working of Kerberos as an authentication protocol, describing the roles of the Authentication Server (AS), Ticket Granting Server (TGS), and the sequence of message exchanges, with the help of a diagram. (b) Explain the architecture of IP Security (IPSec), describing the roles of the Authentication Header (AH) and Encapsulating Security Payload (ESP). Also explain the working of the Secure Socket Layer (SSL)/Transport Layer Security (TLS) protocol in securing web traffic.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-6.2	Course Name: Computer Graphics

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Differentiate between Raster-Scan and Random-Scan display systems with respect to their image representation and refresh process.	2
2.	State the advantage of Bresenham's Line Drawing Algorithm over the DDA (Digital Differential Analyzer) Algorithm.	2
3.	Differentiate between Point Clipping and Line Clipping, briefly explaining the Cohen-Sutherland region code scheme used for line clipping.	2
4.	Differentiate between Parallel Projection and Perspective Projection, giving one example of each.	2
5.	State any two properties of Bezier Curves that make them useful for curve modeling in computer graphics.	2
6.	Differentiate between Gouraud Shading and Phong Shading with respect to the interpolation approach used.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Using Bresenham's Line Drawing Algorithm, plot the line segment from point (2, 3) to point (9, 8). Show the decision parameter calculations and the sequence of plotted pixel coordinates. (b) Explain the Cohen-Sutherland Line Clipping Algorithm with the help of a diagram showing the 9-region code scheme. Apply the algorithm to clip a line segment from (-2, 3) to (5, 8) against a clipping window with corners (0, 0) and (6, 6), showing the clipped endpoints.	6
8.	(a) A triangle has vertices A(2, 2) , B(6, 2) , C(4, 6) . Using homogeneous coordinate transformation, find the new coordinates of the triangle after it is rotated by 90° about the origin in the counter-clockwise direction. Show the	6

	transformation matrix and all calculation steps. (b) Explain the concept of Composite Transformation. Derive the transformation matrix for rotating an object about an arbitrary pivot point (a, b) by an angle θ, showing the sequence of translate-rotate-translate operations.	
9.	(a) Explain the Z-Buffer (Depth Buffer) Method for Visible-Surface Detection, describing its algorithm with the help of a flowchart, and state one limitation of this method. (b) Explain the Phong Illumination Model, describing the contributions of Ambient, Diffuse, and Specular reflection components to the final intensity of a point on a surface. Briefly explain the basic working principle of the Ray-Tracing algorithm for rendering realistic images.	6

Session: 2026 -27	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-6.3	Course Name: Project with viva voce

General Note:

1. Students are required to select **any one** project title from the following list, based on their individual interest, skill level, and available resources, in consultation with their project supervisor.
2. All datasets, tools, technologies, frameworks, and software mentioned above are suggested examples only. Students may use alternative or newer tools, as well as publicly available or self-created datasets, based on project needs. The final choice should be made in consultation with the project supervisor.
3. Guidelines for preparing Project/Dissertation is available at link:
http://uprtou.ac.in/upload_pdf/01_02_2023_Guidelines_fo_Project_Lit_Survey_Dissertation.pdf

Project No.	Project Details
1.	Title: AI-Based Student Performance Predictor and Early Warning System Objective: Build a machine learning system that predicts a student's likely academic outcome using historical data such as attendance, assignment scores, and test marks. The project applies data preprocessing, feature selection, and classification/regression models to flag at-risk students early. The system is deployed as a browser-accessible dashboard for faculty and mentors. Technologies / Tools: • ML: Python, Pandas, Scikit-learn (Logistic Regression, Decision Tree) • Backend: Flask or Django • Database: MySQL/SQLite • Frontend: HTML, Bootstrap, JavaScript • Visualisation: Matplotlib, Seaborn (performance trend charts) Dataset: Kaggle "Student Performance Dataset" (UCI Student Performance Data Set), or self-collected/anonymized institutional data (attendance registers, marksheets), or synthetically generated data via Python for demo purposes. Real-World Application: Colleges and universities can use this system for academic monitoring, timely counselling, and reducing dropout rates — a direct fit for UPRTOU and other affiliated institutions.
2.	Title: Fuzzy Logic Based Smart Traffic Signal Control Simulator Objective: Build a simulation system that dynamically adjusts traffic signal timing based on real-time vehicle density using fuzzy logic. The project applies fuzzification, rule-based inference, and defuzzification to convert traffic conditions (low/medium/high) into optimal signal durations. The system is presented through an interactive visual simulator. Technologies / Tools: • Soft Computing: Python, scikit-fuzzy (or custom fuzzy inference engine) • Simulation/Visualisation: Tkinter or Pygame • Optional Web Layer: Flask, HTML/CSS/JS • Documentation: Membership function graphs (Matplotlib)

	Dataset: Not applicable — a rule-based fuzzy inference system operating on simulated/randomly generated vehicle-count inputs at runtime rather than trained historical data. Real-World Application: Prototype for smart city traffic management systems, reducing congestion and fuel wastage at busy intersections in Indian metros.
3.	Title: Online Examination and Auto-Evaluation Portal with Anti-Cheating Detection Objective: Build a full-stack web-based examination system that conducts MCQ/short-answer tests with automatic grading and real-time integrity monitoring. The project applies timer-based session control, instant scoring logic, and browser-event tracking (tab-switch/copy-paste detection) to safeguard exam fairness. The system is deployed as a secure, role-based (admin/student) web portal. Technologies / Tools: • Backend: PHP/ASP.NET or Python-Django • Database: MySQL • Frontend: HTML, CSS, JavaScript, AJAX, Bootstrap • Security: Session management, JavaScript event listeners Dataset: Not applicable — data (questions, student responses, scores) is created and stored by the system itself as users interact with it; no external dataset needed. Real-World Application: Directly usable by colleges for conducting secure online assessments, a critical need since the shift toward hybrid and remote examination models.
4.	Title: Genetic Algorithm Based Timetable Scheduler for Colleges Objective: Build an automated timetable generation system that produces a clash-free schedule for subjects, faculty, and rooms using a Genetic Algorithm. The project applies chromosome encoding, fitness evaluation (clash penalty scoring), crossover, and mutation operators to iteratively evolve an optimal timetable. The system is deployed as a web application with exportable schedule outputs. Technologies / Tools: • Algorithm: Python, DEAP library or custom GA implementation • Backend: Flask • Database: MySQL (constraints, faculty/room/subject data) • Frontend: HTML, Bootstrap, PDF export (ReportLab) Dataset: Not applicable — inputs are institution-specific constraints (subjects, faculty availability, room capacity, time slots) entered by the admin; the GA optimizes against these constraints rather than learning from historical data. Real-World Application: Solves a recurring administrative challenge faced by every academic institution, saving hours of manual scheduling effort each semester.
5.	Title: Neural Network Based Handwritten Digit/Character Recognition Web App Objective: Build a deep learning system that recognizes handwritten digits drawn by a user in real time. The project applies image preprocessing, a Convolutional/Feed-forward Neural Network trained on the MNIST dataset, and model deployment via a REST API. The system is delivered as a browser-based drawing canvas with instant prediction feedback. Technologies / Tools: • ML/DL: Python, TensorFlow/Keras, NumPy

	• Backend: Flask (REST API for inference) • Frontend: HTML5 Canvas, JavaScript • Visualisation: Accuracy/loss curves, confusion matrix (Matplotlib) Dataset: MNIST Handwritten Digit Dataset (60,000 training + 10,000 test images, built into Keras/TensorFlow — <code>tf.keras.datasets.mnist</code>). Real-World Application: Foundational technology for bank cheque processing, postal code reading, and digitization of handwritten forms in government and BFSI sectors.
6.	Title: Secure File Encryption and Digital Signature Tool Objective: Build a security utility that encrypts files and verifies their authenticity using cryptographic techniques. The project applies symmetric (AES) and asymmetric (RSA) encryption alongside SHA-256 based digital signature generation and verification. The system is deployed as a desktop or lightweight web-based tool for secure file exchange. Technologies / Tools: • Security: Python (PyCryptodome) or Java Cryptography Extension (JCE) • Frontend: Tkinter/Swing (desktop) or Flask + HTML (web) • File Handling: OS-level file I/O • Testing: Hash comparison, signature verification scripts Dataset: Not applicable — a cryptographic utility that processes whatever file the user uploads at runtime; no training data required. Real-World Application: Applicable in banking, legal, and government sectors for ensuring confidentiality and non-repudiation during secure document exchange.
7.	Title: Hospital/Clinic Management System with Predictive Appointment No-Show Analysis Objective: Build a database-driven management system for handling patient records, doctor scheduling, and billing. The project applies relational database design and a supervised ML classifier trained on patient history to predict the likelihood of appointment no-shows. The system is deployed as a web-based portal for clinic staff and administrators. Technologies / Tools: • Backend: Python-Django or PHP • ML: Scikit-learn (Decision Tree/Logistic Regression) • Database: MySQL • Frontend: HTML, Bootstrap, JavaScript Dataset: Kaggle "Medical Appointment No Shows" dataset (~110,000 records, Brazil-based public dataset), or synthetically generated patient/appointment records for institution-specific demonstration. Real-World Application: Addresses genuine inefficiencies in healthcare administration, where missed appointments cause revenue loss and scheduling conflicts for clinics and hospitals.
8.	Title: Sentiment Analysis Dashboard for Product/Course Reviews Objective: Build an NLP-based system that classifies user-submitted reviews as positive, negative, or neutral. The project applies text preprocessing, feature extraction (Bag-of-Words/TF-IDF), and a classification model (Naive Bayes/SVM) trained on labeled review data. The system is deployed as an interactive analytics dashboard.

	Technologies / Tools: • NLP/ML: Python, NLTK/TextBlob, Scikit-learn • Backend: Flask • Database: MySQL • Visualisation: Chart.js/Plotly (sentiment trend graphs) Dataset: Kaggle "Amazon Product Reviews" or "IMDB Movie Reviews" dataset for training; live user-submitted reviews for real-time inference and dashboard demonstration. Real-World Application: Widely applicable to e-commerce platforms, ed-tech portals, and app stores for automated customer feedback analysis at scale.
9.	Title: Personal Finance and Expense Tracker with ML-Based Spending Prediction Objective: Build a web application that lets users log and categorize daily expenses. The project applies data aggregation, trend visualization, and a time-series/regression model to forecast the user's likely spending for the upcoming month. The system is deployed as a responsive, browser-accessible personal finance dashboard. Technologies / Tools: • Backend: Python-Django/Flask • ML: Pandas, Scikit-learn (Linear Regression/time-series forecasting) • Database: MySQL/SQLite • Frontend: HTML, Bootstrap, Chart.js Dataset: Primarily self-generated — grows organically as the user logs expenses; a synthetic seed dataset (Kaggle "Daily Household Transactions" or similar) can be used to demo the prediction model before enough live data accumulates. Real-World Application: A practical personal fintech tool demonstrating combined full-stack development and applied machine learning, valued in both academia and industry portfolios.
10.	Title: Campus Placement and Resume Screening System using AI Keyword Matching Objective: Build a placement portal that automatically ranks student resumes against job requirements posted by recruiters. The project applies NLP-based text extraction from resumes (PDF parsing), TF-IDF vectorization, and cosine similarity scoring to compute candidate-job fit. The system is deployed as a web application for students, placement cells, and recruiters. Technologies / Tools: • NLP/ML: Python, Scikit-learn (TF-IDF Vectorizer, Cosine Similarity), PyPDF2 • Backend: Flask or Django • Database: MySQL • Frontend: HTML, CSS, Bootstrap Dataset: Self-collected sample resumes (PDF, 15–20 samples across different domains) and sample job descriptions; optionally supplemented with Kaggle "Resume Dataset" for broader testing coverage. Real-World Application: Mirrors real-world Applicant Tracking Systems (ATS) used by corporate HR teams, giving students direct exposure to a high-demand industry technology.

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-EC	Course Name: Computer Architecture

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Differentiate between Fixed-Point and Floating-Point number representation, giving one example of each.	2
2.	Differentiate between an Instruction Format using a Single Address scheme and one using a Three Address scheme, with a suitable example.	2
3.	Distinguish between a Combinational ALU and a Sequential ALU with respect to their design approach.	2
4.	Differentiate between Hardwired Control and Microprogrammed Control units, stating one advantage of each.	2
5.	Define Pipeline Hazards. State any two types of hazards that affect the performance of an instruction pipeline.	2
6.	Differentiate between Programmed I/O and Interrupt-Driven I/O with respect to CPU involvement.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Represent the decimal number -27 in 8-bit Sign-Magnitude, 1's Complement, and 2's Complement forms, showing all steps. (b) Explain Booth's Algorithm for multiplication of signed binary numbers. Using Booth's Algorithm, multiply (-6) × (5) taking both numbers in 5-bit 2's complement representation, showing the step-by-step multiplication table.	6
8.	(a) Explain the design of a Hardwired Control Unit with the help of a block diagram, describing the roles of the instruction decoder, timing generator, and	6

	control signal generation logic. (b) Explain Microprogrammed Control, describing the structure of a Control Word (Micro-instruction) and the role of the Control Address Register (CAR) and Control Memory. Compare Microprogrammed Control with Hardwired Control with respect to flexibility and speed.	
9.	(a) Explain the concept of Instruction Pipelining with a suitable example showing a 4-stage pipeline (Fetch, Decode, Execute, Write-back) for a sequence of 5 instructions, using a space-time diagram. Discuss the impact of pipeline hazards on performance. (b) Explain the working of DMA (Direct Memory Access) for I/O data transfer, describing how it differs from Interrupt-Driven I/O. Briefly explain the concept of Multiprocessor systems and processor-level parallelism.	6

Session: 2025 -26	Max. Marks: 30
Program Name:	Bachelor of Computer Application (BCA)
Course Code: BCA-ED	Course Name: Microprocessor and its Applications

SECTION -A		2*6=12 marks
Q. No.	Short answer type question (approx. 200 -300 words)	Marks
1.	Differentiate between the Address Bus and the Data Bus in a microcomputer system, with respect to direction of data flow and width.	2
2.	Differentiate between Static RAM (SRAM) and Dynamic RAM (DRAM) with respect to their internal construction and need for refreshing.	2
3.	Differentiate between Memory-Mapped I/O and Isolated (Standard) I/O structures with one advantage of each.	2
4.	Differentiate between a Vectored Interrupt and a Non-Vectored Interrupt in the 8085 microprocessor, giving one example of each.	2
5.	State the purpose of the Control Word Register in Intel 8255 PPI. Name the three operating modes supported by 8255.	2
6.	Differentiate between the Fully Nested Mode and the Special Fully Nested Mode of operation in Intel 8259A Programmable Interrupt Controller.	2
SECTION -B		6*3=18 marks
Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	(a) Draw and explain the internal architecture of the Intel 8085A microprocessor, describing the functions of the Accumulator, Flag Register, General Purpose Registers, and the ALU. (b) Write an 8085 Assembly Language Program (with mnemonics, opcodes, and comments) to add two 8-bit numbers stored at memory locations 2000H and 2001H, and store the result at memory location 2002H. Handle a possible carry by storing it at location 2003H.	6
8.	(a) Explain the Opcode Fetch Machine Cycle and the Memory Read Machine Cycle of the 8085 microprocessor, with the help of a timing diagram showing	6

	the control signals ALE, RD, and $\text{IO}/\overline{\text{M}}$. (b) Explain the interfacing of Intel 8255 Programmable Peripheral Interface (PPI) with the 8085 microprocessor. Describe the significance of the Control Word format for selecting Mode 0 (Simple I/O) with Port A as input and Port B as output, and calculate the control word value.	
9.	(a) Explain the internal block diagram of Intel 8253/8254 Programmable Interval Timer, describing any three of its six operating modes (Mode 0 to Mode 5) with waveform diagrams. (b) Explain the interrupt sequence and the role of Initialization Control Words (ICW1–ICW4) in configuring the Intel 8259A Programmable Interrupt Controller. Briefly describe one practical application of the 8085 microprocessor — either a stepper motor control system or a traffic light controller.	6