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: **2026 -27**	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.	Define an algorithm and list its essential characteristics (finiteness, definiteness, input, output, effectiveness). Using these characteristics, write an algorithm and draw a corresponding flowchart to find the largest of three numbers entered by a user.	**2**
2.	What are *tokens* in the C language? List the different categories of tokens (keywords, identifiers, constants, operators, special symbols) with one example of each. Also, briefly state the basic structure of a C program (with section names) in which such tokens would appear.	**2**

3.	Differentiate between formatted and unformatted input/output functions in C. Predict the output of the following code segment, explaining the role of each format specifier:
	
	`int a = 7; float b = 2.5;`
	`printf("Value = %d, Float = %.2f\n", a, b);`
		2

4.	Explain the concept of operator precedence and associativity in C. Evaluate the following expression step-by-step, clearly showing the order of operations: `result = 5 + 3 * 2 - (12 / 4) % 3;`	**2**
5.	What are string handling functions in C? Explain any four commonly used functions (e.g., `strlen()`, `strcpy()`, `strcat()`, `strcmp()`) with a suitable example for each.	**2**

6.	Explain any four file-opening modes used in C (`"r"`, `"w"`, `"a"`, `"r+"`) along with the purpose of each, supported with a short example of the `fopen()` syntax used for each mode.	**2**
	SECTION -B	**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	**(a)** Discuss the fundamental principles of good program design, including top-down design and modular programming. Explain the different categories of program errors — syntax errors, logical errors, runtime errors, and linker errors — giving one illustrative example of each. **(b)** Write a menu-driven C program that acts as a simple calculator, using a `switch` statement to select the operation (add, subtract, multiply, divide) and a loop (`for` or `while`) to allow the user to repeat calculations until they choose to exit. Trace your program manually for the input sequence: `Add(5,3)`, `Divide(10,0)`, `Exit`, and predict the output at each step, explaining how `break`/`continue` and error handling (division by zero) are used.	**6**
8.	**(a)** Explain the four storage classes in C — `auto`, `register`, `static`, and `extern` — comparing their scope**,** lifetime**,** default initial value**,** and storage location in a tabular format. **(b)** Explain the concept of pointer arithmetic with the help of a suitable diagram showing memory addresses. Write a C program that declares an integer array of 5 elements, uses a pointer to traverse the array, and prints each element along with its memory address.	**6**
9.	**(a)** Differentiate between structures and unions in C with respect to memory allocation, using a labelled diagram to show how memory is assigned in each case. Explain the concept of "structure within structure" (nested structures) with a suitable example (e.g., an `Employee` structure containing a `Date` structure for date of joining). **(b)** Explain the concept of recursion in C. Write a recursive C function to compute the factorial of a number, and trace the function call stack for input `n = 4`, showing each recursive call and its return value. Also explain how a structure can be passed as an argument to a function, with a brief code illustration.	**6**

Session: **2026 -27**	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.	Differentiate between linear and nonlinear data structures, giving two examples of each. Explain, with a brief real-world scenario, why the choice of data representation affects the efficiency of an application.	**2**
2.	Explain the concept of time complexity and space complexity of an algorithm. Using Big-O notation, compare the complexity of a linear search algorithm versus a binary search algorithm on a sorted array of `n` elements, and state which is preferable for large datasets.	**2**
3.	For a two-dimensional array `A[3][4]` stored in row-major order, with the base address `1000` and each element occupying `4` bytes, calculate the address of element `A[2][3]`. Show the formula used and each step of the calculation.	**2**
4.	Explain the operations of a circular queue (enqueue and dequeue) and why a circular queue is preferred over a simple linear queue. Trace the state of a circular queue of size 5 after the operations: `Enqueue(10), Enqueue(20), Enqueue(30), Dequeue(), Enqueue(40)`, showing the front and rear pointers at each step.	**2**
5.	Compare Bubble Sort and Selection Sort in terms of their working principle and time complexity. Trace Bubble Sort on the array `[5, 1, 4, 2, 8]` for the first two passes, showing the array state after each pass.	**2**
6.	Explain the difference between sequential file organization and indexed sequential file organization, giving one real-world application scenario where each would be preferred.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**

7.	**(a)** Explain the principle of recursion and how a recursive call is managed internally using the system (call) stack. Design a recursive algorithm to compute the Fibonacci of a number `n`, and trace the sequence of recursive calls and returns for `n = 5` using a call-stack diagram. Briefly explain what tail recursion is and how it differs from your algorithm. **(b)** Explain the algorithm for converting an infix expression to postfix expression using a stack. Convert the expression `A + B * (C - D) / E` into postfix notation, showing the stack contents at each step. Then evaluate the postfix expression `6 3 2 4 + - *` by tracing the stack-based evaluation process step-by-step.	**6**
8.	**(a)** Compare singly linked list, doubly linked list, and circular linked list with respect to structure, memory overhead, and traversal capability, using a labelled diagram for each. Explain one real-world application of linked lists (e.g., polynomial representation and addition). **(b)** Construct a Binary Search Tree (BST) by inserting the following sequence of numbers in the given order: 45, 20, 60, 15, 30, 50, 70. Draw the resulting tree, and write the sequence of nodes obtained by inorder, preorder, and postorder traversal. Also explain, with an example, when and why the tree may need to be balanced (brief mention of AVL rotation).	**6**
9.	**(a)** Explain the difference between Breadth-First Search (BFS) and Depth-First Search (DFS) graph traversal techniques. For the following graph with vertices `{A, B, C, D, E}` and edges `{A-B, A-C, B-D, C-D, D-E}`, starting from vertex `A`, write the order of vertices visited using BFS and using DFS, showing the queue/stack state at each step. **(b)** Explain the concept of hashing, hash functions, and collision resolution. Given the hash function `h(k) = k % 7` and the keys `{50, 700, 76, 85, 92, 73, 101}`, construct the hash table using linear probing to resolve collisions, showing the final table with all slot assignments.	**6**

Session: **2026 -27**	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.	Define the union, intersection, and complement of sets. Using a Venn diagram, illustrate the symmetric difference of two sets. If A = {1, 2, 3, 4, 5} and B = {3, 4, 5, 6, 7}, find A Δ B and verify your answer using the Venn diagram.	**2**
2.	Define an equivalence relation, stating the three properties it must satisfy (reflexive, symmetric, transitive). Let R = {(a, b) : a, b ∈ Z and (a − b) is divisible by 3}. Verify whether R is an equivalence relation on the set of integers, checking each property explicitly.	**2**
3.	Define the domain and range of a real function. For $f(x) = 1/(x - 2)$, determine the domain and range, and sketch a rough graph indicating the behaviour of the function as x approaches 2.	**2**
4.	For the quadratic equation $2x^2 - 5x + 3 = 0$, determine the nature of the roots using the discriminant ($D = b^2 - 4ac$), and find the roots. State, in general, how the sign of D determines whether roots are real-distinct, real-equal, or imaginary.	**2**
5.	State the elementary integration formulae for $\int x^n\,dx$, $\int \sin x\,dx$, $\int e^x\,dx$, and $\int (1/x)\,dx$. Using these, evaluate: $\int (3x^2 - 4x + 5)\,dx$.	**2**
6.	Explain the method of computing the determinant of a 3×3 matrix by expansion along the first row (using minors and cofactors). Compute the determinant of: $\begin{vmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 5 & 6 & 0 \end{vmatrix}$	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**

7.	**(a)** Define the limit of a function at a point and explain the condition for continuity of a function at that point. Evaluate: $\lim (x \to 2) [(x^2 - 4) / (x - 2)]$ showing the algebraic simplification step-by-step. Briefly explain, with one example, how a function can fail to be continuous at a point even if its limit exists there. **(b)** State the signs of trigonometric ratios (sin, cos, tan) in each of the four quadrants (the ASTC rule). Using a right-angled triangle, derive the standard trigonometric ratios for 30°, 45°, and 60°. Hence, solve the trigonometric equation $2 \sin \theta - 1 = 0$ for $0° \leq \theta \leq 360°$.	**6**
8.	**(a)** Derive the slope-intercept form of the equation of a straight line. Find the equation of the line passing through the points (2, 3) and (4, 7). Also state the condition of concurrency for three straight lines and briefly explain its geometric significance. **(b)** Solve the following system of linear equations using Cramer's Rule, showing the value of the main determinant and each variable's determinant clearly: $x + y + z = 6$ $2x - y + z = 3$ $x + 2y - z = 2$	**6**
9.	**(a)** State and prove the product rule of differentiation. Using the chain rule, differentiate $y = \sin(3x^2 + 2x)$ with respect to x. Additionally, expand e^x using Maclaurin's Theorem up to the first three terms. **(b)** Evaluate the following integral using integration by parts: $\int x \cdot e^x \, dx$ Then find the area of the region bounded by the parabola $y = x^2$ and the x-axis between $x = 0$ and $x = 2$, using definite integration, showing the setup of the definite integral and its evaluation.	**6**

Session: **2026 -27**	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.	Distinguish between round-off error and truncation error, giving one example of each in the context of numerical computation. Using the Bisection Method, perform the first two iterations to locate a root of $f(x) = x^3 - x - 2$ in the interval [1, 2], showing the midpoint calculation and the updated interval at each step.	**2**
2.	State the Newton-Raphson formula for finding the root of an equation $f(x) = 0$. Explain the geometric interpretation of the method (tangent-line approximation) and briefly state its order of convergence, contrasting it with the order of convergence of the Bisection Method.	**2**
3.	Using Cramer's Rule, solve the following system of linear equations, showing the main determinant and each variable's determinant: $3x + 2y = 12$ $x - y = 1$	**2**
4.	Construct a **forward difference table** for the following data and state the value of the first forward difference (Δy) at $x = 1$: **x 1 2 3 4** y 2 5 10 17	**2**
5.	Explain the difference between interpolation at equal intervals and unequal intervals, stating which formula is applicable in each case. Briefly outline the structure of Lagrange's Interpolation Formula and state one limitation of using it for a large number of data points.	**2**
6.	State the Trapezoidal Rule for numerical integration. Using it, evaluate the approximate value of $\int_0^2 x^2\,dx$ by dividing the interval [0, 2] into 4 equal subintervals, showing the table of x and f(x) values used.	**2**
SECTION -B		**6*3=18 marks**

Q. No.	Long answer type question (approx. 500 -800 words)	Marks
7.	**(a)** Explain the Regula Falsi (False Position) Method for finding roots of an equation, stating how it differs from the Bisection Method in choosing the next approximation. Using Regula Falsi, find the first two approximations of the root of $f(x) = x^3 - 4x - 9$ in the interval [2, 3], showing the formula and calculation at each step. **(b)** Explain the Gauss Elimination Method for solving a system of linear equations, describing the process of forward elimination and back-substitution. Solve the following system using Gauss Elimination, showing the row-reduction steps clearly: $x + y + z = 6$ $2x + y - z = 1$ $x - y + 2z = 5$	**6**
8.	**(a)** Explain the Gauss-Seidel Iteration Method for solving a system of linear equations, stating its advantage over the Jacobi Iteration Method. Using Gauss-Seidel, perform 2 iterations to solve the system below, starting with initial approximation $x_0 = y_0 = 0$: $10x + y = 12$ $x + 10y = 12$ **(b)** Explain the concept of divided differences and their key properties. Using Newton's Divided Difference Interpolation Formula, find the interpolating polynomial (or estimate f(3)) for the following unequally spaced data: **x 1 2 4 7** f(x) 1 4 16 49	**6**
9.	**(a)** State Simpson's One-Third Rule for numerical integration, including the condition on the number of subintervals required for its application. Using it, evaluate $\int_0^4 (1/(1+x))\,dx$ by dividing the interval into 4 equal subintervals, showing the table of computed function values and the final calculation. **(b)** Explain Euler's Method for solving a first-order ordinary differential equation $dy/dx = f(x, y)$, $y(x_0) = y_0$. Given $dy/dx = x + y$, with $y(0) = 1$ and step size $h = 0.2$, compute the value of y at $x = 0.2$ and $x = 0.4$ using Euler's Method. Briefly explain, without full derivation, why the 4th Order Runge-Kutta Method generally gives more accurate results than Euler's Method for the same step size.	**6**

Session: **2026 -27**	Max. Marks: **30**
Program Name:	**Bachelor of Computer Application (BCA)**
Course Code: **BCA-2.1**	Course Name: **Design and Analysis of Algorithms**

SECTION -A		**2*6=12 marks**
Q. No.	**Short answer type question (approx. 200 -300 words)**	**Marks**
1.	Differentiate between Backtracking and Branch-and-Bound with respect to the criterion used for pruning the search tree.	**2**
2.	Differentiate between Time Complexity and Space Complexity, with an example of an algorithm having O(1) space and O(n) time.	**2**
3.	Using the Substitution Method, solve the recurrence T(n) = T(n/2) + 1, T(1) = 1.	**2**
4.	Differentiate between Counting Sort and Bucket Sort with respect to the type of input data each is suited for.	**2**
5.	State the general strategy of Dynamic Programming. Explain how it differs from Divide and Conquer with respect to overlapping subproblems.	**2**
6.	Define Strongly Connected Components (SCC) in a directed graph. Name the algorithm commonly used to find them.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Derive and solve the recurrence for Binary Search using the Master Method. (b) Trace Heapsort on the array [4, 10, 3, 5, 1], showing the max-heap construction and each extraction step.	**6**
8.	Using the Greedy method, solve the Job Sequencing with Deadlines problem for the jobs: J1(deadline=2, profit=100), J2(deadline=1, profit=19), J3(deadline=2, profit=27), J4(deadline=1, profit=25), J5(deadline=3, profit=15). Show the sequence selected and total profit.	**6**

9.	(a) Explain the Branch-and-Bound approach for the Travelling Salesperson Problem with a cost-matrix reduction example. (b) Explain the concept of NP-Hard and NP-Complete classes, and state why the SAT problem is considered NP-Complete.	**6**

Session: **2026 -27**	Max. Marks: **30**
Program Name:	**Bachelor of Computer Application (BCA)**
Course Code: **BCA-2.3**	Course Name: **Discrete Mathematics**

SECTION -A		**2*6=12 marks**
Q. No.	**Short answer type question (approx. 200 -300 words)**	**Marks**
1.	Define a Quantifier. Distinguish between Universal and Existential quantifiers with an example each.	**2**
2.	Using the Indirect Method of proof, prove: "If n^2 is even, then n is even."	**2**
3.	Define Isomorphic Boolean Algebras. State the condition for two Boolean algebras to be isomorphic.	**2**
4.	Let A = {a, b, c}. Determine the total number of distinct relations possible on set A.	**2**
5.	Define a Partition of a set. Give an example of a partition of the set {1,2,3,4,5,6} into three blocks.	**2**
6.	State the Well-Ordering Property. How is it related to the Principle of Mathematical Induction?	**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 argument: *"All engineers are logical. Ram is an engineer. Therefore, Ram is logical."* using rules of inference. (b) Simplify the Boolean expression F = A'BC + AB'C + ABC' + ABC using Boolean algebra laws (not K-map), showing each law applied.	**6**
8.	(a) Let f: R → R be defined by f(x) = 2x + 3. Show that f is bijective and find $f^{-1}(x)$. (b) In how many ways can the letters of the word "STATISTICS" be arranged? Also find the number of arrangements in which all the S's are together.	**6**

9.	(a) State and prove the Binomial Theorem for positive integral index. Find the coefficient of x^5 in the expansion of $(1+x)^{12}$. (b) A bag contains 5 red and 7 black balls. Two balls are drawn at random. Find the probability that both are red, using the Product Law and Combination formula.	**6**

Session: **2026 -27**	Max. Marks: **30**
Program Name:	**Bachelor of Computer Application (BCA)**
Course Code: **BCA-2.3**	Course Name: **Object Oriented Programming with C++**

SECTION -A		**2*6=12 marks**
Q. No.	**Short answer type question (approx. 200 -300 words)**	**Marks**
1.	Differentiate between a Class and an Object with a real-world analogy.	**2**
2.	State any two advantages of C++ over C as a programming language.	**2**
3.	Differentiate between Function Overloading and Operator Overloading with an example each.	**2**
4.	Explain the purpose of the `this` pointer in C++ with a short code snippet.	**2**
5.	Differentiate between an Abstract Class and a Concrete Class in C++.	**2**
6.	Define Command Line Arguments. Write the function signature of `main()` that accepts them.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain Dynamic Initialization of objects through constructors with an example. (b) Write a C++ program for a class `Account` with a static data member `total_accounts` that tracks the number of objects created, incremented in the constructor and decremented in the destructor.	**6**
8.	(a) Explain the rules for overloading unary operators in C++. (b) Write a C++ program to overload the unary – (minus) operator for a class `Point` (with x, y coordinates) to negate the coordinates of a point object.	**6**

9.	(a) Explain the concept of pure virtual functions and abstract classes with an example involving a base class `Shape` and derived classes `Circle`, `Square`. (b) Write a C++ program that reads student records (roll_no, name, marks) from a file `students.txt` and displays them on screen, handling file-open errors appropriately.	**6**

Session: **2026 -27**	Max. Marks: **30**
Program Name:	**Bachelor of Computer Application (BCA)**
Course Code: **BCA-2.4**	Course Name: **Database Management System**

SECTION -A		**2*6=12 marks**
Q. No.	**Short answer type question (approx. 200 -300 words)**	**Marks**
1.	Differentiate between Data Independence at the Logical level and the Physical level.	**2**
2.	Define a Composite Attribute and a Derived Attribute in the ER Model, with one example each.	**2**
3.	State any two Relational Model constraints (e.g., Entity Integrity, Referential Integrity) with a brief explanation.	**2**
4.	Differentiate between a Candidate Key and a Super Key with an example.	**2**
5.	Define Multivalued Dependency. State the condition under which a relation violates 4NF.	**2**
6.	Differentiate between Shadow Paging and Log-Based Recovery techniques used in database recovery.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	A hospital wants a database where each **Doctor** (doctor_id, name, specialization) treats multiple **Patients** (patient_id, name, disease), and each visit is recorded with a date and diagnosis. Draw the ER diagram with appropriate cardinality, and convert it into relational tables with keys clearly marked.	**6**
8.	Consider relations Product(P_ID, P_Name, Price, S_ID) and Supplier(S_ID, S_Name, City). Write SQL for: (i) create tables with keys; (ii) list products priced above 500 in ascending order of price; (iii) find the supplier-wise count of products supplied; (iv) update the price of a product by 5% where P_ID=101; (v) create a view listing product name with supplier name; (vi) delete suppliers from 'Delhi' with no products.	**6**

9.	(a) Explain the Second and Third Normal Forms with formal definitions and an example relation for each. (b) Explain Serializability and the concept of a Conflict-Serializable Schedule, illustrating with two transactions T1 and T2 operating on the same data item.	**6**

Session: **2026 -27**	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.	Differentiate between a Process and a Thread with respect to memory sharing.	**2**
2.	Define Context Switching. State two overheads associated with frequent context switching.	**2**
3.	Differentiate between Mutual Exclusion and Synchronization in concurrent processing.	**2**
4.	State the Resource-Allocation Graph (RAG) approach to deadlock representation, explaining what a cycle in the graph indicates.	**2**
5.	Differentiate between Logical Address and Physical Address, and name the hardware unit that performs the mapping.	**2**
6.	Define Thrashing. State one cause and one remedy for thrashing.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain the Dining Philosophers problem as a classical synchronization problem and outline a semaphore-based solution avoiding deadlock. (b) For the processes below, compute average waiting and turnaround time using Round Robin scheduling with time quantum = 4: **Process Arrival Burst** P1 0 6 P2 2 4	**6**

	P3 4 8 Draw the Gantt chart.	
8.	Explain Deadlock Prevention strategies by discussing how each of the four necessary conditions (Mutual Exclusion, Hold and Wait, No Preemption, Circular Wait) can be individually violated to prevent deadlock, with a brief example for each.	**6**
9.	(a) Explain Paging with Page Table structure, and calculate the number of pages and page table entries for a process of size 32KB with page size 4KB. (b) Explain the SCAN (Elevator) and C-SCAN disk scheduling algorithms, and compute total head movement for requests 98, 183, 37, 122, 14, 124, 65, 67 with head starting at 53, using SCAN (moving towards higher cylinder numbers), disk size 0–199.	**6**

Session: **2026 -27**	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.	Differentiate between the Incremental Model and the Spiral Model of software development.	**2**
2.	Define the "Management Spectrum" in project management, listing its four P's.	**2**
3.	Differentiate between Version Control and Change Control in Software Configuration Management.	**2**
4.	Define Modularity in software design. State one benefit of high modularity.	**2**
5.	Differentiate between Regression Testing and Smoke Testing with respect to their purpose.	**2**
6.	Define Software Restructuring. How does it differ from Reverse Engineering?	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain the Concurrent Development Model, describing its states and how it differs from the linear Waterfall Model. (b) A project has three functions: Inputs=4 (weight 4 each), Outputs=6 (weight 5 each), Files=3 (weight 10 each) with unadjusted function point count. Given a Complexity Adjustment Factor (CAF) of 1.1, compute the Adjusted Function Points. Show the calculation formula.	**6**
8.	(a) Explain Requirements Elicitation techniques used to gather software requirements from stakeholders. (b) Explain the essential contents of a good SRS document and describe the	**6**

	difference between Functional and Non-Functional requirements with examples.	
9.	(a) Explain Structural Partitioning in software architecture, distinguishing between horizontal and vertical partitioning. (b) Explain the taxonomy of CASE tools and describe the role of the CASE Repository in an Integrated CASE (I-CASE) environment.	**6**

Session: **2026 -27**	Max. Marks: **30**
Program Name:	**Bachelor of Computer Application (BCA)**
Course Code: **BCA-3.3**	Course Name: **Computer Network**

	SECTION -A	**2*6=12 marks**
Q. No.	**Short answer type question (approx. 200 -300 words)**	**Marks**
1.	Differentiate between Connection-Oriented and Connectionless services with an example protocol of each.	**2**
2.	Differentiate between Baseband and Broadband coaxial cable transmission.	**2**
3.	Define Framing in the Data Link Layer. State why framing is necessary.	**2**
4.	Differentiate between Polling and Token Passing as channel access methods.	**2**
5.	Differentiate between Flooding and Flow-Based Routing techniques.	**2**
6.	Define Tunneling in internetworking, with one example use case.	**2**
	SECTION -B	**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain the ALOHA protocol (Pure and Slotted), deriving/stating the maximum channel utilization for each. (b) Explain the working of Token Ring (IEEE 802.5), describing how token passing avoids collisions, with a diagram.	**6**
8.	(a) For the network address **172.16.0.0/20**, determine the subnet mask in dotted decimal, the number of subnets, and the number of hosts per subnet. (b) Explain the Distance Vector Routing algorithm (Bellman-Ford based), illustrating the "count-to-infinity" problem with a simple 3-node example.	**6**

9.	(a) Explain the working of a Firewall in providing network security, distinguishing between Packet-Filtering and Proxy Firewalls. (b) Explain Data Compression techniques used at the Presentation Layer, distinguishing between Lossy and Lossless compression with one example format of each.	**6**

Session: **2026 -27**	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 a Primitive Data Type and a Derived (Reference) Data Type in Java, with examples.	**2**
2.	Explain the use of the `final` keyword in Java with respect to variables, methods, and classes.	**2**
3.	Differentiate between the `throw` and `throws` keywords in Java exception handling.	**2**
4.	Differentiate between a Byte Stream and a Character Stream in Java I/O, naming one class for each.	**2**
5.	Define Garbage Collection in Java. Explain the purpose of the `finalize()` method.	**2**
6.	Differentiate between the AWT (Abstract Window Toolkit) and Swing GUI frameworks in Java.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain Java Arrays with a program to find the largest and smallest elements in a 1-D array of integers entered by the user. (b) Explain the concept of abstract classes in Java. Write a program with an abstract class `Vehicle` having an abstract method `fuelType()`, implemented by derived classes `Car` and `Bike`.	**6**

8.	(a) Explain Interfaces in Java and how multiple inheritance is achieved using them. Write a program implementing two interfaces `Printable` and `Showable` in a single class. (b) Write a Java program to read data from a text file `data.txt` and write it to another file `copy.txt`, using FileInputStream and FileOutputStream, with proper exception handling.	**6**
9.	(a) Explain event handling in Java GUI programming (AWT/Swing) with a program that displays a message when a button is clicked. (b) Explain the concept of Datagrams in Java networking. Describe, with code outline, how `DatagramSocket` and `DatagramPacket` are used to send a UDP message between a client and server.	**6**

Session: **2026 -27**	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.	Define a Dynamic Linking Library (DLL). State one advantage of using DLLs over static linking.	**2**
2.	Differentiate between Accelerators and Bitmaps as Windows programming resources.	**2**
3.	Differentiate between a Struct and a Class in Visual C++ with respect to default access specifiers.	**2**
4.	State the difference between the intrinsic controls RichTextBox and TextBox in Visual Basic.	**2**
5.	Differentiate between Explorer-Style Interface and standard MDI applications.	**2**
6.	Define ActiveX Control. State one advantage of using ActiveX controls in application development.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain the concept of Serialization in MFC's Document-View architecture, describing how objects are saved to and loaded from a file. (b) Explain the role of Application Wizard in Visual C++ for generating a skeleton SDI/MDI application, listing the key files generated.	**6**
8.	(a) Explain the working of Splitter Windows in an Explorer-style interface application. (b) Write the algorithmic steps (pseudocode) for a Visual Basic procedure that validates a login form (username and password fields) and displays an appropriate message using a common dialog box.	**6**

9.	(a) Explain Object Linking and Embedding (OLE) and its role in enabling compound documents across applications. (b) Explain the concept of Access Control and Security Descriptors in the Windows operating environment.	**6**

Session: **2026 -27**	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 binary number **$(11010110)_2$** to its equivalent Gray Code.	**2**
2.	Differentiate between SOP (Sum of Products) and POS (Product of Sums) forms of Boolean expressions with an example.	**2**
3.	Differentiate between an Encoder and a Decoder digital circuit, with respect to input-output count relationship.	**2**
4.	Differentiate between a Latch and a Flip-Flop with respect to clock dependency.	**2**
5.	Differentiate between General Purpose Registers and Special Purpose Registers, giving one example of each.	**2**
6.	Define Virtual Memory. State one advantage it provides over using only physical main memory.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Design a Half Subtractor circuit, deriving its truth table and Boolean expressions for Difference and Borrow, and draw its logic diagram. (b) Design a 4-bit Binary Counter using J-K Flip-Flops, drawing the circuit diagram and state transition table.	**6**
8.	(a) Explain Branch, Skip, and Jump instructions with respect to their effect on the Program Counter, giving one example of each. (b) Explain the working of a 4-to-1 Multiplexer and a 1-to-4 Demultiplexer with their truth tables and logic diagrams.	**6**

9.	(a) Explain the Bus structure of a computer system (Address, Data, and Control buses), describing how they support communication between CPU, memory, and I/O devices. (b) Explain the difference between Static RAM and Dynamic RAM with respect to their internal cell structure, and briefly explain the working of EAROM.	**6**

Session: **2026 -27**	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.	State any four trends currently shaping the mobility space (e.g., 5G, IoT integration).	**2**
2.	Differentiate between the Mobile Client Application layer and the Mobile Support Infrastructure layer.	**2**
3.	Differentiate between Discontinued and Existing Mobile Operating Systems, giving one example of each.	**2**
4.	State the role of Siri (or a similar voice assistant) in iOS, and explain how it is launched and configured.	**2**
5.	Differentiate between Qualcomm Snapdragon and Samsung Exynos processors with respect to manufacturer and typical usage.	**2**
6.	Differentiate between a Proximity Sensor and a Compass sensor in a smartphone, with one application of each.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Discuss the key challenges and considerations involved in developing mobile applications as compared to traditional PC-based applications. (b) Explain the process of Mobile App Testing, discussing the key areas that must be tested (functionality, usability, performance, security) before deployment.	**6**
8.	(a) Explain the Memory Management approach used in Android OS, describing how it handles low-memory situations. (b) Explain the concept of Multitasking in iOS, describing how applications are switched and how background tasks are managed.	**6**

9.	(a) Explain the basic design of an x86 processor and its Instruction Execution Cycle. (b) Explain the types of Non-Volatile memory used in mobile phones (ROM, EPROM, EEPROM, Flash), highlighting their key differences.	**6**

Session: **2026 -27**	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 Cyber Crime. State any four categories/kinds of cyber crime.	**2**
2.	Differentiate between Authentication and Authorization in the context of cyber security techniques.	**2**
3.	State any two reasons why individuals hesitate to report cyber crime incidents, and explain why reporting is important.	**2**
4.	Differentiate between a Password Manager and Two-Step Verification, explaining how each enhances security.	**2**
5.	State the criteria for selecting the "best browser" suited to a user's requirements, listing any three factors.	**2**
6.	Differentiate between securely communicating via Voice and via Messages on a smartphone, stating one precaution for each.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Discuss any two recent cyber security attack incidents, describing their nature and impact. (b) Explain the steps involved in configuring the firewall on a Mac OS X computer, describing the settings available for controlling incoming connections.	**6**
8.	(a) Explain the counter cyber security initiatives undertaken in India (e.g., CERT-In, Cyber Swachhta Kendra), describing the role of at least two such bodies. (b) Explain the process of installing and using a free antivirus program for	**6**

	securing a personal computer, listing the key steps and precautions.	
9.	(a) Explain the guidelines for using Instant Chats and joining Groups/Communities safely on social networking platforms. (b) Explain smartphone security guidelines with respect to app installation/setup and protecting the device against unauthorized access.	**6**

Session: **2026 -27**	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 Set and a Dictionary in Python, giving one example of each.	**2**
2.	Explain the difference between a Global Variable and a Local Variable in a Python function, with a short example.	**2**
3.	Differentiate between `pip install` and `import` in Python, explaining the purpose of each.	**2**
4.	State the difference between Data Hiding using name-mangling (`__var`) and a normal instance variable in a Python class.	**2**
5.	Differentiate between `os` module functions and `time`/`datetime` module functions in Python's standard library, giving one example use of each.	**2**
6.	Differentiate between Simple Linear Regression and Multiple Regression in Machine Learning.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain Dictionary Comprehension in Python with a suitable example. Write a program to create a dictionary of numbers 1–10 mapped to their cubes. (b) Write a Python program to implement a Queue using a list, with functions `enqueue()`, `dequeue()`, and `display()`.	**6**
8.	(a) Explain Default Arguments and Variable-Length Arguments in Python functions with examples. Write a function `calc_total(*prices)` that returns the sum of any number of prices passed. (b) Write a Python program defining a class `BankAccount` with attributes `balance` and methods `deposit()`, `withdraw()` (raising a user-defined	**6**

	exception `InsufficientFundsError` if withdrawal exceeds balance), and demonstrate its use.	
9.	(a) Explain Multithreading in Python, describing how the `threading` module is used to run two functions concurrently. (b) Explain the concept of Classification in Machine Learning, distinguishing between Binary and Multi-class classification, with one real-world example of each.	**6**

Session: **2026 -27**	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 File Formats. Name any two common audio and two common video file formats.	**2**
2.	Differentiate between FM Synthesis and Wave Table Synthesis in audio generation.	**2**
3.	Differentiate between Live Video and Full Motion Video capture.	**2**
4.	Differentiate between Icon Animation and Bit-Map Animation, giving one example use of each.	**2**
5.	State the purpose of a Topic Editor in a multimedia authoring tool.	**2**
6.	Differentiate between Multimedia on a LAN and Multimedia over the Internet, with respect to bandwidth and latency considerations.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain the working of Speech Synthesis and Speech Recognition systems, describing their basic processing stages. (b) Explain the concept of Playback Acceleration methods used for smooth video playback, discussing hardware and software-based approaches.	**6**
8.	(a) Explain Human Modeling and Animation techniques in 3D animation, describing the challenges involved in realistic human motion. (b) Explain Automatic Motion Control in 3D animation and describe the role of Transparency and Anti-Aliasing in enhancing visual realism.	**6**

9.	(a) Explain the essential steps involved in developing a multimedia title using an authoring tool, from project planning to final testing. (b) Explain Video Conferencing techniques over high-speed digital networks, discussing the bandwidth and compression requirements for smooth real-time transmission.	**6**

Session: **2026 -27**	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 a Production System in AI. State its three main components.	**2**
2.	Differentiate between Forward Chaining and Backward Chaining in rule-based inference systems.	**2**
3.	Define a Fuzzy Cartesian Product. Explain its role in forming fuzzy relations.	**2**
4.	Differentiate between a Fuzzy If-Then rule and a crisp If-Then rule, with an example of each.	**2**
5.	Differentiate between the Perceptron and ADALINE neural network architectures.	**2**
6.	Define Fitness Function in a Genetic Algorithm. State its role in the selection process.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain Heuristic Search techniques in AI, describing the working of the A* algorithm with a suitable example. (b) Explain First Order Predicate Logic, converting the statement "All students who study pass the exam" into predicate logic form, and explain the resolution method for inference.	**6**

8.	(a) Explain Fuzzy Rule-Based Systems, describing the Mamdani Fuzzy Inference approach with an example rule base for a temperature-control application. (b) Explain the Extension Principle in Fuzzy Set Theory and its use in extending crisp functions to operate on fuzzy sets.	**6**
9.	(a) Explain the Multi-Layer Perceptron (MLP) architecture, describing the role of hidden layers in solving non-linearly separable problems, with reference to the XOR problem. (b) Explain the concept of Encoding Methods (binary, real-valued, permutation) used to represent chromosomes in a Genetic Algorithm, and discuss the difference between Global and Local optimization.	**6**

Session: **2026 -27**	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 IMAP and POP3 protocols with respect to email storage location. Section B (6 × 3 = 18) **Q7.** **Q8.** *(6)* **Q9.** *(6)*	**2**
2.	Differentiate between an Array and an Object in JavaScript, with an example of each.	**2**
3.	Explain the concept of Dynamic Positioning in DHTML with a short example.	**2**
4.	Differentiate between Simple Data Binding and Record-Set based Data Binding in DHTML applications.	**2**
5.	Differentiate between the DOM (Document Object Model) and DTD (Document Type Definition) in the context of XML.	**2**
6.	Differentiate between a `GET` request and a `POST` request handled by a Servlet, with respect to data visibility and size limits.	**2**
	SECTION -B	**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain JavaScript Functions with a program that computes the factorial of a number using a recursive function.	**6**

	(b) Explain the `navigator` object in JavaScript and describe how DHTML can be used to dynamically change the style (color, font) of a webpage element on a button click.	
8.	(a) Explain how Session Tracking is implemented using Cookies in a web application, describing the creation and retrieval of a cookie with a code outline. (b) Explain how a Server-Side Active-X Component can be used within an ASP page to perform a specific task (e.g., file handling), with a description of its usage.	**6**
9.	(a) Explain the concept of Multi-Tier Web Applications, describing the roles of the presentation, business logic, and data tiers. (b) Explain JSP Directives and Standard Actions with an example of `<jsp:include>` and `<jsp:forward>` usage.	**6**

Session: **2026 -27**	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 Mainframe Computing and Client-Server Computing with respect to processing distribution.	**2**
2.	Differentiate between the Common Type System (CTS) and Common Language Specification (CLS) in the .NET Framework.	**2**
3.	Explain the Auto Postback property of an ASP.NET control, with a short example.	**2**
4.	Differentiate between Private Assemblies and Shared Assemblies in .NET.	**2**
5.	Differentiate between Windows Configuration and .NET Configuration files with respect to their scope.	**2**
6.	Define SQL Cache Invalidation. State its benefit in an ASP.NET web 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 Just-In-Time (JIT) Compilation in the .NET Framework and describe the role of the Microsoft Intermediate Language (MSIL). (b) Explain the working of Validation Controls in ASP.NET (e.g., RequiredFieldValidator, RangeValidator), with a code example validating a registration form's age field.	**6**

8.	(a) Explain the concept of Data Binding using a DataReader for accessing data in a disconnected manner, contrasting it with a DataSet's connected/disconnected capability. (b) Explain the working of LINQ (Language Integrated Query) in .NET with a short example querying a list of integers for even numbers.	**6**
9.	(a) Explain the use of Themes and Skins in ASP.NET for customizing the appearance of a website. (b) Explain the AJAX Control Toolkit and describe the roles of `UpdateProgress` and `Timer` controls in building a responsive ASP.NET AJAX application.	**6**

Session: **2026 -27**	Max. Marks: **30**
Program Name:	**Bachelor of Computer Application (BCA)**
Course Code: **BCA-6.1**	Course Name: **Information and Network**

SECTION -A		**2*6=12 marks**
Q. No.	**Short answer type question (approx. 200 -300 words)**	**Marks**
1.	Differentiate between an Active Attack and a Passive Attack on a network, giving one example of each.	**2**
2.	State Fermat's Little Theorem, and explain its relevance in public-key cryptography.	**2**
3.	Differentiate between MAC (Message Authentication Code) and a Hash Function with respect to key usage.	**2**
4.	Differentiate between the X.509 Authentication Service and Kerberos with respect to their underlying trust mechanism.	**2**
5.	Differentiate between PGP and S/MIME for email security.	**2**
6.	Differentiate between Intrusion Detection and Intrusion Prevention, stating the primary role of each.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain the Playfair Cipher encryption technique with an example, encrypting the plaintext "MEET ME" using the keyword "MONARCHY". (b) Explain Block Cipher Modes of Operation, describing ECB (Electronic Codebook) and CBC (Cipher Block Chaining) modes with diagrams, and state one weakness of ECB mode.	**6**
8.	(a) Explain the SHA-1 hash algorithm's general structure and compare it with MD5 with respect to output size and security strength. (b) Explain the Digital Signature Standard (DSS), describing the process of signing and verifying a message digitally.	**6**

9.	(a) Explain password-based Intrusion Techniques and describe good Password Selection Strategies to defend against them. (b) Explain the different Types of Viruses (e.g., boot sector, macro, polymorphic), and describe general Antivirus detection approaches.	**6**

Session: **2026 -27**	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 a Light Pen and a Graphics Tablet as input devices for computer graphics.	**2**
2.	State the Midpoint Circle Algorithm's decision parameter formula, and explain its role in plotting circle points.	**2**
3.	Differentiate between the Cyrus-Beck and Sutherland-Hodgman clipping algorithms with respect to the type of object they clip.	**2**
4.	Differentiate between Isometric and Oblique projections with respect to viewing direction.	**2**
5.	Define a Polygon Mesh. State one application where polygon meshes are used in 3D modeling.	**2**
6.	Differentiate between the Scan-Line and Area-Subdivision methods for Visible-Surface Detection.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Using the Midpoint Circle Drawing Algorithm, compute the pixel positions for a circle of radius 8 centered at the origin, for the first octant. (b) Explain the Scan-Line Polygon Filling Algorithm with the help of a diagram and a worked example on a simple triangle.	**6**
8.	(a) A square has vertices A(1,1), B(4,1), C(4,4), D(1,4)**.** Apply a Scaling transformation with Sx=2, Sy=1.5 about the origin, and find the new coordinates using the homogeneous transformation matrix. (b) Explain the Sutherland-Hodgman Polygon Clipping Algorithm, describing how it clips a polygon against each edge of a rectangular clip window in	**6**

	sequence.	
9.	(a) Explain Bezier Curves, describing the role of control points and deriving the Bezier blending functions for a cubic (4 control-point) curve. (b) Explain the Basic Ray-Tracing Algorithm, describing how primary and secondary (reflected/refracted) rays are traced to render a scene.	**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 — `tf.keras.datasets.mnist`). **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: **2026 -27**	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.	State any two additional features found in modern CPU organization beyond the basic fetch-decode-execute model.	**2**
2.	Differentiate between Instruction Types based on the number of operands (zero-address, one-address, two-address).	**2**
3.	Differentiate between Restoring and Non-Restoring Division algorithms for fixed-point arithmetic.	**2**
4.	State any two design considerations involved in a hardwired control unit design example.	**2**
5.	Differentiate between Instruction-Level Pipelining and Superscalar Processing.	**2**
6.	Differentiate between Processor-Level Parallelism and Multiprocessing, with an example of each.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain the IEEE-754 Single Precision Floating-Point format, and represent the decimal number 10.25 in this format, showing all steps. (b) Explain the Restoring Division algorithm for unsigned binary numbers with a flowchart, and divide $(1011)_2$ by $(0011)_2$ using this algorithm, showing the quotient and remainder.	**6**

8.	(a) Explain the design of a Multiplier Control Unit using Microprogrammed Control, describing the sequence of micro-operations for binary multiplication. (b) Explain Superscalar Processing, describing how multiple instructions are issued and executed in parallel, and state one hazard that limits superscalar performance.	**6**
9.	(a) Explain the working of Interrupt-Driven I/O, describing the sequence of steps from interrupt request to servicing, using a flowchart. (b) Explain Processor-Level Parallelism in multiprocessor systems, distinguishing between Tightly-Coupled and Loosely-Coupled multiprocessor architectures.	**6**

Session: **2026 -27**	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 MROM and EAROM with respect to programmability.	**2**
2.	State the significance of Tristate Logic in bus architecture of a microcomputer system.	**2**
3.	Differentiate between Latency Time and Response Time in the context of interrupt handling.	**2**
4.	Differentiate between an ADC (Analog-to-Digital Converter) and a DAC (Digital-to-Analog Converter), stating one application of each with the 8085.	**2**
5.	State the purpose of the READ-BACK command in Intel 8254 PIT.	**2**
6.	Differentiate between the Poll Command and the EOI (End of Interrupt) mode in Intel 8259A.	**2**
SECTION -B		**6*3=18 marks**
Q. No.	**Long answer type question (approx. 500 -800 words)**	**Marks**
7.	(a) Explain the State-Transition Diagram of the 8085 microprocessor, describing the states T1 through T4 during a machine cycle. (b) Write an 8085 Assembly Language Program to find the largest number from a block of 5 numbers stored starting at memory location 2500H, storing the result at 2600H.	**6**
8.	(a) Explain Macro RTL (Register Transfer Language) with reference to the execution of the `MOV` and `ADD` instructions in 8085. (b) Explain memory chip interfacing with the 8085, describing address decoding technique to interface a 2Kx8 EPROM at address range starting from	**6**

	0000H.	
9.	(a) Explain the internal structure of a port bit in Intel 8255, describing Mode 1 (Strobed I/O) operation with a handshaking diagram. (b) Explain the interfacing of a DAC chip with the 8085 microprocessor for generating an analog waveform, briefly describing a stepper motor control application using 8085.	**6**