Program	Bachelor of Science (Hons.) in Computer Science (BSc(H)-CS)	Semester-2
Type of Course	Value Added Courses	
Prerequisite	CPC (Computer Programming using C)	
Course Objective	To understand the basics of programming and demonstrate fundamental programming techniques.	

Teaching Scheme				Examination Scheme				
Lecture	Tutorial	Lab	Credit	Theory Marks		Practical Marks		Total Marks
				SEE	CIA	SEE	CIA	
0	0	4	2	0	0	0	100	100

List of Practical

1.	A	Write following programs in C. (Basic) 1. Write a program that takes name, rollno and marks obtained by a student in 4 subjects of 100 marks each and display the name, rollno with percentage score secured. 2. Write a program to calculate simple and compound interest. S.I. = (P × R × T)/100, CI = P $(1 + r/n)^{nt}$ - P 3. Write a Program to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm). 4. If a five-digit number is input through the keyboard, write a program to calculate the sum of its digits. (do not use a loop)
	B	Write following programs in C. (Basic) 1. Input two numbers into two locations C and D. Write a program to interchange the contents of C and D. (Without using 3rd Variable) 2. If length of three side's triangle are inputted through the keyboard, write a program to find area of triangle.
	C	Write following programs in C. (Basic) 1. Find the Absolute Value of a Number. 2. Calculate the Total Cost After Discount.
2.	A	Write basic level following programs in C. (Decision Making: if, else) 1. Write a program that reads two real numbers and tells whether the product of two numbers is equal or greater than 100. 2. Write a program that inputs two numbers a and b and then determine the product of two numbers is greater than half of a. 3. Write a program that inputs two integers and determines whether it is evenly divisible by 6 and 7. 4. Write a program that asks the user to input two integers, a and b, and then state whether or not a is evenly divisible by b.
	B	Write basic level following programs in C. (Decision Making: if, else) 1. Write a program to compute x for given y y=3x+5 if x<=10 y=8x+5 if x>10 2. While purchasing certain items, a discount of 10% is offered if the quantity purchased is more than 1000. If quantity and price per item are input through the keyboard, write a program to calculate the total expenses. 3. The current year and the year in which the employee joined the organization are entered through the keyboard. If the number of years for which the employee has served the organization is greater than 3 then a bonus of Rs. 2500/- is given to the employee. If the years of service are not greater than 3, then the program should do nothing.
	C	Write basic level following programs in C. (Decision Making: if, else) 1. Write a program that checks if the given year is leap year or not. 2. Write a C program to find the second largest number among three given numbers using if-else.
3.	A	Write intermediate level following programs in C. (Decision Making: if, else)

		1. If cost price and selling price of an item is input through the keyboard, write a program to determine whether the seller has made profit or incurred loss. Also determine how much profit he made or loss he incurred. 2. Write a program called parking charge that, given the type of vehicle ('c' for car, 'b' for bus, 't' for truck) and the hours a vehicle spent in the parking lot, returns the parking charge based on the rates shown below a. car $2 per hour b. bus $3 per hour c. truck $4 per hour 3. A company insures its drivers in the following cases: If the driver is married. If the driver is unmarried, male & above 30 years of age. If the driver is unmarried, female & above 25 years of age. In all other cases the driver is not insured. If the marital status, sex and age of the driver are the inputs, write a program to determine whether the driver is to be insured or not. 4. Given three points (x1, y1), (x2, y2) and (x3, y3), write a program to check if all the three points fall on one straight line.
	B	Write intermediate level following programs in C. (Decision Making: if, else) 1. Write a program to determine whether the character entered is a capital letter, a small case letter, a digit or a special symbol. The following table shows the range of ASCII values for various characters. Characters ASCII Values A – Z 65 – 90 a – z 97 – 122 0 – 9 48 – 57 Special symbols 0 - 47, 58 - 64, 91 - 96, 123 – 127 2. A library charges a fine for every book returned late. For first 5 days, the fine is 50 paisa, for 6-10 days fine is one rupee and above 10 days fine is 5 rupees. If you return the book after 30 Days, your membership will be cancelled. Write a program to accept the number of days the member is late to return the book and display the fine or the appropriate message. 3. Without using == operator check weather both given number is equal or not. 4. Without using % operator check weather given number is odd or even.
	C	Write basic level following programs in C. Decision Making: nested if, else if ladder) 1. Tax is computed on the taxable income (Gross Income - Deductions) based on the progressive tax slab structure. Example slab structure for a non-senior citizen: Up to ₹2,50,000: No tax. ₹2,50,001 to ₹5,00,000: 5%. ₹5,00,001 to ₹10,00,000: 20%. Above ₹10,00,000: 30%. Deductions and Benefits: Tax-free income limit increases for senior citizens: Senior Citizen (60–79): Up to ₹3,00,000 tax-free. Super Senior Citizen (80+): Up to ₹5,00,000 tax-free. Apply deductions under relevant tax rules before calculating the taxable income. Error Handling: Reject negative income values. Ensure deductions do not exceed the gross income. Constraints: Taxable income cannot be negative. If deductions exceed income, treat taxable income as ₹0. Tax rates and slab limits may vary by the user's age category.
4.	A	Write basic level following programs in C. (Decision Making: nested if, else if ladder)

		1. In boxing the weight, class of boxer is decided as per the following table. Write a program that receives the weight as input and prints the boxer's weight class. Boxer class Weight | in pound Flyweight | <115 Bantamweight | 115-121 Featheweight | 122-153 Middleweight | 154-189 Heavyweight | >=190 2. The body mass index is defined as ratio of the weight of a person to the square of the height. Write a program that receives weight and height, calculate the BMI, and reports the BMI category as per the following table: BMI category | BMI Starvation | <15 Anorexic | 15.1 – 17.5 Underweight | 17.6 – 18.5 Ideal | 18.6 – 24.9 Overweight | 25 – 25.9 Obese | 30 – 30.9 Morbidly obese | >=40 3. The policy followed by a company to process customer orders is given by the following rules: (a) If a customer order is less than or equal to that in stock and has credit is OK, supply has requirement. (b) If has credit is not OK do not supply. Send him intimation. (c) If has credit is Ok but the item in stock is less than has order, supply what is in stock. Intimate to him data the balance will be shipped. Write a C program to implement the company policy.
	B	Write basic level following programs in C. Decision Making: nested if, else if ladder, Conditional operator) 1. Write a program using conditional operators to determine whether a year entered through the keyboard is a leap year or not. 2. Write a program to find the greatest of the three numbers entered through the keyboard using conditional operators. 3. An Insurance company follows following rules to calculate premium. 1. If a person's health is excellent and the person is between 25 and 35 years of age, lives in a city, and is a male then the premium is Rs. 4 per thousand and his policy amount cannot exceed Rs. 2 lakhs. 2. If a person satisfies all the above conditions except that the sex is female then the premium is Rs. 3 per thousand and her policy amount cannot exceed Rs. 1 lakh. 3. If a person's health is poor and the person is between 25 and 35 years of age, lives in a village, and is a male then the premium is Rs. 6 per thousand and his policy cannot exceed Rs. 10,000. 4. In all other cases the person is not insured. Write a program to output whether the person should be insured or not, his/her premium rate and maximum amount for which he/she can be insured.
	C	Write basic level following programs in C. Decision Making: nested if, else if ladder) 1. Design a program for an e-commerce platform that calculates the final price of a product after applying discounts based on the user's membership type and seasonal offers. The program should accept the following inputs: Product Price (positive float value). Membership Type: Gold Member: 20% discount. Silver Member: 10% discount. Regular Customer: 5% discount. Seasonal Discount Offer: If a seasonal discount is active, an additional 10% discount is applied on the discounted price.

		If no seasonal discount, only the membership discount applies. Invalid Inputs: Handle invalid membership types and negative prices gracefully. Input: Product Price: 1000 Membership Type: Gold Seasonal Discount: Yes Output: Final Price: 720 (20% Gold discount + 10% Seasonal discount).
5.	A	Write following programs in C. (Decision Making: Switch…Case) 1. Write a c program that test the value of an integer num1. If the value is 10, square num1. If it is 9 read a new value into num1. If it is 2 or 3, multiply num1 by 99 and print out the result. 2. Write a menu driven program that allows user to enters five numbers and then choose between finding the smallest, largest, sum or average. Use switch case to determine what action to take. Provide error message if an invalid choice is entered. 3. Write a C program to check whether an alphabet is vowel or consonant using switch case. 4. Write a C program to find maximum between two numbers using switch case.
	B	Write following programs in C. (Decision Making: Switch…Case) 1. Write a C program to check whether a number is positive, negative or zero using switch case. 2. Write a C program to find roots of a quadratic equation using switch case.
	C	Write following programs in C. (Decision Making: Switch…Case) 1. Create a program to calculate a patient's bill based on the type of treatment: General Checkup: Fixed cost. Specialist Consultation: Cost varies by specialty (nested switch for specialties like cardiology, dermatology, etc.). Surgery: Additional costs based on the type of surgery. Emergency Services: Flat rate. Use a switch case to handle different billing categories.
6	A	Write following programs in C. (While Loop) 1. Print odd numbers between 1 to 10 then modify 1 to N using while loop. 2. Print numbers between two given numbers, which is divisible by 2 and not divisible by 5. 3. Print odd number's sum from 1 to 2*n numbers. 4. Write a program to print first 50 numbers in series 1,4,7,10,.....
	B	Write following programs in C. (While Loop) 1. Write a program to read n floating-point numbers from user and calculate average of positive numbers as well as negative number. 2. Write a program that asks the user to enter a radius value, and computes the value of sphere with that radius. The program should terminate when non-positive value is entered. 3. Write a program that prints Fibonacci series upto n term. 4. Write a menu driven program which has following options (with help of switch): 1. Factorial of a number. 2. Prime or not 3. Odd or even 4. Exit Once a menu item is selected, the appropriate action should be taken and once the action is finished the menu should be reappear. Unless the user selects the 'Exit' option, the program should continue to work.
	C	Write following programs in C. (While Loop) 1. Write a program to convert a decimal number to a base B (2-16) using a while loop.

		Input: An integer N and a base B. 2. Write a program to calculate the square root of a number using a while loop and iterative approximation.
7	A	Write following programs in C. (For Loop) 1. Print sum of series 1 – 2 + 3 – 4 + 5 – 6 + 7 … n. (Series should be printed also along with sum) 2. Calculate x^Y without using power function also do not use multiplication 3. Find factorial of the given number without using multiplication. 4. Find factors of the given number without using % operator.
	B	Write following programs in C. (For Loop) 1. Get a decimal number from user and convert it into roman digits. (Symbol: I:1, IV:4, V:5, IX:9, X:10, XL:40, L:50, XC:90, C:100, CD:400, D:500, CM:900, M:1000) 2. Check whether the given number is perfect number or not
	C	Write following programs in C. (For Loop) 1. Find prime numbers between 1 to N. 2. Check whether the given number is Armstrong Number or not.
8	A	Write following advance programs in C. (For Loop) 1. Write a program that finds a largest and smallest number from series of inputted number from user (stop asking a number if user has inputted -1 as number) 2. Write a C program where the computer randomly selects a number between 1 and 100. The user is then prompted to guess the number. After each guess, the program should give feedback: If the guessed number is lower than the target, print "Too low! Try again." If the guessed number is higher than the target, print "Too high! Try again." If the guessed number is correct, print "Congratulations! You guessed the correct number. 3. Write a program to generate Pythagorean triplets in 1 to 100. "3 4 5 is Pythagorean triplet where 3*3+4*4=5*5.
	B	Write following advance programs in C. (For Loop) 1. Write a program to generate all combinations of 1, 2 and 3 using loop. 2. Write a function that creates the following pattern, given the height and width. ex: ********** ********** ********** 3. Write a program to fill the entire screen with a smiling face. The smiling face has an ASCII value
	C	Write following advance programs in C. (For Loop) 1. Write a program to print the triangle shown below: A 12 BCD 3456 EFGHI 2. 1 121 12321 1234321 123454321
9	A	Write following basic programs in C. (Array) 1. Twenty-five numbers are entered from the keyboard into an array. Write a program to find out how many of them are positive, negative, even and odd. 2. Write a program that interchanges the odd and even elements of an array. 3. Write a program to copy the contents of one array into another in the reverse order.

	B	Write following basic programs in C. (Array) 1. Write a program to read the marks of one subject of 20 students and computes the number of students in categories FAIL, PASS, FIRST CLASS and DISTINCTION using array. 2. Write a program to find median of array. 3. Write a program to tally how many of each number within a range are entered.
	C	Write following basic programs in C. (Array) 1. We have two arrays A and B each of 10 integers. Write a program that tests if every element of array A is equal to corresponding element in array B. In other words, program must check if A [0] is equal to B [0] and so on... The program prints 1 if all elements are equal and prints 0 if at least one element is not equal. 2. Write a C program that finds the missing number in an array containing n-1 integers from 1 to n. You are given an array that has numbers in the range 1 to n, but one number is missing. Using a loop, identify the missing number. Input: An array of integers containing n-1 elements. Output: The missing number. Example Input: 1, 2, 4, 5 (Missing number is 3) Example Output: 3
10	A	Write following advance programs in C. (Array) 1. Find a peak element, which is not smaller than its neighbours. input: arr[]= {5, 10, 20, 15} Output: 20 Explanation: The element 20 has neighbours 10 and 15, both of them are less than 20. 2. Given a list of N integers, representing height of mountains. Find the height of the tallest mountain. Input First line will contain T, number of test cases. Then the test cases follow. The first line in each test case contains one integer, N. The following line contains N space separated integers: the height of each mountains. Output: For each test case, output one line with one integer: the height of the tallest mountain for that test case.
	B	Write following advance programs in C. (Array) 1. We are given two arrays that represent the arrival and departure times of trains; the task is to find the minimum number of platforms required so that no train waits. Input: arr[] = {9:00, 9:40, 9:50, 11:00, 15:00, 18:00}, dep[] = {9:10, 12:00, 11:20, 11:30, 19:00, 20:00} Output: 3 Explanation: There are at-most three trains at a time (time between 9:40 to 12:00)
	C	Write following advance programs in C. (Array) 1. Chef visited a grocery store for fresh supplies. There are N items in the store where the ith item has a freshness value Ai and cost Bi. Chef has decided to purchase all the items having a freshness value greater than equal to X. Find the total cost of the groceries Chef buys. Input Format The first line of input will contain a single integer T, denoting the number of test cases. Each test case consists of multiple lines of input. The first line of each test case contains two space-separated integers N and X — the number of items and the minimum freshness value an item should have. The second line contains N space-separated integers, the array A, denoting the freshness value of each item. The third line contains N space-separated integers, the array B, denoting the cost of each item. Output Format For each test case, output on a new line, the total cost of the groceries Chef buys.
11	A	Write following programs in C. (2D Array)

		1. Given a N x M matrix, print its element in zig-zag fashion, i.e., print first row from left to right, second row from right to left, third row again from left to right and so on. 2. Given a N x M(N rows and M columns) matrix, print it upside down, i.e, last row should come first, second last should come second.....so on..and finally first row should come in last. 3. Given an N x M integer matrix, if an element is 0, set its entire row and column to 0's.
	B	Write following programs in C. (2D Array) 1. Given a N x M row-wise sorted matrix, find the median of the matrix. (Note: N*M is always odd) 2. Given an m x n matrix, return all elements of the matrix in spiral order. 3. Given a square matrix mat, return the sum of the matrix diagonals. Only include the sum of all the elements on the primary diagonal and all the elements on the secondary diagonal that are not part of the primary diagonal.
	C	Write following programs in C. (2D Array) 1. Write a program that does 3x3 Matrix Multiplication. 2. Check a given matrix is a sparse matrix or not.
12	A	Write following programs in C. (loop, array) 1. Write a C program that finds the second largest element in an array of integers using a loop. Input: A list of n integers. Output: The second largest element in the array. Example Input: 5, 1, 9, 3, 7 Example Output: 7 2. Rotate an array: Rotate an array to the left or right by k positions.
	B	Write following programs in C. (loop, array) 1. Write a C program that merges two arrays of integers into a single array and then displays the merged array. The arrays must be merged in the order in which they are entered. Input: Two arrays of size m and n. Output: The merged array. Example Input: Array 1: 1, 2, 6 Array 2: 4, 5, 3 Example Output: 1, 2, 6, 4, 5, 3 2. Write a program that implements an insertion sort algorithm on array.
	C	Write following programs in C. (loop, array) 1. Write a program that implements selection sort algorithm. 2. Write a program that implements Merge sort algorithm.
13	A	Write following programs in C. (String) 1. You are given a large number N, You need to print the number N+1. Note: The number is very large and it will not fit in standard integer data type. You have to take the input as String and then manipulate the digits to convert it to N+1. 2. Convert a roman number to integer. Roman numerals are represented by seven different symbols: I, V, X, L, C, D and M. Symbol Value I 1 V 5 X 10 L 50 C 100 D 500 M 1000 For example, 2 is written as II in Roman numeral, just two ones added together. 12 is written as XII, which is simply X + II. The number 27 is written as XXVII, which is XX + V + II. Roman numerals are usually written largest to smallest from left to right. However, the numeral for four is not IIII. Instead, the number four is written as IV. Because the one is before the five we subtract it making

		four. The same principle applies to the number nine, which is written as IX. There are six instances where subtraction is used: I can be placed before V (5) and X (10) to make 4 and 9. X can be placed before L (50) and C (100) to make 40 and 90. C can be placed before D (500) and M (1000) to make 400 and 900. Given a roman numeral, convert it to an integer. 3. Write a program to find the longest common prefix string amongst an array of strings. Input: strs = ["flower","flow","flight"] Output: "fl"
	B	Write following programs in C. (String) 1. Given a string s consisting of words and spaces, return the length of the last word in the string. 2. Given two binary strings a and b, return their sum as a binary string. Input: a = "11", b = "1" Output: "100"
	C	Write following programs in C. (String) 1. Write a program that determine if the input string is valid or not. Given a string s containing just the characters '(', ')', '{', '}', '[' and ']'. An input string is valid if: Open brackets must be closed by the same type of brackets. Open brackets must be closed in the correct order. Every close bracket has a corresponding open bracket of the same type. 2. Write a program that determines if the input string is palindrome or not. A phrase is a palindrome if, after converting all uppercase letters into lowercase letters and removing all non-alphanumeric characters, it reads the same forward and backward. Alphanumeric characters include letters and numbers. Given a string s, return true if it is a palindrome, or false otherwise.
14	A	Write following programs in C. (Pointer) 1. Find a largest and smallest element from array using pointer. 2. Given an integer array nums, move all the even integers at the beginning of the array followed by all the odd integers using pointer 3. Given an integer array nums and an integer val, remove all occurrences of val in nums in-place using pointer.
	B	Write following programs in C. (Pointer) 1. Delete all duplicate elements from an array using a pointer. 2. Sort an array using pointers (Any algorithm).
	C	Write following programs in C. (Pointer) 1. Reverse a string using a pointer. 2. Implement atoi() function using pointer.
15	A	Write following programs in C. (Structure and Union) 1. Define a structure Complex with fields real and imag. Write functions to: Add two complex numbers. Multiply two complex numbers. Display the result. (use a function for passing a structure) 2. Define a structure Student with fields name, roll_no, and an array marks[5]. Write a program to: Input the details and marks of 3 students. Calculate the total and average marks for each student. Display the results.
	B	Write following programs in C. (Structure and Union) 1. Create a structure Item with fields item_code, item_name, quantity, and price. Write a program to: Allow the user to add, update, and view items in the inventory. Calculate the total cost of all items in stock. 2. Define a structure Date with fields day, month, and year. Write a program to: Input a date from the user. Validate whether the date is valid or not (consider leap years). Display the result.

	C	Write following programs in C. (Structure and Union) 1. Create structures Book and Member: Book: id, title, author, available (1 or 0). Member: id, name, issued_book_id (if any). Write a program to: Add books and members. Issue a book to a member (update available and issued_book_id). Display all members with their issued books.
16	A	Write following programs in C. (File handling) 1. Write a C program that takes a string from the user and writes it to a file named output.txt. 2. Write a C program that reads the contents of a file input.txt and displays it on the screen. 3. Write a C program that appends a string entered by the user to the end of an existing file (log.txt). 4. Write a C program that searches for a word entered by the user in a file (text.txt) and displays the line numbers where the word appears.
	B	Write following programs in C. (File handling) 1. Write a C program that merges two text files (file1.txt and file2.txt) into a third file (merged.txt). 2. Write a C program that counts the number of words in a file (file.txt). A word is defined as a sequence of characters separated by spaces or newlines. 3. Write a C program that creates a simple structure of student records (name, ID, grade) and stores them in a file (students.dat).
	C	Write following programs in C. (File handling) 3. Write a C program to encrypt and decrypt a file using a simple encryption technique, such as XOR encryption. 4. Write a C program that compresses a text file using Run-Length Encoding (RLE) and saves the compressed file as compressed.txt. The program should also be able to decompress the file back to its original form.
17	A	Write following programs in C. (DMA) 1. Write a C program that dynamically allocates memory for an integer array of size n, where the user gives n. Populate the array with values provided by the user, and then print the array. Finally, free the allocated memory. 2. Write a program that dynamically allocates memory for a 2D matrix of size m x n (rows and columns), where both m and n are provided by the user. Populate the matrix with values entered by the user, compute the sum of all elements, and free the memory.
	B	Write following programs in C. (DMA) 1. Write a program that dynamically allocates memory for a string of user-defined length. Accept the string input from the user and print it. Then, reverse the string and print the reversed version. Finally, free the memory. 2. Write a program that dynamically allocates a matrix of size m x n, takes input from the user to fill the matrix, then computes and prints the transpose of the matrix. Finally, free the allocated memory.
18	A	Write following programs in C. (Use all Concepts) 1. Write a program to implement stack operations (push, pop, peek, and display) using an array. 2. Write a program to reverse the contents of a stack using recursion.
	B	Write following programs in C. (Use all Concepts) 1. Write a C program to evaluate a given postfix expression in the form of string. A postfix expression (also known as Reverse Polish Notation) is a mathematical expression where operators follow their operands, making it easier to evaluate expressions without the need for parentheses. The program should read a valid postfix expression consisting of single-digit operands and operators (+, -, *, /, %), and output the computed result. Input: A valid postfix expression as a string (e.g., "23*54*+").
	C	Write following programs in C. (Use all Concepts) 1. Write a C program to implement and operate on a queue data structure. A queue is a linear data structure that follows the First in First out (FIFO) principle. Elements are added from the rear (enqueue) and

		removed from the front (dequeue). The program should allow users to perform basic queue operations interactively.
19-26		Subject Project Definition A Hospital Management System (HMS) is required to streamline the administrative and operational functions of a hospital, improving efficiency and user experience. This system will allow two types of users—Admin Staff and Patients—to interact with the system to manage and access hospital-related information. The system will be implemented in C language, providing a text-based menu-driven interface for simplicity. It will store information in files for persistence and ensure data security and segregation based on user roles. *Functional Requirements* 1. Admin Staff ➢ Manage patient records (add, update, delete, view). ➢ Manage appointments. ➢ View and manage doctors' schedules. ➢ Access hospital room availability and allocate rooms. ➢ View financial reports (billing). 2. Patient ➢ Register and log in. ➢ Book or cancel appointments. ➢ View assigned doctor details and visit history. ➢ Check room allocation status. ➢ Access personal billing details. *Non-Functional Requirements* 1. The system should provide secure access based on user roles. 2. It should store data persistently using files (e.g., text or binary files). 3. The interface should be user-friendly and text-based. Screen Description *Login Screen* • Purpose: Authenticate users based on their roles. • Fields: ➢ User Role: Admin Staff / Patient ➢ Username ➢ Password • Options: ➢ Login ➢ Register (for new Patients) ➢ Exit *Admin Staff Dashboard* • Options: 1. Manage Patient Records ▪ Add Patient ▪ Update Patient Details ▪ Delete Patient ▪ View Patient Details 2. Manage Appointments ▪ Schedule Appointment ▪ Cancel Appointment

		▪ View All Appointments 3. Manage Doctors ▪ Add/Update Doctor Schedule ▪ View Doctor Details 4. Room Management ▪ View Room Availability ▪ Allocate/Release Room 5. Financial Reports ▪ Generate Billing Report 6. Logout *Patient Dashboard* • Options: 1. View Personal Details 2. Book Appointment 3. Cancel Appointment 4. View Visit History 5. View Room Status 6. View Billing Information 7. Logout