Computer Programming Lab
(Common to all Branches)

Course Code	**23ES1152**	**Year**	I	**Semester**	I
Course Category	Engineering Sciences	**Branch**	CSE (DS)	**Course Type**	Lab
Credits	1.5	**L-T-P**	0-0-3	**Prerequisites**	Basic Mathematics
Continuous Internal Evaluation:	30	**Semester End Exam:**	70	**Total Marks:**	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		
CO1	Apply C programming language constructs to solve the given problem	L2
CO2	Implement programs as an individual on different IDE's/ online platforms.	L3
CO3	Develop an effective report based on various programs implemented.	L3
CO4	Apply technical knowledge for a given problem and express it with effective oral communication.	L3
CO5	Analyze outputs using given constraints/test cases.	L4

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H:High, M: Medium, L:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													
CO2	2				1									
CO3										3				
CO4										3				
CO5		3										1		

Syllabus		
Expt. No.	**Contents**	**Mapped CO**
I	**WEEK 1** **Objective: Getting familiar with the programming environment on the computer and writing the first program**. Suggested Experiments/Activities: Tutorial 1: Problem-solving using Computers. Lab1: Familiarization with programming environment Basic Linux environment and its editors like Vi, Vim & Emacs etc. Exposure to Turbo C, gcc Writing simple programs using printf(), scanf()	**CO1, CO2, CO3, CO4, CO5**
II	**WEEK 2** **Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.** Suggested Experiments /Activities: Tutorial 2: Problem-solving using Algorithms and Flow charts. Lab 1: Converting algorithms/flow charts into C Source code. Developing the algorithms/flowcharts for the following sample programs Sum and average of 3 numbers Conversion of Fahrenheit to Celsius and vice versa Simple interest calculation	**CO1, CO2, CO3, CO4, CO5**
III	**WEEK 3** **Objective: Learn how to define variables with the desired datatype, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.** Suggested Experiments/Activities: Tutorial 3: Variable types and type conversions: Lab 3: Simple computational problems using arithmetic expressions. Finding the square root of a given number Finding compound interest Area of a triangle using heron's formulae Distance travelled by an object	**CO1, CO2, CO3, CO4, CO5**
IV	**WEEK 4** **Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.** Suggested Experiments/Activities: Tutorial4: Operators and the precedence and as associativity: Lab4: Simple computational problems using the operator' precedence and associativity i) Evaluate the following expressions. a. A+B*C+(D*E) + F*G	**CO1, CO2, CO3, CO4, CO5**

	b. A/B*C-B+A*D/3 c. A+++B---A d. J= (i++) + (++i) Find the maximum of three numbers using conditional operator Take marks of 5 subjects in integers, and find the total, average in float	
V	**WEEK 5** **Objective: Explore the full scope of different variants of "if construct" namely if-else, null- else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".** Suggested Experiments/Activities: Tutorial 5: Branching and logical expressions: Lab 5: Problems involving if-then-else structures. i) Write a C program to find the max and min of four numbers using if-else. ii) Write a C program to generate electricity bill. iii)Find the roots of the quadratic equation. iv)Write a C program to simulate a calculator using switch case. v) Write a C program to find the given year is a leap year or not.	**CO1, CO2, CO3, CO4, CO5**
VI	**WEEK 6** **Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.** Suggested Experiments/Activities: Tutorial 6: Loops, while and for loops Lab 6: Iterative problems e.g., the sum of series Find the factorial of given number using any loop. Find the given number is a prime or not. Compute sine and cos series Checking a number palindrome Construct a pyramid of numbers.	**CO1, CO2, CO3, CO4, CO5**
VII	**WEEK 7:** **Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.** Suggested Experiments/Activities: Tutorial 7: 1 D Arrays: searching. Lab 7:1D Array manipulation, linear search Find the min and max of a 1-D integer array. Perform linear search on1D array. The reverse of a 1D integer array Find 2's complement of the given binary number. Eliminate duplicate elements in an array.	**CO1, CO2, CO3, CO4, CO5**

VIII	**WEEK 8 :** **Objective:** Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays. **Suggested Experiments/Activities:** **Tutorial 8:** 2 D arrays, sorting and Strings. **Lab 8:** Matrix problems, String operations, Bubble sort i) Addition of two matrices ii) Multiplication two matrices iii) Sort array elements using bubble sort iv) Concatenate two strings without built-in functions v) Reverse a string using built-in and without built-in string functions	**CO1,** **CO2,** **CO3,** **CO4,** **CO5**
IX	**WEEK 9:** **Objective:** Explore pointers to manage a dynamic array of integers, including memory allocation &amp; value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C **Suggested Experiments/Activities:** **Tutorial 9:** Pointers, structures and dynamic memory allocation **Lab 9:** Pointers and structures, memory dereference. i) Write a C program to find the sum of a 1D array using malloc() ii) Write a C program to find the total, average of n students using structures iii) Enter n students data using calloc() and display failed students list iv) Read student name and marks from the command line and display the student details along with the total. v) Write a C program to implement realloc()	**CO1,** **CO2,** **CO3,** **CO4,** **CO5**
X	**WEEK 10:** **Objective:** Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures **Suggested Experiments/Activities:** **Tutorial 10:** Bitfields, Self-Referential Structures, Linked lists **Lab10 :** Bitfields, linked lists Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields i) Create and display a singly linked list using self-referential structure. ii) Demonstrate the differences between structures and unions using a C program. iii) Write a C program to shift/rotate using bitfields. Write a C program to copy one structure variable to another structure of the same type	**CO1,** **CO2,** **CO3,** **CO4,** **CO5**
	WEEK 11: **Objective:** Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration	**CO1,** **CO2,** **CO3,** **CO4,** **CO5**

XI	**Suggested Experiments/Activities:** **Tutorial 11:** Functions, call by value, scope and extent, **Lab 11:** Simple functions using call by value, solving differential equations using Eulers theorem. i) Write a C function to calculate NCR value. ii) Write a C function to find the length of a string. iii) Write a C function to transpose of a matrix. iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method.	
XII	**WEEK 12:** **Objective:** Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions. **Suggested Experiments/Activities:** **Tutorial 12: Recursion, the structure of recursive calls Lab 12: Recursive functions** i) Write a recursive function to generate Fibonacci series. ii) Write a recursive function to find the lcm of two numbers. iii) Write a recursive function to find the factorial of a number. iv) Write a C Program to implement Ackermann function using recursion. v) Write a recursive function to find the sum of series.	**CO1, CO2, CO3, CO4, CO5**
XIII	**WEEK 13:** **Objective**: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers **Suggested Experiments/Activities:** **Tutorial 13: Call by reference, dangling pointers** **Lab 13: Simple functions using Call by reference, Dangling pointers.** i) Write a C program to swap two numbers using call by reference. ii) Demonstrate Dangling pointer problem using a C program. iii) Write a C program to copy one string into another using pointer. iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.	**CO1, CO2, CO3, CO4, CO5**
XIV	**WEEK14:** **Objective:** To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files. **Suggested Experiments/Activities:** **Tutorial 14: File handling Lab 14: File operations** i) Write a C program to write and read text into a file. ii) Write a C program to write and read text into a binary file using fread() and fwrite()	**CO1, CO2, CO3, CO4, CO5**
	iii) Copy the contents of one file to another file. iv) Write a C program to merge two files into the third file using command-line arguments. v) Find no. of lines, words and characters in a file Write a C program to print last n characters of a given file.	

Learning Resources
Text Books
1. Ajay Mittal, Programming in C: A practical approach, Pearson. 2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill
Reference Books
1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India 2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE
e- Resources & other digital material
1. https://www.geeksforgeeks.org/c-programming-language/ 2. https://www.greatlearning.in/academy/learn-for-free/courses/c-programming 3. https://onlinecourses.nptel.ac.in/noc22_cs101/course