Year: 2023 - 24

Semester: 1

1. Name of the Faculty : Sandip Kumar Chaurasiya — Course Code:
2. Course : Programming in C- Lab — L: 0
3. Program : B.Tech- CSE — T: 0
4. Target : Level- 2 — P: 3
   C: 2

COURSE PLAN

Target	50% (marks)
Level-1	40% (population)
Level-2	50% (population)
Level-3	60% (population)

1. Method of Evaluation

UG
Quizzes, Lab-Tests, Assignments (50%)
Viva-Voce (50%)

2. Passing Criteria

Scale	**PG**	**UG**
Out of 10 point scale	SGPA – "6.00" in each semester CGPA – "6.00" Min. Individual Course Grade – "C" Course Grade Point – "4.0"	SGPA – "5.0" in each semester CGPA – "5.0" Min. Individual Course Grade – "C" Course Grade Point – "4.0"

*for PG, passing marks are 40/100 in a paper
*for UG, passing marks are 35/100 in a paper

3. **Pre-requisites:** Elementary Knowledge of Computers

4. Course Objectives:

- Introduce students to the basic principles and concepts of programming.
- Develop students' ability to solve programming problems by applying the fundamental concepts of C programming.
- Teach students how to design and develop structured programs using modular programming techniques.
- Enable students to apply their C programming skills to develop small-scale applications.

5. Pedagogy

- Presentation
- Class Test
- Quizzes
- Voice over Presentation & Video lectures
- Performance Tests
- Concept diary (needs to be maintained by students-short and concise notes that include course concepts that he/she has understood)

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6. References:

Text Books	Kernighan, B.W. and Ritchie, D.M. (1988). The C programming language. Prentice Hall (2nd ed.).
Web resources	
Journals	
Reference books	1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill. 2. H. M. Deitel, P. J. Deitel, C: How to program, 7th edition, Pearson Education.

GUIDELINES TO STUDY THE SUBJECT

Instructions to Students:

1. Go through the 'Syllabus' uploaded on the My UPES- LMS platform in order to find out the Reading List.
2. Get your schedule and try to pace your studies as close to the timeline as possible.
3. Get your on-line lecture notes (Content, videos) at Lecture-Notes section. These are our lecture notes. Make sure you use them during this course.
4. Check your LMS student portal regularly.
5. Go through study material.
6. Check mails and announcements on LMS student portal.
7. Keep updated with the posts, assignments and examinations which shall be conducted on the LMS student portal.
8. Be regular, so that you do not suffer in any way.
9. **Cell Phones and other Electronic Communication Devices:** Cell phones and other electronic communication devices (such as Blackberries/Laptops) are not permitted in classes during Tests or the Mid/Final Examination. Such devices MUST be turned off in the class room.
10. **E-Mail and online learning tool:** Each student in the class should have an e-mail id and a pass word to access the LMS system regularly. Regularly, important information – Date of conducting class tests, guest lectures, via online learning tool. The best way to arrange meetings with us or ask specific questions is by email and prior appointment. All the assignments preferably should be uploaded on online learning tool. Various research papers/reference material will be mailed/uploaded on online learning platform time to time.
11. **Attendance:** Students are required to have minimum attendance of 75% in each subject. Students with less than said percentage shall NOT be allowed to appear in the end semester examination.

This much should be enough to get you organized and on your way to having a great semester! If you need us for anything, send your feedback through e-mail to your concerned faculty. Please use an appropriate subject line to indicate your message details.

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RELATED OUTCOMES

1. The expected outcomes of the Program:

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team-work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at-large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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2. The expected outcomes of the Specific Program:

PSO1	Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques.
PSO2	Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms.
PSO3	

3. The expected outcomes of the Course:

On completion of this course, the students will be able to,

CO 1	Demonstrate a high level of proficiency in writing correct and efficient C code.
CO 2	Acquire the skills to debug and troubleshoot C programs efficiently.
CO 3	Expertise in designing structured programs using modular programming techniques.
CO 4	Utilize various file and memory management techniques.
CO 5	Apply their C programming skills to develop practical applications.

4. Co-Relationship Matrix

Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

Program Outcomes / Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	2	3	2	2		1			2	2		2	3	2
CO 2	2	3	2	2		1			2	2		2	2	2
CO 3	1	3	2	2		1			2	2		2	3	2
CO 4	2	2	2	2		1			2	2		2	2	2
CO 5	2	3	2	2		1			2	2		2	3	2

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Average	1.8	2.8	2	2		1			2	2		2	2.6	2

5. Course outcomes assessment plan:

Components / Course Outcomes	Experiments*	Quiz/Viva-1	Quiz/Viva-2
CO1	✔	✔	
CO2	✔	✔	
CO3	✔		✔
CO4	✔		✔

*Experimentation & Report

BROAD PLAN OF COURSE COVERAGE

Course Activities:

Exp. No.	Topics	Modality
1	Unix Commands & Problem Solving using Algorithms and Flow charts	F2F
2	Operators and Expressions	F2F
3	Conditional Logic	F2F
4	Working with Loops	F2F
5	Functions & Recursion	F2F
6	Storage Class Specifiers	F2F
7	Arrays and String Handling	F2F
8	Pointers, Pointer to Functions, and Pointer to Arrays	F2F
9	Structures and Union	F2F
10	Command Line Arguments, Dynamic Memory Allocation	F2F
11	Sorting, Searching and File Handling	F2F

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DETAILED SESSION PLAN

EXPERIMENT -1: Linux Commands and C programming Environment

Objective: Familiarization with Linux Environment and demonstrate a clear understanding of Algorithm and Flowchart.

List of Lab Activities:
(i) Study and application of basic linux commads,
(ii) Design algorithms (as per the given template) and draw the respective flow charts for the following problems. Create suitable test cases to evaluate the algorithms.

Algorithm Template:

Algorithm <Algorithm-Name>
Input:
Output:
Step 1:
Step 2:
Step 3:
. . .

(a) Using Euclidean theorem, compute greatest common divisor of the two integers entered by the user.
(b) Compute factorial of a given number.
(c) Print all the prime number between the two numbers entered by the user
(d) Determine whether a three digit number entered by the user is an Armstrong number or not.
(e) Print an arithmetic series up to 15 terms. Ask user to enter the values of first term and common difference accordingly.

EXPERIMENT-2: Sequential Logic

Objective: To code sequential logic in C language

List of Lab Activities:
Write algorithm and C program, compile, execute and test the code using Linux C compiler with suitable test cases.

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(i) Obtain the required inputs and compute the areas of the following shapes: (i) Parallelogram (with base and height), (ii) Cuboid (with height, length, width), (iii) Rhombus (with height and side), (iv) Sphere (with radius), (v) Ellipse (with major and minor radius).
(ii) Given two numbers. Demonstrate the swapping of the values by using a third variable and without using a third variable.
(iii) Convert temperature from Celsius to Fahrenheit and Kelvin.
(iv) Print the given days in years-month-days format. E.g. 396 days = 1 year, 1 month, 1 day.

EXPERIMENT-3: Conditional Branching

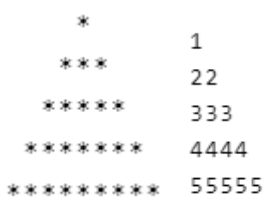
Objective: To understand conditional logic of execution; applying conditional branching structures in C (if, if-else, if-else-if ladder, nested-if, switch-case).

List of Lab Activities:
Write algorithm and C program, compile, execute and test the code using Linux C compiler with suitable test cases.
(i) Find the biggest of 3 numbers entered by the user.
(ii) Check whether a given year is leap year or not.
(iii) Find the roots of a quadratic equation.
(iv) Check whether a given character is an alphabet, digit or special character.

EXPERIMENT-4: Working with Loops

Objective: To understand the concepts of Looping with Iterations; applying while, do-while and for constructs.

List of Lab Activities:
Write algorithm and C program, compile, execute and test the code using Linux C compiler with suitable test cases.
(i) Given positive number 'n', generate all the Armstrong numbers between 1 and n. [Hint: A 3-digit number (Ex. 153) is an Armstrong number if the sum of cube of each digit ($1^3+5^3+3^3$) is equal to 153].
(ii) Multiple two given numbers without using the arithmetic binary multiplication operator using for loop.
(iii) Generate all the prime numbers between 1 and n, where n is a value supplied by the user.
(iv) Reverse the digits of a given number and check if given number is a Palindrome or not using do-while.
(v) Using a menu driven control, print the given patterns as per user choice.
(vi) Given value of 'n', find the sum of the series 1+ 1/2 + 1/3 + 1/4 + 1/5 + …+ 1/n.



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EXPERIMENT-5: Functions & Recursion

Objective: To understand the concept of Functions in C.

List of Lab Activities:

Write algorithm and C program, compile, execute and test the code using Linux C compiler with suitable test cases.

(i) Function main() gets a number and calls the following three functions

(a) "void armstrong(int)" checks if the given number is a Armstrong number or not.
(b) "void coprime(int) reverses the given number and checks if the given number and reversed number are coprime.
(c) "int factorial(int) computes the factorial of the given number using recursion and returns to main().

(iii) Function main() gets two numbers from the user and calls three functions in the given order:

(a) "int triangle_area(int base, int height)" returns the area of the right-angled triangle to main().
(b) "void swap(int *, int*)" swaps the two numbers using bitwise operator and displays them.
(c) "float* remainder (int a, int b)" returns the remainder of a/b to main().

EXPERIMENT-6: Storage Class Specifiers

Objective: To understand the concept of storage class specifiers

List of Lab Activities:

(i) Study of various storage class specifiers

(ii) Write a menu-driven program that calls different user-defined functions to demonstrate the use of various storage class specifiers available in C.

EXPERIMENT-7: Arrays and String Handling

Objective: To understand the concept of Arrays, manipulating array elements, arrays of unknown or varying size.

List of Lab Activities:

Write algorithm and C program, compile, execute and test the code using Linux C compiler with suitable test cases.

(i) Find sum of all array elements using recursion.

(ii) Copy all elements of 'a1' into another array 'a2' using pointers. Display the contents of both the arrays using pointers.

(iii) Merge the contents of 'a1' and 'a2' into a new array 'a3'.

(iv) Find the total number of alphabets, digits or special characters in a string.

(v) Find the Transpose and Inverse of a matrix.

EXPERIMENT-8: Pointers, Pointer to Functions, and Pointer to Arrays

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Objective: To understand the concepts of pointers, pointer to functions, and pointer to arrays

List of Lab Activities:

Write algorithm and C program, compile, execute and test the code using Linux C compiler with suitable test cases.

(i) Find the product of two matrices using pointers.
(ii) Pass an array of 'n' integers to a function which sorts them using selection sort algorithm.

EXPERIMENT-9: Structures and Union

Objective: To understand the concept of structure and union.

List of Lab Activities:

Write algorithm and C program, compile, execute and test the code using Linux C compiler with suitable test cases.

(i) Design a structure 'product' to store the details of the product purchased like product name, price per unit, number of quantities purchased, and amount spent. Get the name, price per unit, and number of quantities of the product purchased. Calculate the amount spent on the product and then display all the details of the procured product using structure pointers.
(ii) Design a structure 'student_record' to store student details like name, SAP ID, enrollment number, date of registration and data of birth. The element date of joining is defined using another structure 'date' to store date details like day, month, and year. Get data of 'n' students and then print the entered values [Hint: Use concept of Nested structures and Array of Structures].
(iii) Design a union 'product' to store the details of the product purchased like product name, price per unit, number of quantities purchased, and amount spent. Get the name, price per unit, and number of quantities of the product purchased. Calculate the amount spent on the product and then display all the details of the procured product using union pointers.

EXPERIMENT-10: Command Line Arguments, Dynamic Memory Allocation

Objective: To understand the concept of dynamic memory allocation.

List of Lab Activities:

Write algorithm and C program, compile, execute and test the code using Linux C compiler with suitable test cases.

(i) Design a structure 'subject' to store the details of the subject like subject name and subject code. Using structure pointer allocate memory for the structure dynamically so as to obtain details of 'n' subjects using for loop.
(ii) Use self-referential structure to handle its elements with random and dynamically allocated memory.
(iii) Use self-referential structure with random and dynamically allocated memory to handle its elements in

(a) LIFO format
(b) FIFO format

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EXPERIMENT-11: Sorting, Searching and File Handling

Objective: To understand the concept of Files, Operations on Files, and working with different sorting algorithms.

List of Lab Activities:

Write algorithm and C program, compile, execute and test the code using Linux C compiler with suitable test cases.

(i) Merge the contents of two files to another file.

(ii) Create a file with a list of 'n' integers. Read the numbers from the file into an array and sort them in ascending order. [Hint: Bubble Sort algorithm.]

(iii) Find a word in a text file and replace it with another word.

(iv) Input numbers from file using fscanf() and write even, odd and prime numbers to different files.

(v) Obtain 'n1' integers into an array (a1) and 'n2' integers into another array (a2). Sort 'a1' with Insertion sort algorithm and 'a2' with Selection sort algorithm. Write the elements of these two sorted arrays into a file in sorted manner.