Semester: II

PRINCIPLES OF PROGRAMMING USING C
Category: Professional Core Course
Stream: Computer Science (Common to AI, BT, CS, CY, CD & IS Programs)
(Theory and Practice)

Course Code	**:**	**CS222AI**		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	2:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	28L+30P		**SEE Duration**	**:**	3 Hours

Unit-I	**06 Hrs**
Logical Reasoning and Algorithmic Problem Solving: Skill development – Examples related to Arithmetical Reasoning and Analytical Reasoning. **Introduction to Programming:** Design and Implementation of efficient programs. Program Design Tools: Algorithms, Flowcharts and Pseudo codes. Types of Errors. **Introduction to C:** Introduction, structure of a C program, writing the first program, Files used in a C program. Compiling and executing C Programs using comments, C Tokens, Character set in C, Keywords, Identifiers, Basic Data Types in C, Variables, Constants, I/O statements in C. Operators in C, Type conversion and type casting, scope of variables.	
Unit – II	**05 Hrs**
Decision Control and Looping Statements: Introduction to decision control, conditional branching statements, iterative statements, Nested loops, Break and continue statements, goto statements **Arrays:** Introduction, Declaration of Arrays, accessing elements of an array, Storing values in arrays, Operations on Arrays. Two dimensional arrays- Operations on two dimensional arrays.	
Unit –III	**06 Hrs**
Strings: Introduction, Operations on strings- finding length of a string, converting characters of a string into uppercase and lowercase, Concatenating two strings, appending a string to another string, comparing two string, reversing a string, String and character Built in functions. **Functions:** Introduction, using functions, Function declaration/function prototype, Function definition, Function call, Return statement, passing parameters to a function, Built-in functions. Passing arrays to functions. Recursion.	
Unit -IV	**06 Hrs**
Structures: Introduction: Structure Declaration, Typedef declaration, initialization of structures, accessing members of a structures, copying and comparing structures, array of structures, Structures and functions. **Pointers:** Introduction to pointers, declaring pointer variables, pointer expressions and pointer arithmetic, null pointers, passing arguments to functions using pointers, pointers and arrays.	
Unit-V	**05Hrs**
Dynamic memory allocation: Memory allocation process, allocating a block of memory, releasing the used space. **Linked List and Files:** Introduction, Linked lists vs Arrays, Memory allocation and deallocation for a linked list, types of linked lists, singly linked lists. Introduction to files, using files in C, Reading data from files, writing data to files, Detecting End-Of-File, Functions for selecting a record randomly, Remove().	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply logical skills to solve the engineering problems using C programming constructs.
CO2	Evaluate the appropriate method/data structure required in C programming to develop solutions by investigating the problem.
CO3	Design a sustainable solution using C programming with societal and environmental concern by engaging in lifelong learning for emerging technology
CO4	Demonstrate programming skills to solve inter-disciplinary problems using modern tools effectively by exhibiting team work through oral presentation and written reports.

Reference Books	
1	Programming in C, Reema Thareja, 2018, Oxford University Press. ISBN: 9780199492282.
2	Algorithmic Problem Solving, Roland Backhouse, 2011, Wiley, ISBN: 978-0-470-68453-5
3	The C Programming Language, Kernighan B.W and Dennis M. Ritchie, 2015, 2nd Edition, Prentice Hall, ISBN (13): 9780131103627.
4	Turbo C: The Complete Reference, H. Schildt, 2000, 4th Edition, Mcgraw Hill Education, ISBN-13: 9780070411838.

Laboratory Experiments

PART A

Implement the following programs using cc/gcc compiler

Practice Programs:

a) Familiarization with programming environment: Concept of creating, naming and saving the program file in gedit/vi editor, Concept of compilation and execution, Concept of debugging in GDB environment.

b) Implementation and execution of simple programs to understand working of

- Printf, formatted printf, Escape sequences in C.
- Using formula in a C program for specific computation.
- Example: computing area of circle, converting Celsius to Fahrenheit, area of a triangle, converting distance in centimeters to inches, etc.
- Preprocessor directives (#include, #define)

c) Execution of erroneous C programs to understand debugging and correcting the errors like:

- Syntax / compiler errors
- Linker errors
- Logical errors
- Semantical errors

d) Implementation and execution of simple programs to understand working of operators like:

- Unary
- Arithmetic
- Logical
- Relational
- Conditional
- Bitwise

Programming Assignments:

1. Assignment statements.
2. Control Statements.
3. Loop Statements.
4. One dimensional Arrays – Searching and sorting.
5. Two dimensional arrays – Matrix operations.
6. Functions.
7. Recursion.
8. Structures.
9. Pointers
10. Linked Lists
11. Dynamic memory allocation
12. Files.

PART B

Design and development of a working model using any of the following combination of hardware and software.

- Develop a model that helps the user to monitor whether, health condition, environment parameters etc using Arduino board.
- Develop a simple Robot that can assist the user to perform simple activities home sanitization, lifting things etc using Raspberry pi.
- Hardware interfacing (**Ardunio Board, Finch, Lego WeDo 2.0**) with scratch to design various models to solve simple problems.

Develop applications using Nvidia Jetson Kit.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY WITH LAB)		
#	**COMPONENTS**	**MARKS**
1	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. **THE AVERAGE OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**10**
2	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO tests will be conducted**. Each test will be evaluated for **50 Marks**. **FINAL TEST MARKS WILL BE REDUCED TO 30 MARKS.**	**30**
3	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (10**) ADDING UPTO 30 MARKS**.	**30**
4	**LAB:** Conduction of laboratory exercises, lab report, observation and analysis **(30 Marks)**, lab test **(10 Marks)** and Innovative Experiment/ Concept Design and Implementation (**10 Marks)** adding up to 50 Marks. **THE FINAL MARKS WILL BE REDUCED TO 30 MARKS**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	10
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1 : (Compulsory)	14
3 & 4	Unit 2 : Question 3 or 4	14
5 & 6	Unit 3 : Question 5 or 6	14
7 & 8	Unit 4 : Question 7 or 8	14
9 & 10	Unit 5 : Question 9 or 10	14
11	Lab Component (Compulsory)	20
	MAXIMUM MARKS FOR THE SEE THEORY	**100**