

A Laboratory Manual for

Programming for Problem Solving

(BE01000121)

B.E. Semester 2
(Computer Engineering)



Directorate of Technical Education, Gandhinagar,
Gujarat

Government Engineering College, Rajkot

Certificate

This is to certify that Mr./Ms. _____
_____ Enrollment No. _____ of B.E. Semester _____
Computer Engineering of this Institute (GTU Code: _____) has satisfactorily
completed the Practical / Tutorial work for the subject **Programming for
Problem Solving (BE01000121)** for the academic year 2024-25.

Place: _____

Date: _____

Name and Sign of Faculty member

Head of the Department

Practical – Course Outcome matrix**Course Outcomes (COs):**

<u>Sr. No.</u>	<u>CO statement</u>
CO-1	Identify fundamental programming constructs such as variables, data types, operators, expressions, control structures, functions and basic data structures
CO-2	Explain the principles of programming and software development, including the structure and operation of algorithms, flowcharts, and pseudocode.
CO-3	Develop simple programs using appropriate data structures and standard libraries.
CO-4	Apply programming constructs such as loops, conditional statements, and functions to solve basic engineering problems.
CO-5	Debug and troubleshoot programming errors by systematically testing and refining code.

Sr. No.	Objective(s) of Experiment	CO1	CO2	CO3	CO4	CO5
1.	Write C Programs for basic understanding of C programming syntax.	√	√			
2.	Write C Programs to perform arithmetic operations as per the given equations.	√	√			
3.	Write C Programs to implement various if statements.	√	√			
4.	Write C Programs to implement various conditional and branching statements.			√	√	
5.	Implement given programs using Iteration - Part 1.			√	√	
6.	Implement given programs using Iteration - Part 2.			√	√	
7.	Write C Programs to print given patterns using iteration.			√	√	
8.	Write given programs for concepts of array.			√		√
9.	Write given programs for string manipulation.			√		√
10.	Write given programs using User Defined Functions.			√		√
11.	Write given programs using concepts of Structure.					√
12.	Write given programs using concepts of Pointers.					√
13.	Write given programs using concepts of File handling.					√
14.	Write given programs to generate mathematical series using control statements and functions.				√	√

Industry Relevant Skills

The following industry relevant competency are expected to be developed in the student by undertaking the practical work of this laboratory.

1. Problem solving skills
2. Representing a problem using algorithm/flowchart
3. Writing a program for solution of the given problem
4. Documentation for the program using comments in C language

Instructions for Students

1. Students are expected to carefully listen to all the theory classes delivered by the faculty members and understand the COs, content of the course, teaching and examination scheme, skill set to be developed etc.
2. Students shall organize the work in the group and make record of all observations.
3. Students shall develop maintenance skill as expected by industries.
4. Student shall attempt to develop related hand-on skills and build confidence.
5. Student shall develop the habits of evolving more ideas, innovations, skills etc. apart from those included in scope of manual.
6. Student shall refer technical magazines and data books.
7. Student should develop a habit of submitting the experimentation work as per the schedule and s/he should be well prepared for the same.

Common Safety Instructions

1. Tempering of hardware is strictly prohibited.
2. Students should shutdown computer and switch off the power supply after completion of the laboratory session.
3. Students should not remove power plug, mouse or key board.
4. Students should not install any software without permission.
5. Students should not store programs on DESKTOP.

Index (Progressive Assessment Sheet)

Sr. No.	Objective(s) of Experiment	Page No.	Date of performance	Date of submission	Assessment Marks	Sign. of Teacher with date	Remarks
1.	Write C Programs for basic understanding of C programming syntax.						
2.	Write C Programs to perform arithmetic operations as per the given equations.						
3.	Write C Programs to implement various if statements.						
4.	Write C Programs to implement various conditional and branching statements.						
5.	Implement given programs using Iteration - Part 1.						
6.	Implement given programs using Iteration - Part 2.						
7.	Write C Programs to print given patterns using iteration.						
8.	Write given programs for concepts of array.						
9.	Write given programs for string manipulation.						
10.	Write given programs using User Defined Functions.						
11.	Write given programs using concepts of Structure.						
12.	Write given programs using concepts of Pointers.						
13.	Write given programs using concepts of File handling.						
14.	Write given programs to generate mathematical series using control statements and functions.						
Total							

Experiment No: 0

1. Vision & Mission

1.1.1 Vision of DTE

- To provide globally competitive technical education
- Remove geographical imbalances and inconsistencies
- Develop student friendly resources with a special focus on girls' education and support to weaker sections
- Develop programs relevant to industry and create a vibrant pool of technical professionals

1.2.1 Institute's Vision

- To bring out technically competent and socially responsible engineers.

1.2.2 Institute's Mission

- To upgrade and enhance learning resources for delivering quality technical education.
- To improve pedagogical skills and subject knowledge of the faculty members.
- To fortify industry interaction for up gradation of the skills of students for meeting upcoming professional challenges.
- To nurture innovative thinking and experimentation for addressing real life problems.
- To practice and encourage high standards of professional ethics, transparency and accountability.
- To take cognizance of social, ethical and environmental issues.

1.3.1 Department's Vision

- To provide value-based technology education in Computer Engineering.

1.3.2 Department's Mission

- To bring out graduates who can solve challenges of industry and society by applying computing techniques.
- To develop partnership with industries, government agencies and Research and Development organizations for knowledge and resource sharing.
- To encourage faculties and students to participate in reputed conferences, workshops, seminars and other such technical activities.
- To motivate students/graduates to be entrepreneurs.
- To impart human and ethical values among students in the service of society.

2. Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **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.
4. **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.
5. **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.
6. **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.
7. **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.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

3. Program Specific Outcomes (PSOs)

Students will be able to...

1. Apply the fundamental knowledge of computer engineering to develop computer programs / computer-based systems in the areas of algorithms, networking, web design, cloud computing, IoT and data analytics of varying complexity.
2. Apply the core concepts of information assurance and security, system architecture, system administration, maintenance and integration, to handle real-time software projects.
3. Opt for start-ups by practicing the technical skill and ethical values cultivated.

4. Program Educational Objectives (PEOs)

Graduates will...

1. Solve real life problems related to Computing.
2. Develop computing solutions to the business and societal needs.
3. Pursue higher studies, carry out R&D, imbibe high degree of professionalism or become entrepreneur.
4. Embrace life-long learning.
5. Work and excel in a highly competitive and multicultural environment by abiding legal and ethical responsibilities.

5. Course Outcomes of Programming for Problem Solving Course

<u>Sr. No.</u>	<u>CO statement</u>
CO-1	Identify fundamental programming constructs such as variables, data types, operators, expressions, control structures, functions and basic data structures
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CO-3	Develop simple programs using appropriate data structures and standard libraries.
CO-4	Apply programming constructs such as loops, conditional statements, and functions to solve basic engineering problems.
CO-5	Debug and troubleshoot programming errors by systematically testing and refining code.

Experiment – 1

Write C Programs for basic understanding of C programming syntax.

Date:

Competency and Practical Skills: C basic programming syntax and datatypes

Relevant CO: CO-1, CO-2

Objectives: (a) To understand the structure and syntax of C Program.
(b) To understand declaration and use of variables in C Program.

Equipment/Instruments: Computer with C Compiler

1) Write a program to that performs as calculator (addition, multiplication, division, subtraction).

2) Write a C program to interchange two numbers.

3) Write a C program to enter a distance into kilometer and convert it in to meter, feet, inches and centimeter.

Quiz:

- 1) Draw a flowchart for Program 1.**
- 2) Write an algorithm for Program 2.**

Experiment – 2

Write C Programs to perform arithmetic operations as per the given equations.

Date:

Competency and Practical Skills: C basic programming syntax and datatypes

Relevant CO: CO-1,CO-2

Objectives: (a) To understand the use of arithmetic operators and evaluation of expression in C.
(b) To understand declaration of variables of the required datatype in C Program.

Equipment/Instruments: Computer with C Compiler

1) Write a program to find area of triangle ($a = h * b * .5$) a = area, h = height, b = base

2) Write a program to calculate simple interest

$i = (p * r * n) / 100$

i = Simple interest

p = Principal amount

r = Rate of interest

n = Number of years

3) Write a program to compute Fahrenheit from Celsius. ($f=1.8*c + 32$)

4) Write a C program to find out distance travelled by the equation $d = ut + \frac{1}{2}at^2$

5) Write a c program to prepare pay slip using following data:

Da = 10% of basic,

Hra = 7.50% of basic,

Ma = 300,

Pf = 12.50% of basic,

Gross = basic + Da + Hra + Ma,

Nt = Gross – Pf.

Quiz:

- 1) Draw a flowchart for Program 3.**
- 2) Write an algorithm for Program 4.**

Experiment – 3

Write C Programs to implement various if statements.

Date:

Competency and Practical Skills: Control structures in C

Relevant CO: CO-1,CO-2

Objectives: (a) To understand types of if statements.
(b) To decide appropriate if statement as per the requirement of the problem.

Equipment/Instruments: Computer with C Compiler

1) Write a program to read marks of a student from keyboard and check whether the student is pass or fail (using if else).

2) Write a C program to find that the accepted number is Negative, or Positive or Zero.

3) Write a program to read three numbers from keyboard and find out maximum out of these three. (nested if else)

4) Write a C program to check whether the entered character is capital, small letter, digit or any special character.

Quiz:

- 1) List various types of if statements.**
- 2) Write syntax of nested if statement.**

Experiment – 4

Write C Programs to implement various conditional and branching statements.

Date:

Competency and Practical Skills: Control structures in C

Relevant CO: CO-3,CO-4

Objectives: (a) To understand syntax of various conditional and branching statements.

(b) To decide appropriate conditional and branching statements as per the requirement of the problem.

Equipment/Instruments: Computer with C Compiler

1) Write a program to read marks from keyboard and your program should display equivalent grade according to following table (if else ladder)

Marks Grade

100 - 80 Distinction

79 - 60 First Class

59 - 40 Second Class

< 40 Fail

2) Write a C program to read no 1 to 7 and print relatively day Sunday to Saturday.

3) Write a C program to find out the Maximum and Minimum number from given 10 numbers.

4) Write a C program to input an integer number and check the last digit of number is even or odd.

Quiz:

- 1) Draw a flowchart to find whether a number is odd or even.**
- 2) Draw a flowchart of switch statement.**

Experiment – 5

Implement given programs using Iteration - Part 1.

Date:

Competency and Practical Skills: Control structures in C

Relevant CO: CO-3,CO-4

Objectives: (a) To understand the structure and syntax of control structures in C.

Equipment/Instruments: Computer with C Compiler

1) Write a C program to find factorial of a given number.

2) Write a program to reverse a number.

3) Write a program to generate first n number of Fibonacci series .

4) Write a program to find out sum of first and last digit of a given number.

Quiz:

- 1) Explain break and continue statements.**
- 2) Write an algorithm to generate first n number of Fibonacci series.**

Experiment – 6

Implement given programs using Iteration - Part 2.

Date:

Competency and Practical Skills: Control structures in C

Relevant CO: CO-2

Objectives: (a) To understand the structure and syntax of control structures in C.

Equipment/Instruments: Computer with C Compiler

1) Write a C program to find the sum and average of different numbers which are accepted by user as many as user wants.

2) Write a program to calculate average and total of 5 students for 3 subjects (use nested for loops)

3) Read five persons height and weight and count the number of persons having height greater than 170 and weight less than 50.

4) Write a program to check whether the given number is prime or not.

Quiz:

- 1) Explain forward jump and backward jump using goto statement.**
- 2) Write an algorithm to check whether the given number is prime or not.**

Experiment – 7

Write C Programs to print given patterns using iteration.

Date:

Competency and Practical Skills: Control structures in C

Relevant CO: CO-3,CO-4

Objectives: (a) To understand the structure and syntax nested loops.

Equipment/Instruments: Computer with C Compiler

1) Write a program to print following patterns:

a)

1

22

333

4444

55555

b)

1

12

123

1234

12345

c)

55555

4444

333

22

1

d)
12345
1234
123
12
1

2) Write a program to print following patterns:

a)

```
*  
* *  
* * *  
* * * *  
* * * * *
```

b)

```
  *
 * *
* * *
* * * *
* * * * *
```

c)

* * * * *

* * * *

* * *

* *

*

3) Write a program to print following patterns:

a)

AAAAA

BBBB

CCC

DD

E

b)
ABCDE
ABCD
ABC
AB
A

Quiz:

- 1) Explain nested for loop.**
- 2) Write syntax of while loop.**

Experiment – 8

Write given programs using concepts of array.

Date:

Competency and Practical Skills: Array in C

Relevant CO: CO-3,CO-5

Objectives: (a) To understand the requirement of array in C.
(b) To understand array implementation in C.

Equipment/Instruments: Computer with C Compiler

1) Write a C program to read and store the roll no and marks of 20 students using array.

2) Write a program to find out which number is even or odd from list of 10 numbers using array.

3) Write a program to find maximum element from 1-Dimensional array.

4) Write a program to sort given array in ascending order.

Quiz:

- 1) Explain multidimensional array.**
- 2) Write a program for matrix multiplication.**

Experiment – 9

Write given programs for string manipulation.

Date:

Competency and Practical Skills: Array in C

Relevant CO: CO-3,CO-5

Objectives: (a) To understand use of string in C.
(b) To understand inbuilt string functions in C.

Equipment/Instruments: Computer with C Compiler

1) Write a program to find a character from given string.

2) Write a program to replace a character in given string.

3) Write a program to delete a character in given string.

4) Write a program to reverse string.

5) Write a program to convert string into upper case.

Quiz:

- 1) Write a program to find length of a string without using inbuilt function.**
- 2) Explain strcmp() function.**

Experiment – 10

Write given programs using User Defined Functions.

Date:

Competency and Practical Skills: User Defined Functions in C

Relevant CO: CO-3,CO-5

Objectives: (a) To understand benefits of user defined functions.
(b) To understand categories of functions.

Equipment/Instruments: Computer with C Compiler

1) Write a program that defines a function to add first n numbers.

2) Write a function in the program to return 1 if number is prime otherwise return 0.

3) Write a function Exchange to interchange the values of two variables, say x and y using a function.

4) Write a program to find factorial of a number using recursion.

5) Write a C program using global variable, static variable.

6) Write a function that will scan a character string passed as an argument and convert all lowercase character into their uppercase equivalents.

Quiz:

- 1) Explain categories of functions with example.**
- 2) Write a program to sort elements using merge sort.**

Experiment – 11

Write given programs using concepts of Structure.

Date:

Competency and Practical Skills: Structure in C

Relevant CO: CO-5

Objectives: (a) To understand the concept of structure in C.
(b) To create user defined datatypes in C.

Equipment/Instruments: Computer with C Compiler

1) Write a program to read structure elements from keyboard.

- 2) Define a structure type struct person that would contain person name, date of joining and salary. Using this structure read information of 5 people and print the same on screen.**

- 3) Define structure data type called time_struct containing three member's integer hour, integer minute and integer second. Develop a program that would assign values to the individual number and display the time in the following format: 16: 40:51**

- 4) Design a structure student_record to contain name, branch and total marks obtained. Develop a program to read data for 10 students in a class and print them.**

5) Define a structure called cricket that will describe the following information:

Player name,

Team name,

Batting average,

Using cricket declare an array player with 50 elements and write a C program to read the information about all the 50 players and print the list containing names of players with their batting average.

Quiz:

- 1) Write syntax of Structure Declaration.**
- 2) What is the difference between Structure and Union?**

Experiment – 12

Write given programs using concepts of Pointers.

Date:

Competency and Practical Skills: Pointers in C

Relevant CO: CO-5

Objectives: (a) To understand pointers in C.

(b) To access array and string using pointers.

Equipment/Instruments: Computer with C Compiler

1) Write a program to print address of variable using pointer.

2) Write a C program to swap the two values using pointers.

3) Write a C program to print the address of character and the character of string using a pointer.

4) Write a program to access elements using pointer.

5) Write a program for sorting using pointer.

Experiment – 13

Write given programs using concepts of File handling.

Date:

Competency and Practical Skills: File Management in C

Relevant CO: CO-2

Objectives: (a) To understand file functions in C.
(b) To access files from C program.

Equipment/Instruments: Computer with C Compiler

1) Write a program to write a string in file.

2) A file named data contains series of integer numbers. Write a c program to read all numbers from file and then write all odd numbers into file named “odd” and write all even numbers into file named “even”. Display all the contents of these file on screen.

Experiment – 14

Write given programs to generate mathematical series using control statements and functions.

Date:

Competency and Practical Skills: Control Structures and User Defined Functions

Relevant CO: CO-4,CO-5

Objectives: (a) To solve mathematical series using control structures and functions.

Equipment/Instruments: Computer with C Compiler

1) Write a program to evaluate the series $1^2+2^2+3^2+.....+n^2$

2) Write a C program to find $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots + \frac{1}{n}$.

3) Write a C program to find $1 + 1/2! + 1/3! + 1/4! + \dots + 1/n!$.

4) Write a program to evaluate the series $\text{sum} = 1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \frac{x^4}{4!} \dots - \frac{x^9}{9!}$

Case Study: Implement a singly linked list with operations like insertion, deletion, and traversal.

