GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-IV

Course Title: Basic of C Programming
(Course Code: 4342003)

Diploma Programme in which this course is offered	Semester in whichoffered
Mechatronics Engineering	4th syllabus

1.   RATIONALE

The present era can be said a digital era. Nowadays almost in every walk of life there is application of digitization, atomization as well as connecting various gadgets, home appliances, human body etc. to each other. The core component which drives these tasks is a piece of code for the machine, known as a program. It is essential for the students to learn basic concepts and methodology to develop computer programs.

This Course intends to develop programming skills in the students, using a popular structured programming language `C'. The students will learn step by step procedure (i.e. flowcharting & Algorithm) of any program development process. The programming skills thus acquired using `C' language can be used for acquiring necessary programming skill to work with advance level programming languages which in turn will be helping in developing programs for the scientific, research and business purposes.

2.   COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences.

- **Develop structured, modular and memory efficient programs in 'C'.**

3.   COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with this competency are to be developed in the student to display the following COs:

- a.   Design algorithm and flowchart for the given Problem.
- b. Develop adequate knowledge on the need of programming languages and problem solving techniques.
- c.   Interpret the basic principles of C Programming and to familiarize with basic syntax and semantics of C language.
- d.   Construct C programs using control structures.
- e. Demonstrate derived data type in C language using Array & String.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (CI+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
2	0	2	3	30*	70	25	25	150

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** - End Semester Examination.

5.   SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are the sub-components of the COs. *These PrOs need to be attained to achieve the Cos.*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Draw Flow Chart and write algorithm for at least four problems.	1	
2	Write minimum 5 programs using Constants, Variables & arithmetic expression.	2	
3	Write programs to understand Data types, Type modifiers and Type conversion.	2	
4	Write programs providing insight to formatted and unformatted input and output in C.	2	
5	Write minimum 5 programs providing understanding of Relational operators.	3	
6	Write programs using logical and bitwise operators.	3	
7	Make programs using If, If-else, If-else-if and Nested If statements.	4	
8	Make programs using break, continue, goto and switch statements.	4	
9	Write programs to understand simple For loop and nested loops.	5	
10	Write programs using While Loop and Do-while loop.	5	
11	Write programs on arrays. (Sorting, merging, finding particular value etc.)	6	

Note

i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list**.**

ii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency..

Sr. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Correctness of algorithm/program	30
2	Readability and documentation of the program/Quality of input and output displayed (messaging and formatting)	10
3	Code efficiency	20
4	Debugging ability	20
5	Program execution/answer to sample questions	20
	Total	**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS AND SOFTWARE REQUIRED

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practical in all institutions across the state.

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer with basic configuration with windows or unix os	All
2	C Compiler	All

7.AFFECTIVE DOMAIN OUTCOMES

The following **sample** Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned COs and PrOs. More could be added to fulfil the development of this coursecompetency.

a) Follow safety practices.
b) Practice good housekeeping.
c) Demonstrate working as a leader/a team member.
d) Maintain tools and equipment
e) Follow ethical practices.

8.UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Major Learning Outcomes	Topics and Sub-topics

Unit – 1:
 	
Flowchart & Algorithm
	1.1. Draw flow chart to solvegiven problem logically.
	1.2. Develop Algorithm tosolve given program.
		Flowchart and Algorithm
		➢ Flowchart
		  • Definition and Importance of flowchart.
		  • Symbols of Flowchart.
		  • Flow lines, Terminals, Input/output ,ProcessingDecision, Connection off-page connectors
		  • Guidelines for preparing Flowchart.
		  • Flowchart structure
		  o Sequence, selection, repetition.
		  • Limitation of flowchart
		➢ Algorithm
		  • Developing and writing algorithm using pseudocodes

Unit– 2:
Basics of 'C'
	2.1. Comprehend general structure of 'C' program
	2.2. Declare and definevariables
	2.3. Write and execute simpleprogram in 'C'
		➢ **Basics of 'C'**
		  • General structure of 'C' program and standard directories
		  • Advantages of C language.
		  • Character set, 'C' tokens
		  • Keywords and Identifiers , C Constants
		  • Data Types in 'C'
		  • Variables, Rules for defining variables, declaration and Initialization of variables
		  • Dynamic initialization of variables
		  • Type modifiers and type conversion
		  • Constant variable, symbolic constant using #define
		  • Input and Output statements in 'C'
		  • Write, compile, execute a simple 'C' program

Unit– 3:
Operators and Expression
	3.1. Use arithmetic, relationaland logical operators for forming expressions.
	3.2. Format input and outputusing 'C' statements.
		➢ **Operators and Expression**
		  • Introduction of different types of operators and their symbolic representation
		  • Properties of operator
		  • Priority of operator and their clubbing
		  • Arithmetic operators
		  • Relational operators
		  • Assignment operators and expressions
		  • Logical operators
		  • Bitwise operators
		  • Increment & Decrement operator, sizeof operator
		  • Comma and conditional operator
		  • Formatted input and output in 'C'

Unit–4: Decision Statements	4.1. Develop programs using decision making statements in 'C' language.	➤ **Decision Statements** • Conditional branching statements: If statement • If-else statement • Nested If-else statement • If-else-if Ladder statement • switch statements • Unconditional branching: goto statement • break and continue statements

Unit–5: Loop Control	5.1. Develop programs using Structured loop control statements in 'C' Language.	➤ **Loop Control Statements** • For loop • Nested for loop • While loop • Do-while loop
Unit– 6: Introduction of Array (one dimensional)	6.1. Declare and define array. 6.2. Develop programs using array in 'C' language.	➤ **Introduction of Array (one dimensional)** • Array Terminology • A characteristics of an array • Array Declaration • Array initialization • Accessing an array • Storing value in an array (Bubble Sort)

Note: The Unit Outcomes (UOs) need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Flowchart and Algorithm	4	3	5	4	12
2.	Basics of 'C'	4	3	3	4	10
3.	Operators and Expression	6	4	4	3	11
4.	Decision Statements	5	3	5	5	13
5.	Loop Control Statements	5	4	5	5	14
6.	Introduction of Array (one dimensional)	4	2	3	5	10
	Total	**28**	**19**	**25**	**26**	**70**

Legends: R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)
Note: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.

10.SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

a) Design algorithm and construct a flowchart for at least 6 problems
b) Students are encouraged to learn Visual Language programming like scratch, snap etc.
c) Undertake micro-projects in teams.
d) Prepare charts to explain use/process of the identified topic.
e) https://www.codechef.com/ , in this website very elementary programs are available,students are expected to solve those programs
f) Students are encouraged to register themselves in various MOOCs such as: Swayam,edx, Coursera, Udemy etc to further enhance their learning.
g) Encourage students to participate in different coding competitions like hackathon,online competitions on codechef etc.
h) Encourage students to form a coding club at institute level.

11.SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)
These are sample strategies, which the teacher can use to accelerate the attainment of thevarious outcomes in this course:
a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide student(s) to take micro-projects.
c) Blend the basic concepts with more specialized instruction
d) Visualization, Cooperative Learning, inquiry based instruction, differentiation, effective use of technology, think-pair and share etc pedagogies can be implementedas per the enlisted course outcomes.
e) Give at least 10 competitive problems for each course outcomes of this course
f) Practice, practice and practice - expose students to wide range of problems
g) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
h) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
i) Guide students on how to address issues on environment and sustainability using the knowledge of this course.

12. SUGGESTED MICRO-PROJECTS
Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop- based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the microproject should beabout **14**-**16** *(fourteen to sixteen) student engagement hours* during the course. The students ought to submit micro-project by the end of the semester to develop the industry-orientedCOs.

A suggestive list of micro-projects is given here. This has to match the competencyand the COs. Similar micro-projects could be added by the concerned course teacher:

Suggested List of Micro-Project Definition :-

1. Develop a menu driven C program to perform basic arithmetic operations/mathematical operations like calculators on user inputted data.

2. Develop a C program for currency conversion.

3. Develop a C program for record keeping of student database.

4. Develop a C program to display a minimum number of currency notes required based on the entered amount. Output will also display the total number of notes required for each currency note. Valid currency notes are 1, 2, 5, 10, 20, 50, 100, 200, 500, 2000. E.g. if the user enters 140 then the output will be "3 currency notes are required. 1*100 + 2*20 = 140".

5. Develop a C program to generate salary slip of employee. Read Basic salary and find Gross salary and net salary of employee.

   Gross Salary=Basic salary +DA+ HRA (Da=25% of Basic Hra=15% of Basic)

   Net Salary=Gross Salary-PF-PT (PF=10% of Basic)

   Pt = 80 Rs. If gross salary > =12000

       = 60 if gross salary<12000 and gross salary >=10000

       = 40 if gross salary<10000 and gross salary >=8000

       =20otherwise.

6. Develop a C program to generate result for student. User enters component wise marks for each subject. After entering the marks, students will know his/her SPI as well as total backlogs.

13. **SUGGESTED LEARNING RESOURCES**

Sr.No.	Author	Title of Books	Publication
1	Kamthane Ashok N.	Programming with ANSI And Turbo C	Pearson publication, Latest Edition
2	Balaguruswami E.	Programming in ANSI C	Tata McGraw-Hills publication, Latest Edition
3	Kanetkar Yashavant	Let us 'C'	BPB publications, Latest Edition

14. **SUGGESTED LEARNING WEBSITES**

a) https://snap.berkeley.edu/snap/snap.html

b) https://scratch.mit.edu/download/scratch2

c) http://nptel.ac.in/courses/! 06105085/4

d) www.w3schools com

e) wvvw. program iz. com/c-programming

f) https://www codecademy.com/courses/getting-started-v2/0/l

g) http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087- practical-programming-in-c-january-iap-2010/

http://spoken-tutorial org/

15. **PO-COMPETENCY-CO MAPPING**

Semester IV (Mechatronics Engg.)	Introduction to C Programming						
	POs						
Competency & Course Outcomes	PO1 Basic and Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and Testing	PO5 Engineering practices for society, sustainability and environment	PO6 Project Management	PO7 Life-long learning
Competency *Develop structured, modular and memory efficient programs in 'C'.*							
Course Outcomes CO a) Design algorithm and flowchart for the given Problem.	2	2	2	2	-	-	1
CO b) Develop adequate knowledge on the need of programming languages and problem solving techniques.	2	2	2	2	-	-	1
CO c) Interpret the basic principles of C Programming and to familiarize with basic syntax and semantics of C language	2	2	2	2	-	-	1
CO d) Construct C programs using control structures.	2	2	2	2	-	-	1
CO e) Demonstrate derived data type in C language using Array & String	2	2	2	2	-	-	1

Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.

➢ **COURSE CURRICULUM DEVELOPMENT COMMITTEE**

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