GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Computer Programming for Mechanical Engineering
(Course Code: 1336503)

Diploma programme in which this course is offered	Semester in which offered
Mechanical Engineering (CAD/CAM)	3rdSemester

1. **RATIONALE**

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. Flowchart & 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) Develop flowchart and algorithm for the solution of assigned problems.
b) Interpret the basic principles and the general structure of C Programming.
c) Develop C Programs using operators and decision statements.
d) Develop C Programs using control structures.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (CI+T/2+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
CI	T	P	C	CA	ESE	CA	ESE	
0	0	2	1	0	0	25*	25	50

(*): For this practical only course, 25 marks under the practical CA have two components i.e. the assessment of micro-project, which will be done out of 10 marks and the remaining 15 marks are for the assessment of practical. This is designed to facilitate the attainment of COs holistically, as there is no theory ESE.

*Legends: **CI**– Classroom Instructions; **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) that are the sub-components of the COs.*Some of the **PrOs** marked **'*'** are compulsory, as they are crucial for that particular CO. These PrOs need to be attained at least at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'*.

Sr. No.	Practical Outcomes (PrOs)	Approx. Hrs. Required
1	Develop flowchart and algorithm for thesolution of assigned problems.	02
2	Study the general structure of C Program and develop a C program to print your name, address and contact details.	04
3	DevelopC Programs to define, change and print different types of variables and constants	04
4	Develop C Programs to perform operations on value using different operators	04
5	Develop C Programs to perform actions using If-Else and Switch statements	04
6	Develop C Programs to perform actions using While loop	04
7	Develop C Programs to perform actions using For loop	04
8	Develop C Programs to define, change and print arrays	02
	Total	28

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.*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Correctness of algorithm/program	30
2	Readability and documentation of the algorithm/flowchart 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/instruments and Software required to develop PrOs are given below with broad specifications to facilitate procurement of them by the administrators/management of the institutes. This will ensure conduction of practical in all institutions across the state in proper way so that the desired skills are developed in students.

Sr.No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer with basic configuration with Windows OS or Unix OS	All
2	Software tool: 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 competency.

a) Follow safety practices.
b) Maintain tools and equipment.
c) Work as a leader/a team member.
d) Follow ethical practices.

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.
iii. 'Characterization Level' in 3rd year.

8. SUGGESTED STUDENT ACTIVITIES

Other than the 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 conduct following activities in group and prepare small reports (of 1 to 5 pages for each activity). For micro project report should be as per suggested format, for other activities students and teachers together can decide the format of the report. Students should also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:

a) Undertake micro-projects in teams.
b) Students are encouraged to register themselves in various MOOCs such as: Swayam, edx, Coursera, Udemy etc to further enhance their learning.
c) Undertake a market survey of different industry suited programming languages.
d) Website, https://www.codechef.com/learn/c, contains elementary programs. Students are expected to solve those programs.

9. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide student(s) in undertaking micro-projects.
c) Practice, practice and practice - expose students to wide range of problems
d) Diagnosing Essential Missed Learning concepts that will help for students.
e) Guide Students to do Personalized learning so that students can understand the course material at his or her pace.
f) Encourage students to do Group learning by sharing so that teaching can easily be enhanced.
g) With respect to ***Section No. 9***, course teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
h) Guide students on how to address issues on environment and sustainability using the knowledge of this course.

10. 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 total work load on each student due to the micro-project should be about ***16 (sixteen) student engagement hours*** (i.e., about one hour per week) during the course. The students ought to submit micro-project by the end of the semester (so that they develop the industry-oriented COs).

A suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs. Similar micro-projects could be added by the concerned course teacher:

a) Develop a menu driven C program to perform basic arithmetic operations/mathematical operations like calculators on user input data.
b) Develop a C program for currency conversion.
c) Develop a C program for record keeping of student database.
d) 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. E.g. if the user enters 140 then the output will be “3 currency notes are required. 1*100 + 2*20 = 140”.
e) 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.

11. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1	Programming in ANSI C	Balaguruswami E.	McGrawHill Education, Latest Edition
2	Programming withANSI and Turbo C	Kamthane Ashok N.	Pearson Education, LatestEdition
3	Let us 'C'	KanetkarYashavant	BPB Publications, Latest Edition

12. SUGGESTED LEARNING WEBSITES

a) https://www.w3schools.com/c/index.php
b) https://www.programiz.com/c-programming
c) https://www.codechef.com/learn/c
d) https://swayam.gov.in/

13. PO-COMPETENCY-CO MAPPING

Semester IV	Computer Programming For Mechanical Engineering (Course Code: 1336503)						
	POs and PSOs						
Competency & Course Outcomes	PO 1 Basic & Discipline Specific Knowledge	PO 2 Problem Analysis	PO 3 Design/ Development of Solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering Practicesfor Society, Sustainability & Environmen	PO 6 Project Management	PO 7 Life-long Learning
Competency **Develop structured, modular and memory efficient programs in 'C'.**							
Course Outcomes							
a) Develop flowchart and algorithm for the solution of assigned problems.	2	2	2	-	-	-	2
b) Interpret the basic principles and the general structure of C Programming.	2	-	-	-	-	-	2

c) Develop C Programs usingoperators and decisionstatements.	-	3	3	3	-	-	2
d) Develop C Programs using control structures.	-	3	3	3	-	-	2

Legend: '**3'** for high, '**2**' for medium, **'1'** for low or **'-'** for the relevant correlation of each competency, CO, with PO/ PSO

14. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

Sr. No.	Name and Designation	Institute	Contact No.	Email
1	Dr. HamirSapramer, HOD Mechanical	Government Polytechnic, Rajkot	9426587197	merhamir@yahoo.com
2	Chirag Kalariya, Lecturer Mechanical	Government Polytechnic, Rajkot	9408488993	cpkalariya@yahoo.co.in