

Maharashtra State Board of Technical Education (MSBTE)**I Scheme****II - Semester Course Curriculum**

Course Title: **'C' Programming Language** (DE, EJ)
(Course Code:)

Diploma Programme in which this course is offered	Semester in which offered
Digital Electronics, Electronics and Telecommunication Engineering	Second

1. RATIONALE

Automation Industry needs to build Microcontroller based applications which are being developed using 'C'. This course deals with concepts of programming to enhance programming skills of diploma students. This course will enable the students to inculcate programming concepts and methodology to solve engineering problems.

2. COMPETENCY

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

- **Develop 'C' programs to solve broad-based electronic engineering related problems.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Interpret the basic code of 'C'.
- Implement decision making in 'C' programming.
- Use Arrays and string in 'C' programming.
- Use functions in 'C' programs for modular programming approach.
- Use pointers to increase efficiency of programs.
- Implement basic concept of structure in 'C'.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
L	T	P	C	Theory Marks		Practical Marks		Total Marks
4	-	4	8	ESE	PA	ESE	PA	200
				70	30*	50	50	

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

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment, '#': No Theory Examination

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
	of entered number using %d, %c, %i, %f, %g, %u, %o, %s, %x		
3	Write a program to perform following operations: (a) Display the message "Hello World", name, address, date of birth and email_id using printf () function. (b) Logical operations: & (AND) , (OR) for given values. (c) Bitwise operations :<< (LEFT SHIFT), >> (RIGHT OPERATOR) for given values.	I	02
4	(a) Write a program to display current time and date using time.h header file. (b) Write a program to display addition of two numbers. (c) Write a program to display value of resistor R, Where, i. $R_{series} = R1 + R2 + R3$ and ii. $R_{parallel} = 1 / (1/R1 + 1/R2 + 1/R3)$ <i>Note. Use math.h header file.</i>	I	02
5	(a) Write a program to calculate inductive reactance (F_L) with the help of given formula $F_L = 2 * \pi * f * L$. Where π , f, L are given data. (b) Write a program to calculate capacitive reactance (F_C) with the help of given formula $F_C = 1 / (2 * \pi * f * C)$. Where π , f, C are given data. <i>Note. Develop above programs using local variables, global variables and arithmetic operators.</i>	I	02
6	Implement decision control statements in C using 'if' (a) Write a program to find whether given number is even or odd. (b) Write a program to find whether given number is Positive, negative or zero.	II	02*
7	(a) Write a program to find the largest among n numbers using 'if-else'. (b) Write a program to determine leap year using 'if-else'.	II	02
8	Implement decision control statements in 'C' using 'nested if-else' (a) Determine whether a string is palindrome. (b) Find the greatest of the three numbers using conditional operators.	II	02
9	Write a program to perform addition, subtraction; multiplication and division according to user's choice using switch case statement for given data.	II	02
10	Implement loop control statements in 'C' using 'for loop' (a) Write a program to print the message "Hello" N time. (b) Write a program to print the table for given no. in one column. (c) Write a program to count the number of digit in a number.	II	02
11	Implement loop control statements in 'C' (a) Find Fibonacci series for given number. (b) Write a program to produce the following output:	II	02

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
	<div>1</div> <div>23</div> <div>456</div> <div>78910</div>		
12	(a) Write a program to print salary statement with following details: Given Basic Pay=Rs.5400/- Calculate HRA(75% of basic), DA(60% of basic) and Gross salary = Basic+ DA+ HRA. (b) Print the Result sheet: Conditions given are: marks $\geq 40\%$ pass, marks $< 40\%$ fail, marks $60 \geq$ first class, marks above 75 % distinction, marks > 100 and marks < 0 not valid.	II	02
13	(a) Write a program to declare, modify and print elements of a given data array. (b) Write a program to find highest marks in a class of n students using array.	III	02*
14	Write a program to copy of one array into second array for given data elements.	III	02
15	Write a program to create an array by reversing the elements of the given array.	III	02
16	(a) Write a program to sort numbers in ascending and descending in a given array. (b) Write a program to store n numbers in an array and find their average. (c) Write a program to add two matrices of size 3*3 store additions in third matrix for given data elements.	III	02
17	(a) Write a program that accept a string from user and print that string. (b) Write a program that accept a string and compare it with existing string. (c) Write a program to accept and display that string in reverse order.	III	02
18	(a) Write a program to convert given string to lower case. (b) Write a program to convert given string to upper case.	III	02
19	(a) Write a program to accept and concatenate two strings. (b) Write a program to find length of a string.	III	02
20	Library Functions: Develop Program to demonstrate: (a). Use of all String handling functions. (b). Use of few Mathematical functions. (c). Use of few other miscellaneous functions.	IV	02*
21	(a) Write a program to add two numbers using function. (b) Write a program to find factorial of number using function for given data.	IV	02
22	Write a program to perform addition, subtraction, multiplication and division using switch case statement and user defined function for given data.	IV	02
23	Write a program to use address operator (&) and pointer	V	02*

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
	operator (*) for given data.		
24	(a) Write a program to add two integer numbers using pointer. (b) Write a program to find area of circle using pointer.	V	02
25	Write a program to calculate the sum of elements of given array using pointer.	V	02
26	Write a program to access the array elements using pointer.	V	02
27	Write a program to interchange given values of two variables using call by value mechanism.	V	02
28	Write a program to interchange given values of two variables using call by reference mechanism.	V	02
29	Write a program to exchange given values of two variables using pointer.	V	02
30	Write a program to create a structure for employee having data members like emp_name, emp_id, and emp_salary.	VI	02
31	Write a program to create a structure for student having data members like Roll No., Name, Class, marks in three subjects.- and calculate the % of marks.	VI	02*
32	(a) Write a program to declare a structure 'Device' having data members name, unit_cost, quantity. Create one object of above structure and display it. (b) Create structure DATE using 'C' having members day, month, year and assign initial values to that structure.	VI	02
	Total		64

Note

- A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Write algorithm and draw flow chart.	20
2	Use 'C' software tool for programming to create, edit, compile the 'C' programs/applications	40
3	Debug, test and execute the programs/applications	20
4	Able to answer oral questions.	10
5	Submission of report in time.	10
	Total	100

Additionally, the following affective domain LOs (social skills/attitudes), are also important constituents of the competency which can be best developed through the above mentioned laboratory/field based experiences:

1. Handle command prompt environment.
2. Experiment with C / C++ environment.
3. Plan, construct, compile, debug and test C programs.
4. Demonstrate working as a leader / a team member.
5. Maintain tools and equipment.
6. Follow ethical practices.

The development of the attitude related LOs of Krathwohl's 'Affective Domain Taxonomy', the achievement level may reach:

- 'Valuing Level' in 1st year.
- 'Organising Level' in 2nd year.
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Expt. S. No.
1	Hardware: Personal computer, (i3-i5 preferable), RAM minimum 2 GB onwards.	For all Experiments
2	Operating system: Windows XP/Windows 7/LINUX onwards.	
3	Software: Turbo C , <u>or</u> Microsoft Visual Studio 2005 onwards (Optional).	

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Overview of C Program ming	1a. Describe the given data type. 1b. Construct algorithm, flow chart for the given problem. 1c. Use pre-increment and post-increment operators in the given situation. 1d. Use bitwise operators in the given situation.	1.1 Structure of 'C' program, Assembler, Linker, Compiler, Interpreter. 1.2 'C' character set-keywords, identifiers, types of constants (Integer, single character, string, and real) variables, scope of variables, concept of ASCII. 1.3 Data types: integer- unsigned, signed, long, float- float, double, character-char, string, octal, hexadecimal 1.4 Algorithm and flow chart. 1.5 Formatted input and output statements. Input and output function. 1.6 Operators and expressions: a. Operators in 'C'- arithmetic, logical, assignment, relational, increment and decrement, conditional, bitwise, special operators b. Expressions

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		c. Precedence and associativity.
Unit– II Decision control and Loop control	2a. Write a 'C' program using the given decision making structure for two-way branching. 2b. Write a 'C' program using the decision making structure for multi-way branching. 2c. Write a 'C' program using loop statements to solve the given iterative problem. 2d. Use related statements to alter the program flow in the given loop.	2.1 Decision making if statement (if, if-else, nested if-else), switch –case statement. 2.2 Repetition in 'C' (loop control statement) while, do-while and for loop, break and continue statement, nested loops.
Unit– III Array and Strings	3a. Write steps to access elements of the given array. 3b. Write steps to perform operation on the given array. 3c. Write steps to initialization and declaration of the given string in 'C' program. 3d. Apply relevant control statement on the given strings to manipulate its elements.	3.1 Introduction to Array and its types 3.2 Declaration, initialization of array, accessing elements of an array, adding, deleting, sorting & searching. 3.3 Introduction to string Initializing, declaring and display of string 3.4 String handling functions from standard library (strlen (), strcpy (), strcat (), strcmp(), strlen(),strupr()):
Unit-IV Functions	4a. Use inbuilt functions for the given problem. 4b. Develop relevant user defined functions for the given problem. 4c. Write 'C' codes to Pass function parameters using the given approach. 4d. Write recursive function for the given problem.	4.1 Concept and need of functions 4.2 Library functions: Math functions, String handling functions, other miscellaneous functions. 4.3 Writing User defined functions, scope of variables. 4.4 Parameter passing: call by value, call by reference. 4.5 Recursive functions
Unit –V Pointers	5a. Use pointer for address access to manipulate the given data. 5b. Use pointers to access memory locations to solve the given problem. 5c. Use pointers for performing the given arithmetic operation. 5d. Develop a program to access array elements using the given pointers.	5.1 Concept of pointer and pointer variables, initialization of pointer, call-by-reference. 5.2 Pointer arithmetic. 5.3 Handling arrays using pointers 5.4 Handling functions using pointers
Unit-VI	6a. Create a structure for the given	6.1 Introduction and Features and Syntax of

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Structur es	data. 6b. Develop a program to access elements of structure using pointers. 6c. Use the structure for solving the given problem. 6d. Use of enumerated data type in structure to solve the given program.	structure 6.2 Declaration and Initialization of Structures 6.3 Initializing, assessing structure members using pointers 6.4 Type def, Enumerated Data Type, using structures in C Program 6.5 Operations on structure.

Note: To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

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 Marks
I	Overview of C Programming	04	-	02	04	06
II	Decision control and Loop control	06	02	02	04	08
III	Array and Strings	06	-	02	08	10
IV	Functions	08	02	07	07	16
V	Pointers	08	02	02	08	12
VI	Structures					
Total		64	6	15	31	50

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

This specification table also provides a general guideline for teachers to frame internal end semester practical theory exam paper which students have to undertake.

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:

- Prepare journals based on practical performed in laboratory.
- Give seminar on relevant topic.
- Library/E-Book survey regarding 'C' used in electronics industries.
- Prepare power point presentation or animation for showing different types of 'C' Applications.
- Find and Utilize android applications related to 'C'.
- Undertake a market survey of different 'C' application and compare with the following points.
 - Available applications.
 - Application profile.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

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. '**L**' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About **15-20% of the topics/sub-topics** which is relatively simpler or descriptive in nature is to be given to the students for **self-directed learning** and assess the development of the LOs/COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- e. Guide student(s) in undertaking micro-projects.
- f. No. of practical's selection to be performed should cover all units.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 duration of the micro-project should not be less than **16 (sixteen) student engagement hours** during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. **Modern Periodic Table using 'C'** - Each group will prepare a periodic table using functions 'Void add()' and 'Void show()'
- b. **Simple Calculator** - Each batch will prepare a menu driven program to perform any five mathematical operations.
- c. **Employee Record System** - Each batch will prepare a menu driven program to perform following operations :
 - i. Add record
 - ii. List record
- d. **Digital clock using 'C'**
- e. **String Manipulation project** - Each batch will prepare a menu driven program to perform following operations (any five) :
 - i. Substrings
 - ii. Palindromes
 - iii. Comparison
 - iv. Reverse string
 - v. String to integer
 - vi. Sort a string

- f. **Matrix Operations** - Each batch will prepare a menu driven program to perform following operations:
- Matrix addition
 - Matrix multiplication
 - Matrix transpose
 - Sum of diagonal of a matrix.
- g. **Basic mathematic functions** - Each batch will prepare a menu driven program to perform following operations:
- Pascal triangle
 - Armstrong No.
 - Floyd's triangle
 - HCF and LCM.
- h. **Patterns** - Each batch will prepare a menu driven program to obtain following patterns (any three):

1	1	*	1
121	12	**	2 2
12321	123	***	3 3 3
1234321	1234	**	4 4 4 4
		*	

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Programming in 'C'	Balguruswamy, E.	Tata McGraw Hill May 2012, New Delhi ISBN:978-1-25-900461-2.
2	Let us 'C'	Kanetkar, Yashwant	BPB Publication July 2016, New Delhi. ISBN : 9788183331630,
3	Basic computation and programming with 'C'	Saha, Subrata ; Mukherjee, Subhodip	Cambridge 2016, New Delhi. ISBN: 978-1-316-60185-3

14. SOFTWARE/LEARNING WEBSITES

- Turbo C Editor
- Dosbox
- www.tutorialspoint.com/cprogramming
- www.cprogramming.com
- www.sourcecodesworld.com/source/LanguageHome.asp?LangId=1
- <http://fresh2refresh.com/c-programming/c-basic-program/>
- <http://www.c4learn.com/c-programs/>
- <http://computer.howstuffworks.com/c2.htm>
- <http://www.programiz.com/c-programming/examples>
- www.indiastudycenter.com/studyguides/cs/default.asp
- Android application resources for 'C' programming from Google Play store.

15. COURSE CURRICULUM DEVELOPMENT COMMITTEE**MSBTE Resource Persons**

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