GUJARAT TECHNOLOGICAL UNIVERSITY

Embedded C
Subject Code:3715205
Semester I

Type of course: Elective

Prerequisite:

1. Basic C-language

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	PA (V) ESE	PA (I)	
4	2	0	5	70	30	30	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment;

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Fundamentals** History of C and overview of standards (K&R, ANSI, C99, C1x, gnu extensions etc.) Development life cycle of a C program, GNU Tools required gcc, cpp, as, ld, nm, objdump etc. Layout of C executable (code, data, bss,stack,heap etc) Debugging C Programs using gdb. Representation of integral, floating values(2's compliment,IEEE 32 bit,64 bit formats), Endianness Portability Issues, usage of Typedef, Register storage class, Volatile Variables	**6**	10
2	**Control Structures, Pointers, Arrays, Functions** Recap of control structures,Architecture dependent, independent optimizations Concept of pointers, NULL Pointer,Pointer arithmetic, void pointer, pointer to pointer, pointer to array, array of pointers, pointers and const keyword. Creation,Initialization of 1D,2D arrays, Accessing elements of 1D, 2D arrays using pointers as well as subscrip Oerators.	**6**	10
3	**Functions, Strings** Scope and Lifetime of variables, Storage classes, Internal vs External linkage, Symbol lookup using nm, Passing arguments by value, address, Return mechanism, Inline Functions, Recursion vs Iteration, Tail Recursion,Function pointers, Callback functions String operations, library functions, implementing own logic,Table of strings(fixed length,variable length), Shallow vs Deep copy of	**7**	10

	strings,Command line arguments, Passing environment variables		
4	**Structures & Unions , Preprocessor** Symbolic constants, Macros, Conditional Compilations, Predefined Constants, Preprocessor operators, Structure Alignment,Packing Issues, Padding Bits, offset of members,Bit fields, Bit manipulations, Unions, Understanding memory layout of variables	**7**	20
5	**Dynamic Memory management & Assembly** Dynamic memory using malloc,calloc, realloc, free , allocating 1D,2D arrays(fixed length,variable length rows) Analysis of memory leaks and heap errors using valgrind Inline assembly, Register allocation, Creation of static and dynamic libraries, Makefiles	**7**	20

Reference Books:

1. Embedded C Programming & the Microchip PIC 1st Edition by Richard H. Barnett, Larry O' Cull/ Delmar Cengage Learning

Course Outcome:

After learning the course the students should be able to:

1. Understand the fundamentals of C programming; enumerate GNU tools used for developing C Language, its various data types and its representation.
2. Analyse the control structures, pointers, and arrays in C and develop programs using them.
3. Develop C applications using user defined functions and strings.
4. Develop C applications using structures, unions and Pre-processors.
5. Develop C applications which uses dynamic memory management and in line assembly.

List of Experiments: (with Open Ended Problems)

1. Implement user defined string function strlen, strcpy, strcmp, strcat, strrev with use of pointer.
2. Write a c program to for addition, subtraction and multiplication of two matrix.
3. Implement your own function for reading and printing string with multiple lines.
4. Write a C program by using structure and string to demonstrate shallow copy, write appropriate solution to implement deep copy.
5. Write a program to allocate dynamic memory to array of pointer to string, and initialize array elements with string dynamically.

6. Convert the string in a.b.c.d format into 32 bit unsigned integer.

List of Open Source Software/learning website:

1. Linux-opensuse