Course Code	Course Title	L	T	P	C
BECE320E	Embedded C Programming	2	0	2	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives

1. To impart logical thinking and fundamental problem-solving skills via the use of a programming language.
2. To develop basic and advanced programming concepts using C and Embedded C language.
3. To interface with microcontroller using Embedded C language.

Course Outcomes

The student will be able to

1. Apply the C programming language for various data types and decision making applications.
2. Comprehend the derived data types, pointers and creation of functions.
3. Describe the architecture of 8051 microcontroller for programming & interfacing applications.
4. Write the embedded C code to 8051 for programming I/O ports, timers, serial communication, interrupt and interfacing external peripherals.
5. Develop microcontroller based applications.

Module:1	Introduction to C	3 hours

Introduction to Embedded C, difference between C and Embedded C. Introduction to C programming, comments, identifiers, variables, headers, data types, operators, order of operations, format specifies, escape sequence characters, input and output statements, programs on sequential statements.

Module:2	Control and loop statements	4 hours

Control statements: if, if-else, if-else ladder, elseif ladder, switch. Loops: do-while, while, for loops and nested loops. Break, continue, goto and exit statements. Programs on if, switch and loops.

Module:3	Arrays and strings	3 hours

Arrays: one dimensional and multi-dimensional array, programs on arrays. Strings, functions, pointers.

Module:4	Introduction to 8051 microcontroller	6 hours

Introduction to microcontroller, difference between microcontroller and microprocessor, 8051 : architecture, pin diagram of 8051, memory organization, special function registers, I/O pins ,timers, interrupts, serial interface, power consumption, external interface of the standard 8051.

Module:5	8051 programming in C	4 hours

Data types: sbit, sfr, and bit. Producing delay using loops, programming I/O ports: bit addressable and byte addressable programming, programs on sending and receiving data through I/O ports. Programs on logic operations, data conversion, data serialization with I/O ports.

Module:6	Timer and serial port programming	4 hours

Programs on accessing timers registers, programs on producing time delay using mode 1 and mode 2, programs on generating various clock frequencies, programming of timers 0 and 1 as counters. Serial port programming: transmitting

and receiving data with different baud rates. Programs on timer and Serial communication interrupts.		
Module:7	**Interfacing with displays and sensors**	**4 hours**
Programming of keyboard interfacing, programming of LEDs interfacing, programming of seven segment display interfacing, interfacing circuit description and programming of 16 x 2 LCD, ADC, DAC and temperature sensor interfacing.		
Module:8	**Contemporary Issues**	**2 hours**
	Total Lecture hours:	**30 hours**

Text Book(s)	
1	Mike McGrath, C Programming in easy steps, 2019, 4th Edition, In Easy Steps Limited.
2	Muhammad Ali Mazidi , Janice Gillispie Mazidi , Rolin McKinlay, 2014, The 8051 Microcontrollers & Embedded Systems , 2nd edition, Pearson.
Reference Books	
1.	Barrett, Michaell, and Ambony Massa. Programming Embedded Systems, with C and GNU Development Tools, 2020, O'Reilly Media.
2	Herbert Schildt, C: The Complete Reference, 2017, 4th Edition, McGraw Hill Education.
Mode of evaluation: Internal Assessment (CAT, quizzes, Digital Assignments) & Final Assessment Test (FAT)	
Lab Component :	
Indicative Experiments	

1	Programs on Sequential statements	2 hours
2	Programs on Condition and Control statements	2 hours
3	Programs on Arrays	2 hours
4	Programs on Strings & Functions	2 hours
5	Programs on I/O ports	2 hours
6	Programs on Timer/Counter	4 hours
7	Programs on serial communication	2 hours
8	Programs on Timer Interrupts	2 hours
9	Programs on Serial Communication Interrupts	2 hours
10	Programs on External interrupts	2 hours
11	Programs on interfacing Keypad and LCDs	4 hours
12	Programs on interfacing ADC, DAC and Sensors	4 hours
	Total Laboratory Hours	**30 hours**

Mode of assessment: Continuous assessment and FAT			
Recommended by Board of Studies	07-11-2023		
Approved by Academic Council	No. 72	Date	13-12-2023