GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3152409
Semester – V
Subject Name: Microcontrollers Architecture, Interfacing and Applications

Type of course: Professional Core Course

Prerequisite: Basic Electronics, Analog & Digital Circuits

Rationale: Microcontrollers have become part of almost every household, industrial and other applications. Considering this, it becomes necessary that Power Electronics engineers learn the subject in details.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	1	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Review of Number system, Combinational and Sequential Circuits:** Number system, binary, hexadecimal, Boolean algebra, logic gates, combinational circuits like decoder, multiplexer, demultiplexer, PLA, Arithmetic circuits, ALU etc. Flip Flop, Latch, Sequential circuits like counter, register, shift register etc., Synchronous and asynchronous circuits.	8 hrs
2	**8051 Microcontroller Basics:** Inside the computer, microcontrollers and embedded processors, block diagram of 8051, psw and flag bits, 8051 register banks and stack, internal memory organization of 8051, io port usage in 8051, types of special function registers and their uses in 8051, pins of 8051. Memory address decoding, 8031/51 interfacing with external rom and ram. 8051 addressing modes.	8 Hrs
3	**Assembly programming and instruction of 8051:** Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming.	8 Hrs
4	**8051 programming in C:** Data types and time delay in 8051C, IO programming in 8051C, Logic operations in 8051 C, Data conversion program in 8051 C, Accessing code ROM space in 8051C, Data serialization using 8051C, 8051 Timer programming in Assembly and C: Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C.	8 Hrs
5	**8051 programming in assembly and C**: Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly, serial port programming in 8051 C. 8051 interrupts, Programming timer, external hardware, serial communication interrupt, Interrupt priority in 8051/52, Interrupt programming in	8 Hrs

	C.	
6	**Interfacing:** LCD interfacing, Keyboard interfacing ADC, DAC and sensor interfacing: ADC 0808 interfacing to 8051, Serial ADC interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning. Motor control: Relay, PWM, DC and stepper motor: Relays and opto isolators, stepper motor interfacing, DC motor interfacing and PWM.	8 Hrs

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**30**	**40**	**0**	**10**	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:
1. 8051 Microcontroller-Internals, Instructions, Programming & Interfacing by Subrata Ghoshal, Pearson
2. The 8051 Microcontroller and Embedded Systems using Assembly and C -by Muhammad Ali Mazidi
3. The 8051 Microcontroller (with CD) by Kenneth Ayala
4. Embedded Systems and Robots – Projects using the 8051 Microcontroller by Subrata Ghoshal

Course Outcomes:

After completing the course, the student should be able to

Sr. No.	CO statement	Topics Mapped	Marks % weightage
CO-1	prepare and execute small programs based on MCS-51 microcontroller	2,3,4,5	30%
CO-2	develop program for given application	1,4,5	30%
CO-3	interface MCS-51 microcontroller with external circuits	1,5,6	25%
CO-4	design small real-world application	5,6	15%

List of Experiments:

This is suggested list of experiments.

Sr No.	Title	CO Mapped
1	Simple arithmetic operations	1, 2
2	Simple logic operations	1, 2
3	Programs on looping	1, 2

4	Programs on code conversion	1, 2
5	Reading from /Writing data to I/O port	3, 4
6	Timer programming	4
7	7 segment display interfacing	3, 4
8	Keyboard interfacing	3,4
9	Project work (weight of 4 experiments)	1, 2, 3, 4, 5, 6

Major Equipment:

Oscilloscope, Multi-meters, Variable Power Supply, microcontroller boards etc.

List of Open Source Software/learning website:

- **Learning website:**

    - **http://nptel.iitm.ac.in/courses.php** (**NPTEL** Course Sanatnu Chattopadhyay)

    - **http://ocw.mit.edu/**

    - **https://swayam.gov.in/**