GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3172001
Semester – VII
Subject Name: Microcontrollers and Embedded Systems

Type of course: Engineering Science

Prerequisite: Zeal to learn the course

Rationale: This subject focuses on the study of microcontroller along with various applications using microcontrollers. It also briefs the students about interfacing of memory and various I/O devices like A to D converter, D to A converter LED, LCD to advanced microcontrollers. The students learn the Programming language (Embedded C) used for microcontrollers. They will be able to use the advanced fast microcontroller.

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	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Embedded Systems design: Definition & examples of embedded systems, Basics of embedded System design, Hardware unit & software for embedded systems, Basic Architectures: Von Neumann versus Harvard Architecture and CISC versus RISC Processors	06
2	Microcontroller 8051: Block diagram, Pin functionality, Embedded C programming basics & sample programs, checksum operation, timers: Architecture & C programming, UART Asynchronous serial communication & C programming, Interrupts: types & configuration, interrupt priorities & C programming	08
3	Interfacing peripherals: LEDs & 7-segment, LCD, Matrix Keyboard, ADC & DAC.	07
4	H-bridge concept for DC motor control, PWM technique for motor control, Stepper motor control: full step & half step	06
5	The PIC18F4xx microcontroller: Block diagram, Programming model & architecture diagram, memory organization, Instruction set & addressing modes, Illustrative programs	07
6	I/O ports & related SFRs, LED Interfacing & concept of current sourcing/sinking, Timers: Capture, Compare & PWM modes, SFRs & Interrupts: types & SFRs, Sample programs for timers & interrupts	08

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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	**20**	**20**	**20**	**10**	**10**

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. The 8051 Microcontroller and Embedded Systems Using Assembly and C, by Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay (Second Edition, Pearson Education).
2. Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family), by Ramesh Gaonkar, Penram.
3. The 8051 Microcontroller & Embedded Systems using Assembly and C by K. J. Ayala, D. V. Gadre (Cengage Learning, India Edition).
4. 8051 Microcontroller: Internals, Instructions, Programming and Interfacing by Subrata Ghoshal, Pearson Education.
5. The 8051 Microcontrollers: Architecture, Programming and Applications by K Uma Rao, Andhe Pallavi, Pearson Education.
6. Embedded systems architecture, programming and design, second edition by Raj Kamal, TMH publishing company limited

Course Outcomes:

After successful completion of the course the students shall be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Understand embedded C programming fundamentals & learn its implementation to build software	25
CO-2	Understand the general process of embedded system development extract relevant requirements for embedded systems, and understand their implications	25
CO-3	Select a suitable microcontroller and develop hardware model for a given task based on system requirements	25

CO-4	Design, implement and test a single-processor embedded systems for real-time applications in engineering & automation	25

List of Experiments:

1. Interfacing LED and LCD Displays with 8051 microcontroller.
2. Interfacing Matrix Keyboard with 8051 microcontroller.
3. Interfacing ADC and DAC with 8051 microcontroller.
4. Interfacing Stepper Motor with 8051 microcontroller.
5. Controlling DC motor using PWM with 8051 microcontroller.
6. Introduction to MPLAB IDE and Basic programming for PIC18F microcontroller.
7. Simulation programs based on data transfer and arithmetic operations in PIC18F Microcontroller.
8. Simulation programs based on logical operations in PIC18F microcontroller.
9. Programming based on stack and subroutines in PIC18F microcontroller.
10. Interfacing Input/output Peripherals with PIC18F microcontroller.
11. Programming the Timers of PIC18F microcontroller.
12. Programming the Interrupts of PIC18F microcontroller.

Major Equipment:

1. MCBx51 Evaluation Board/8051 microcontroller based kit with interfacing peripheral modules
2. MPLAB starter kit for PIC18F MCUs.

List of Open Source Software/learning website:

https://nptel.ac.in/courses/117/104/117104072/

https://nptel.ac.in/courses/108/102/108102045/