

Course Objectives:

Microcontrollers is a core theory course at undergraduate IV semester level. Knowledge of Digital logic Circuits and programming fundamentals are required as prerequisites. The course focuses on architecture and programming aspects of 8051 microcontroller.

Course outcome: Upon the completion of the course, the student should be able to :

- CO-1 Understand** the basic differences between various architectures of programmable devices (PO àc; Strength of Correlation 1/11)
- CO-2 Discuss** the architecture, addressing modes, instruction types and instructions set of 8051 (PO àa, c; Strength of Correlation 2/11)
- CO-3 Identify** the purpose of each instruction (PO àc; Strength of Correlation 1/11)
- CO-4 Apply** the knowledge of architecture and instructions set of 8051 to **develop** programs for various purposes (PO à c, e, i; Strength of Correlation 3/11)
- CO-5 Subdivide** a given task and **develop** program for the same using subroutines (PO àc, e, h, k; Strength of Correlation 4/11)
- CO-6 Outline** the concept of embedded sub systems with **Illustrative** examples (PO à c, e; Strength of Correlation 2/11)

Pre-requisites:

Digital logic Circuits and programming fundamentals

Contents:

1) Microprocessors and microcontroller: Introduction, Overview of 8085 Microprocessor, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture. The 8051 Architecture-Block diagram, Pin Configuration, 8051 port structure.

8 Hrs.

2) Addressing Modes and Operations: Introduction, Addressing modes, External data transfer, Code Memory, Read Only Data transfer / Indexed Addressing modes, PUSH and POP Opcodes, Data exchanges, Example Programs; Byte level logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Example Programs. Arithmetic Operations: Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Example-programs. **8 Hrs.**

3) Jump and Call Instructions: The JUMP and CALL Program range, Jumps, calls and Subroutines, Interrupts and Returns, Examples. **6 Hrs.**

4) 8051 programming in C: Data types and time delays in C for 8051, I/O programming, logic operations, data conversion programs, accessing code ROM

space, data serialization.

4 Hrs.

5) Timer / Counter Programming in 8051: Programming 8051 Timers, Counter Programming, programming timers 0 and 1 in C and ALP. **8 Hrs.**

6) 8051 Serial Communication: Basics of Serial Communication, 8051 connections to RS-232, 8051 Serial communication Programming, Programming the second serial port, Serial port programming in C and ALP. **6 Hrs.**

7) Interrupts Programming: 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Interrupt Priority in the 8051/52, interrupt programming in C and ALP. **6 Hrs.**

8) Embedded Sub Systems Using 8051: Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper Motor. **6 Hrs.**

Beyond the Syllabus Coverage(Suggestive):

1. Microcontroller based projects.
2. Study of MSP, Arduino and Galileo.

References:

- 1) Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", 2/e, Penram International, 1996, Thomson Learning 2005.
- 2) Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay, "The 8051 Microcontroller and Embedded Systems – using assembly and C", PHI, 2006/Pearson, 2006
- 3) Predko, "Programming and Customizing the 8051 Microcontroller", TMH, 2005
- 4) Dr. Ramani Kalpathi and Ganesh Raja, "Microcontroller and its applications", Sanguine Technical Publishers, 2005.

Course Objectives:

Microcontroller laboratory is for IV semester level. This laboratory requires a thorough understanding of Digital Circuits and Programming skills. The course mainly focuses on assembly level language programs and interfacing programs to interface different hardware components.

Course outcome: Upon the completion of the course, the student should be able to :

- CO-1 Understand** the 8051 controller architecture functioning. (PO à b,i; Strength of Correlation 2/11)
- CO-2 Discuss** the architecture, addressing modes, instruction types and instruction set of 8051.(PO àb, e; Strength of Correlation 2/11)
- CO-3 Apply** the knowledge of the instruction set of 8051 to develop programs for various purposes.(PO à b, c, e, i; Strength of Correlation 4/11)
- CO-4 Subdivide** a given task and **develop** program for the same using subroutines.(PO àb, c, e, k; Strength of Correlation 4/11)
- CO-5 Interface** different peripherals (I/O s) and **design** simple microcontroller based systems. (PO àb, c, i, k; Strength of Correlation 4/11)

Pre-requisites:

- i. 1. A thorough understanding of Digital Logic Circuits.
- ii. 2. A basic idea of programming.
- 3. A thorough knowledge of analog circuits and integrated circuits and various mechanical and electronic devices and components

Contents:**SET – I: Assembly Language Programming Experiments**

- 1)Data Transfer - Block move, Exchange,
- 2) control and conditional loops based programs: sorting, Finding largest element in an array
- 3)Arithmetic and Logical Instructions
- 4)Counters
- 5)Subroutines: Conditional CALL & RETURN.
- 6)Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX – Decimal and Decimal – HEX.

SET – II: Interfacing Experiments using C- Language

- 1) Generate different waveforms Sine, Square, Triangular, and Ramp using DAC interface to 8051 Microcontroller; change the frequency and amplitude.
- 2) Stepper Motor control interface to 8051 Microcontroller.
- 3) Alphanumeric LCD panel interface to 8051 Microcontroller.