

<b>Course Title</b>	<b>Microcontroller &amp; Interfacing</b>
<b>Course Code</b>	<b>EC406</b>
<b>Course Credit</b>	Lecture : 03
	Practical : 02
	Tutorial : 00
	Total : 05

### Course Learning Outcomes

After the completion of the course students will be able to

- **Understand** architecture and the operation of microcontroller
- **Differentiate** between microprocessor and microcontroller
- **Write** an assembly & C language program to **solve** basic binary math operations
- **Apply** knowledge of the microcontroller's internal registers and operations by use of a PC based simulator.
- **Develop** the programming skill by converting assembly and C-Language program into machine code and **test** them on the training board.
- **Design** an interface that allows a microcontroller to control various peripherals
- **Develop** the project after identifying proper application.

### Detailed Syllabus

Sr. No.	Name of chapter & Details	Hours Allotted
	<b>SECTION – I</b>	
<b>1</b>	<b>8051 Microcontrollers:</b> Microcontrollers and embedded processors, Overview of the 8051 family	<b>02</b>

2	<p><b>8051 Assembly Language Programming:</b></p> <p>Architecture of 8051, Introduction to 8051 assembly programming, assembling and running an 8051 program, The program counter and ROM space in the 8051, 8051 data types and directives, 8051 flag bits and the PSW register, 8051 register banks and stack</p>	03
3	<p><b>8051 Addressing Modes:</b></p> <p>Immediate and register addressing modes, Accessing memory using various addressing modes, Bit addresses for I/O and RAM, Extra 128-byte on-chip RAM in 8052.</p>	03
4	<p><b>LCD and Keyboard Interfacing:</b></p> <p>Classification, 16x2 LCD Pin Diagram, LCD commands, LCD interface and program, Matrix structure, Algorithm for scanning Matrix keyboard and Program.</p>	03
5	<p><b>ADC and DAC interfacing:</b></p> <p>Parallel and serial operation by ADC and DAC interfacing chips</p>	03
6	<p><b>RTC Interfacing and Programming:</b></p> <p>RTC interfacing, RTC programming in C, Alarm, SQW, and IRQ features of the various chip.</p>	03
7	<p><b>Relay and Motor Control:</b></p> <p>Relays and Opto isolators, Stepper motor interfacing, DC motor interfacing and PWM.</p>	02
<b>SECTION – II</b>		
8	<p><b>Data Transfer, Arithmetic and Logic Instructions and Programs:</b></p> <p>Arithmetic instructions, Signed number concepts and arithmetic operations, Logic and compare instructions, Rotate instruction and data serialization, BCD, ASCII, and other application programs.</p>	04
9	<p><b>Branch Instructions:</b></p> <p>Loop and jump instructions, Call instructions time delay for various 8051</p>	02

	chips.	
<b>10</b>	<p><b>8051 Hardware Configuration and I/O Port Programming:</b></p> <p>Pin description of the 8051, Reset circuitry, Crystal circuitry and internal structure of I/O Ports ; I/O programming, I/O bit manipulation programming, LED and Switch interfacing.</p>	<b>03</b>
<b>11</b>	<p><b>8051 Programming in C:</b></p> <p>Data types and time delay in 8051 C, I/O programming in 8051 C, Logic operations in 8051 C, Data conversion programs in 8051 C, Accessing code ROM space in 8051 C, Data serialization using 8051 C.</p>	<b>03</b>
<b>12</b>	<p><b>8051 Timer Programming in Assembly and C:</b></p> <p>Programming 8051 timers, Counter programming, Programming timers 0 and 1 in 8051 C.</p>	<b>04</b>
<b>13</b>	<p><b>8051 Serial Port Programming in Assembly and C:</b></p> <p>Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in Assembly, Programming the second serial port, Serial port programming in C.</p>	<b>04</b>
<b>14</b>	<p><b>Interrupts Programming in Assembly and C:</b></p> <p>8051 interrupts programming, Timer interrupts, Programming external hardware interrupts, Programming the serial communication interrupt, Interrupt priority in the 8051/52, Interrupt programming in C.</p>	<b>03</b>

### Instructional Method and Pedagogy

- Lectures will be conducted with the aid of multi-media projector, black board, Transparencies etc.
- Assignments and Exercise will be given to the students for each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- Minimum 24 experiments shall be there in the laboratory related to course contents.

### Reference Books

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay , “The 8051 Microcontroller and Embedded Systems Using Assembly and C”, Pearson Education , 2<sup>nd</sup> Edition, **ISBN: 8177589032**
2. By K. J. Ayala, D. V. Gadre , “The 8051 Microcontroller & Embedded Systems using Assembly and C”, Cengage Learning , India Edition, 3<sup>rd</sup> Edition, **ISBN: 978-8131502006**
3. Satish Shah, “8051 Microcontrollers: MCS51 family and its variants”, Oxford University Press.1<sup>st</sup> Edition **ISBN:978-0198063575**
- 4.
4. Subrata Ghoshal, “8051 Microcontroller: Internals, Instructions, Programming and Interfacing”, Pearson Education, 1<sup>st</sup> edition, **ISBN : 9788131731437**

### Additional Resources

- [www.mikroe.com](http://www.mikroe.com)
- <http://www.8051projects.net/>
- <http://www.8051projects.info/>
- <http://www.8051project.org/>

**List of Experiments**

Sr No	Name of Experiment
1	To <b>learn</b> the Architecture of 8051 Microcontroller.
2	To <b>describe</b> various addressing modes of 8051 microcontroller.
3	To <b>develop</b> an Assembly Language program to (A) Add/subtract two 8-bit numbers. (B) Add/subtract two 16-bit numbers (C) Add/subtract two 32 bit numbers
4	To <b>develop</b> an Assembly Language program to (A) Divide an 8 bit number by 8-bit number. (B) Multiply two 8-bit numbers (C) Multiply two 16-bit numbers
5	To <b>develop</b> an Assembly Language program to (A) Transfer accumulator data into register R0 and R1 of Bank-1 (B) Rotate bytes in register R0-R1-R2-R3 (C) Add 1 in every external RAM location addressed from 00H to 06H. (D) Move Bit-4 of RAM location 30H into Bit-7 of Accumulator.
6	To <b>develop</b> an Assembly and C Language program to (A) Add block of data stored in internal memory locations. (B) Transfer block of data in internal RAM. (C) Sort block of data in ascending or descending order.
7	To <b>develop</b> an Assembly and C-Language program to access external RAM and code memory.
8	To <b>develop</b> an Assembly and C-Language Program to (A) Put a random number in address location 20H and increment it until it equals the random no. available in R5. (B) Put random number into R2 and R5, increment R2 and decrement R5 until they are equal. (C) Count the number of ones in register B and put the count in R5. (D) Use R4 (LSB) and R5 (MSB) as a 16 bit counter and decrement the pair until equals 0000H.

**List of Experiments**

9	To <b>develop</b> an Assembly and C-Language program to convert packed BCD number stored in Accumulator to equivalent hexadecimal number and vice-versa.
10	To <b>develop</b> an Assembly and C-Language program to convert the hexadecimal number stored in Accumulator (00h-FFh) to its ASCII equivalent.
11	To <b>demonstrate</b> LED interfacing and <b>develop</b> an assembly and C-Language program for (A) Blinking LED at One second. (B) Ring counter (Shifting) pattern at One second.
12	To <b>demonstrate</b> Switch interfacing and <b>develop</b> an assembly and C-Language program for (A) Scan Monitoring P1.2 until it becomes high; when P1.2 becomes high toggle P0, Sent a high to low pulse to P2.3. (B) Check a status of P1.7 and P1.6 Switches and perform the following (1) If P1.7 pressed, Rotate Left (2) If P1.6 pressed, Rotate Right send letter "Y" to P2.
13	To <b>demonstrate</b> concept of multiplexed seven segment and <b>develop</b> C-program for 4-digit BCD counter.
14	To <b>develop</b> an assembly and C-Language program to (A) Generate 5 KHz pulse waveform of 50% duty cycle on pin 1.0 using timer 1 in mode 2. (B) Generate 1 KHz pulse wave form of 70% duty cycle on pin 1.0 using timer.
15	To <b>develop</b> an assembly and C-Language program to (A) Transfer letter "A" serially, continuously. (B) The message "YES" serially, continuously. (C) Receive data serially, and put them in P1 continuously.
16	To <b>demonstrate</b> concept of External Interrupt-0 and Timer-0 Interrupt and <b>develop</b> an assembly and C-program to (A) Generate Square wave of 5 KHz and 10 KHz using timer-0 interrupt. (B) Toggle Port-2 if INT0 triggers.
17	To <b>demonstrate</b> concept of LCD interfacing with the 8051 and <b>develop</b> an assembly and C-Language program to (A) Write "RK University" using 8-bit Mode (B) Write "EC Department" using 4-bit Mode (C) Write "RK University" and Blink the display at one Second.

**List of Experiments**

18	To <b>demonstrate</b> concept of matrix keyboard interfacing with 8051 and <b>develop</b> a C-program to scan the keyboard and display the key-pressed on LCD.
19	To <b>demonstrate</b> concept of ADC0808 interfacing and <b>develop</b> a C-program to scan potentiometer and display digital value on LCD.
20	To <b>develop</b> C-program for generating (A) Sine wave (B) Saw tooth wave (C) Triangular wave
21	To <b>demonstrate</b> interfacing of DC motor and <b>develop</b> C-language program for (A) Direction control (B) Speed Control using PWM
22	To <b>demonstrate</b> stepper motor interfacing and <b>develop</b> C-language program for (A) Half-step sequence mode (B) Full-step sequence mode (C) Forward and reverse direction control and speed control
23	To <b>develop</b> C-program to control servomotor.
24	To <b>Identify</b> the potential application and <b>develop</b> the project.