

# 19L511- MICROPROCESSORS AND MICROCONTROLLERS

## LABORATORY

### MATERIALS WITH NECESSARY LINK

SOFTWARE EXPERIMENTS		
Expt. No.	EXPERIMENTS	LINK WITH DESCRIPTION
0	<p style="text-align: center;"><b>( PRE-REQUISITE )</b></p> <p style="text-align: center;"><b>Fundamentals of MPMC Lab with Software Tool Introduction</b></p>	<p>1. <a href="https://youtu.be/qjSSXVYoPcs">https://youtu.be/qjSSXVYoPcs</a>  <b>KEIL IDE Downloading Steps</b> for Programming (Assembly &amp; C) is presented here, which helps us to download KEIL IDE in our system.</p> <p>2. <a href="https://youtu.be/7MZzbZiaxuk">https://youtu.be/7MZzbZiaxuk</a>  <b>Simulating our first assembly language program (blink.a)</b> in KEIL IDE. Step-by-Step demonstration for writing the assembly language program is explained clearly in this video presentation.</p> <p>3. <a href="https://youtu.be/Jq7LG8TgVSI">https://youtu.be/Jq7LG8TgVSI</a>  <b>Simulating our second assembly language program (add.a)</b> in KEIL IDE. Significance of <b>Carry Flag</b> is demonstrated clearly in the video presentation with Banking Examples.</p> <p>4. <a href="https://youtu.be/WgGXc2vn70M">https://youtu.be/WgGXc2vn70M</a>  <b>All Flags in 8051 Microcontroller</b>. Four Flags with 16 possible combinations of setting and clearing the same is simulated and demonstrated clearly with examples using KEIL IDE in this presentation here.</p>
	<p style="text-align: center;">Addition and Subtraction of Single and Multi byte data</p>	<p>1. <a href="https://youtu.be/iLK0hehT-ik">https://youtu.be/iLK0hehT-ik</a>  <b>Single Byte Addition with CARRY Flag</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>2. <a href="https://youtu.be/C88P-TXDywc">https://youtu.be/C88P-TXDywc</a>  <b>Multi byte Addition with CARRY Flag</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>3. <a href="https://youtu.be/1g0HQFWy6ck">https://youtu.be/1g0HQFWy6ck</a>  <b>Signed and Unsigned number representation in 8-bit,</b></p>

1		<p><b>16-bit and 32-bit</b>, etc., is discussed clearly with several examples in this presentation.</p> <p>4. <a href="https://youtu.be/HLZX6xwE7MI">https://youtu.be/HLZX6xwE7MI</a>  <b>Single Byte Subtraction without BORROW</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>5. <a href="https://youtu.be/xN0TBDZQpOk">https://youtu.be/xN0TBDZQpOk</a>  <b>Single Byte Subtraction with BORROW</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>6. <a href="https://youtu.be/K01nrjguy3k">https://youtu.be/K01nrjguy3k</a>  <b>Multi Byte Subtraction with BORROW</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p>
2	Multiplication and Division of Single and Multi byte data	<p>1. <a href="https://youtu.be/gPIPEf1n7bl">https://youtu.be/gPIPEf1n7bl</a>  <b>Single Byte Unsigned Multiplication</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>2. <a href="https://youtu.be/CjueW0Ev1Pg">https://youtu.be/CjueW0Ev1Pg</a>  <b>Single Byte Unsigned Multiplication</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>3. <a href="https://youtu.be/MYFYWHkuTpM">https://youtu.be/MYFYWHkuTpM</a>  <b>Multi Byte Unsigned Multiplication</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>4. <a href="https://youtu.be/2IY_yW498Ac">https://youtu.be/2IY_yW498Ac</a>  <b>Multi Byte Unsigned Multiplication</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>5. <a href="https://youtu.be/r3_Tulyf4Os">https://youtu.be/r3_Tulyf4Os</a>  <b>Single Byte Division</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p>

		<p>6. <a href="https://youtu.be/DBY1BR2e8bE">https://youtu.be/DBY1BR2e8bE</a>  <b>Single Byte Division</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation</p>
3	Searching the given number using Linear / Binary Search Algorithm	<p>1. <a href="https://youtu.be/-VLxxlysJJc">https://youtu.be/-VLxxlysJJc</a>  <b>SEARCHING FOR A NUMBER IN AN ARRAY</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>2. <a href="https://youtu.be/9CGaCVFXpqQ">https://youtu.be/9CGaCVFXpqQ</a>  <b>SEARCHING FOR A NUMBER IN AN ARRAY</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>3. <a href="https://youtu.be/o-laiNY0s5c">https://youtu.be/o-laiNY0s5c</a>  <b>SEARCHING FOR ALPHABETS IN AN ARRAY</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p>
4	Sorting the given numbers using Bubble/Insertion Algorithm	<p>1. <a href="https://youtu.be/dFdDN7YAwDk">https://youtu.be/dFdDN7YAwDk</a>  <b>SORTING THE NUMBERS IN AN ARRAY</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>2. <a href="https://youtu.be/QZ3SRLPdprk">https://youtu.be/QZ3SRLPdprk</a>  <b>SORTING THE ALPHABETS IN AN ARRAY</b> is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p>
5	Code Conversion Techniques	<p>1. <a href="https://youtu.be/KReMharybsQ">https://youtu.be/KReMharybsQ</a>  <b>CODE CONVERSION FUNDAMENTALS WITH BINARY TO BCD</b> code conversion is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p> <p>2. <a href="https://youtu.be/Dp-YO8gnzGo">https://youtu.be/Dp-YO8gnzGo</a>  <b>CODE CONVERSION FUNDAMENTALS WITH BINARY TO BCD AND BCD TO ASCII</b> code conversion is presented, coded, simulated and demonstrated clearly in KEIL IDE in this video presentation.</p>

HARDWARE EXPERIMENTS		
	Introduction to Hardware Modules for MPMC Lab	<p>1. <a href="https://youtu.be/TfzjlqZhSiU">https://youtu.be/TfzjlqZhSiU</a>  <b>Pin diagram analysis</b> with (VCC Pin, GND pin, Clock Oscillator Pins, Reset Pin with Power-on-Reset Circuit, Pull-up Resistors, Decoupling Capacitors, etc., is discussed clearly in this presentation video.</p>
6	Interfacing Display Unit (LEDs)	<p>1. <a href="https://youtu.be/6tlhs0b8--s">https://youtu.be/6tlhs0b8--s</a>  <b>Coding and Application C-Programming Steps from the Scratch</b></p> <p>Persistence of Vision, Need for Delay routine in an application for blinking of LEDs. Writing delay routine for making LEDs to blink!  Tool chain for software development, Host and Target Machine, Integrated Development Environment (IDE) (KEIL IDE), etc.,</p> <p><b>Hardware Interfacing and Demo with LED Interfacing circuit diagram; Programming techniques for Blinking of LEDs; Downloading the program from Host Machine and testing the same in the target machine is demonstrated in these two videos!</b></p>
	Interfacing Display Unit (7-Segment Display)	<p>1. <a href="https://youtu.be/qfDGAUIdmGo">https://youtu.be/qfDGAUIdmGo</a>  <b>Hardware Interfacing and Demo of 7-Segment Display</b> Interfacing is discussed in detail from the scratch to refresh Code Conversion requirements.</p> <p>2. <a href="https://youtu.be/LfsT7pvxDwQ">https://youtu.be/LfsT7pvxDwQ</a>  <b>Hardware Interfacing and Demo of Displaying FUEL in Multiplexed 7-segment Display.</b> Applications of 7-segment Code is well understood with this video presentation.</p> <p>3. <a href="https://youtu.be/19l0glyCsc4">https://youtu.be/19l0glyCsc4</a>  <b>Hardware Interfacing and Demo of Displaying PUSH, PULL, FUEL, ALL in Multiplexed 7-segment display.</b>  Circuit Diagram of multiplexed 7-segment display is discussed clearly here.</p>

	Interfacing Display Unit <b>(16x2 LCD INTERFACE )</b>	<p>1. <a href="https://youtu.be/-GF4OMvWh-M">https://youtu.be/-GF4OMvWh-M</a>  <b>Hardware Demo of 16x2 LCD Display Interfacing</b> is discussed in detail from the scratch. Binary to BCD Code Conversion, BCD to ASCII Code Conversion Techniques clearly explained. C-Program for Displaying the Alphanumerical values is discussed and demonstrated clearly here.</p>
7	Interfacing Keyboard Unit  <b>(Interfacing a Single Key with Microcontroller)</b>	<p>1. <a href="https://youtu.be/A-RQRdEty30">https://youtu.be/A-RQRdEty30</a>  <b>How a microcontroller identifies the key</b> press followed by coding for keyboard de-bouncing techniques, etc. discussed and demonstrated here.</p> <p><b>Hardware Demo</b> of Key press identification is demonstrated here.</p>
	Interfacing Keyboard Unit  <b>(Interfacing 4x4 Matrix Key-board with Microcontroller)</b>	<p>1. <a href="https://youtu.be/0oGD46xBBPA">https://youtu.be/0oGD46xBBPA</a>  <b>Hardware Demo of 4x4 Matrix Keyboard Interface with LEDs</b>  Circuit Diagram for interfacing 4x4 Matrix Keyboard with 8051 Microcontroller. Concept of Identifying the Key Press in Matrix Format C-Program for identifying the Key press in 4x4 Key Matrix. Simulation of the same in KEIL IDE. Testing the Key Press Identification in Hardware Development Kit. Displaying the Key Press Value in 8-LEDs</p> <p>2. <a href="https://youtu.be/4AgNGzWggOU">https://youtu.be/4AgNGzWggOU</a>  <b>Hardware Demo of 4x4 Matrix Keyboard interface with Multiplexed 7-segment Display</b>  Displaying the key press value in multiplexed 7-segment display is demonstrated here</p>
8	Timer/Counter Interfacing Techniques	<p>1. <a href="https://youtu.be/2zDOHt0y9F4">https://youtu.be/2zDOHt0y9F4</a>  <b>Hardware Demo</b> of T0 in <b>16-bit timer mode</b> to produce delay to blink LEDs with C-Code. 6.</p> <p>2. <a href="https://youtu.be/ahE9zpZurhk">https://youtu.be/ahE9zpZurhk</a>  <b>Hardware Demo</b> of T0 in <b>16-bit timer mode</b> to produce <b>1-second delay</b> to blink LEDs with C-Code.</p>

		<p>3. <a href="https://youtu.be/DctQdR6139g">https://youtu.be/DctQdR6139g</a>  <b>Hardware Demo</b> of T0 in 8-bit auto-reload mode to produce <b>1-second delay</b> to blink LEDs with C-Code.</p> <p>4. <a href="https://youtu.be/T4lZ5WvH2Go">https://youtu.be/T4lZ5WvH2Go</a>  <b>Hardware Demo</b> of T0 in 8-bit auto-reload <b>COUNTER</b> with C-Code.</p> <p>5. <a href="https://youtu.be/sR8uuyCegCs">https://youtu.be/sR8uuyCegCs</a>  <b>Hardware Demo</b> of T0 in 8-bit auto-reload <b>COUNTER</b> displayed in <b>7-segment</b> display after necessary code conversion, explained with C-Code.</p> <p>6. <a href="https://youtu.be/gUi3W5neWRo">https://youtu.be/gUi3W5neWRo</a>  <b>Hardware Demo</b> of <b>ENTRY/EXIT</b> sensing application using two timers (T0 &amp; T1) as <b>COUNTERS</b>.</p> <p><b>Note:</b> All applications including Speedometer, Odometer, Currency Counter, etc., use this counter mechanism.</p>
9	<p>Hardware and Software Interrupts</p> <p><b>( HARDWARE INTERRUPTS )</b></p>	<p>1. <a href="https://youtu.be/uq0VwEgKchw">https://youtu.be/uq0VwEgKchw</a>  <b>Hardware Demo</b> of External Interrupt 0 in <b>Level Triggered Mode</b> in 8051 Development kit with C-code is explained clearly in this video presentation.</p> <p>2. <a href="https://youtu.be/Gxs9LiCLlpo">https://youtu.be/Gxs9LiCLlpo</a>  <b>Hardware Demo</b> of <b>both External Interrupt 0 (EX0) &amp; (EX1) in Level Triggered Mode</b> in 8051 Development kit with C-code.</p> <p><b>Pre-emption</b> concepts with two interrupts and one main routine is demonstrated highlighting priorities of interrupts in this video presentation.</p> <p>3. <a href="https://youtu.be/LnLvIY0J0aE">https://youtu.be/LnLvIY0J0aE</a>  <b>Hardware Demo</b> of <b>External Interrupt 0 (EX0) in Edge Triggered Mode</b> in 8051 Development kit with C-code is explained clearly in this video presentation.</p> <p>4. <a href="https://youtu.be/CrM3JfAmbf0">https://youtu.be/CrM3JfAmbf0</a>  <b>Hardware Demo</b> of <b>both External Interrupt 0 (EX0) &amp; (EX1) in Edge- Triggered-Mode</b> in 8051 Development kit with C-code.</p>

	<p>Hardware and Software Interrupts</p> <p>( SOFTWARE INTERRUPTS )</p>	<ol style="list-style-type: none"> <li>1. <a href="https://youtu.be/zVNaC5adKog">https://youtu.be/zVNaC5adKog</a>  <b>Hardware Demo</b> Timer-0 periodic interrupt with a period of 8ms is used to refresh the multiplexed 7-segment display. Demonstrated with concepts, coding, programming, simulating and verifying the same in the hardware development kit.</li> <li>2. <a href="https://youtu.be/eIXWSFiw1vU">https://youtu.be/eIXWSFiw1vU</a>  <b>Hardware Demo</b> of two Hardware interrupts in Edge Triggered Mode for entry and exit and One Software (Timer Periodic Interrupt) for display refreshing of multiplexed 7-segment display is demonstrated in the hardware for Display System for Entry Exit application.</li> </ol>
10	<p>UART Programming Technique</p>	<ol style="list-style-type: none"> <li>1. <a href="https://youtu.be/0dYKL67ejeA">https://youtu.be/0dYKL67ejeA</a>  <b>Hardware Demo</b> of Serial communication within the chip (<b>LOOP BACK</b>): Coding and Demonstration of on-chip UART data loop-back using 8051 Hardware Development Kit is demonstrated in this video presentation. This is one way to justify UART is Full Duplex.</li> <li>2. <a href="https://youtu.be/59KH86ATReI">https://youtu.be/59KH86ATReI</a>  <b>Hardware Demo</b> of UART is off-board serial communication protocol (Communication between two boards) is discussed here. COM Port is used to interconnect two boards which communicate using RS232 cable. MAX232 is a Voltage-Level-Converter, which is used to communicate through COM port, which is demonstrated here in this video presentation.</li> </ol>