**Assignment No.: 7**

**AIM:** Write a program to multiply 16 bit number by 8 bit number and store the result in internal

memory location.

**OBJECTIVE:**

i) To learn internal memory access

ii) To perform 16 bit by 8 bit multiplication using 8 bit registers.

S/W & H/W USED: 1. Keil uVision IDE

2. SST Flash Flex Programming tool

3. 8051 Development board.

**THEORY:**

16 bit x 8 bit Multiplication:

Normal multiplication

Consider 25 x 16

Step1: First multiply by the least significant digit 25 x 6= 150

Here take 15 as a carry since it exceeds the number of digits in “6” i. e. 1

Keep 0 as the least significant digit of the answer.

Step 2: Now multiply 25 by the most significant digit 25 x 1= 25

Step 3: Now add the carry to this number 25+15=40

Therefore the answer becomes 400.

Now consider it in hex. Consider FFFF x FF

Step 1: FF x FF=FE01

Keep FE as carry and 01 as the lower byte of answer.

Step 2: FF x FF= FE01

Step 3: Add carry FE01 + FE= FEFF It is addition of a 16 bit number and an 8 bit number. Therefore addition will take two steps if carry gets generated by addition of lower byte.

**ALGORITHM:**

1. Initialize pointer to internal memory and copy the memory location content (input)of corresponding location to corresponding internal registers
2. Load the lower byte of the 16 bit number into accumulator A and 8 bit number into register B
3. Multiply them using instruction MUL AB
4. Store lower byte of product in one of general purpose register which is lower byte of the 24 bit final result.
5. Store the higher byte of product in one of general purpose register
6. Get higher byte of 16 bit number into accumulator and 8 bit number into register B
7. Multiply them using instruction MUL AB.
8. Higher byte of result of second multiplication will give second byte of the final 24 bit result.
9. Add lower byte of the product with higher byte of previous multiplication.
10. Store the result into general purpose registers.
11. Add carry with the higher byte of the result generated after second multiplication. Addition gives most significant byte of the 24 bit result.
12. Display 3 bytes of the result one after other in memory location or on onboard LEDs.

**CALCULATIONS:**

16 bit number= BBEEH

8 bit number= FFH

Multiplication of BBEE x FF

Step 1: EE x FF= ED12H

Keep ED as carry and 12 as the lower byte of the answer.

Step 2: BB x FF=BA45H

Step 3: Add the carry BA45 + ED= BB32

Therefore the answer is BB3212

**INPUT:** 16 bit and 8 bit number stored in internal memory locations.

**OUTPUT:** Result of 16 bit x 8 bit multiplication displayed on onboard LEDs

**CONCLUSION:**