V. Imp Topic

Flag bits and Program status word Register of 8051 (PSW):

PSW register is 8-bit register, also called flag register. These flags indicate status of the current result. They are changed by the ALU after every arithmetic and logic operations. These flags can also be changed by programmer. PSW is a bit-addressable register. Each bit can be individually changed by the programmer. The 8-bits of PSW register are as follows:

PSW.7	PSW.6	PSW.5	PSW.4	PSW.3	PSW.2	PSW.1	PSW.0
CY	AC	F0	RS1	RS0	OVR	—	P

1) **CY — CARRY FLAG : (PSW.7)**

It indicates the carry out of the MSB (most significant bit) after any arithmetic operation.

If there is a carry out of MSB, then carry flag = 1

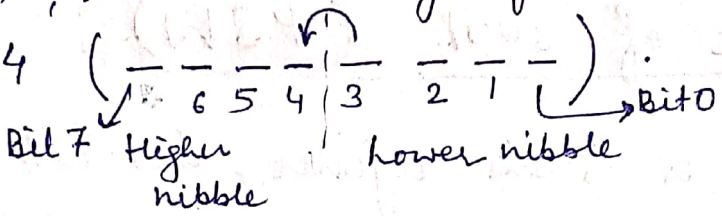
" " " no " " " " = 0

2) **AC — AUXILIARY CARRY FLAG : (PSW.6)**

It indicates the carry from lower

(5)

nibble to higher nibble. In other words, it is carry from bit 3 to bit 4 (_ _ _ _ | _ _ _ _).



If there is a carry from lower Nibble to higher nibble, AC = 1, otherwise AC flag = 0.

eg: Adding:

```
  1 1 1 1 1 1 1 1
+ 0 0 0 0 1 0 0 1
-----------------
  0 0 0 0 | 0 0 0 0
```

Carry: 1 (out of operation) ∴ CY = 1, Also there is a carry from lower nibble to higher nibble ∴ Aux carry flag AC = 1.

(H.N = higher nibble, LN = lower nibble)

3) PARITY FLAG (P) : PSW.0

It is for checking the parity of the result. It is determined by the number of 1's in the result.

If number of 1's are odd, Parity flag = 1 ∴ ODD Parity & If number of 1's in the

result is even, then Parity flag = 0,
The result has even parity.

4) PSW.1 ⇒ It is a user definable flag.
It can be zero or one.

5) PSW.5 (F0) ⇒ It is also user definable flag. Processor neither read this flag, nor it changes this flag. Using the simple commands, it can be made 0 or 1.
for eg:

```
SET B   PSW.5   ⇒ Makes PSW.5 = 1
CLR     PSW.5   ⇒ Makes PSW.5 = 0
```

6) OVERFLOW FLAG (OVR): PSW.2

It indicates if there was an overflow during a signed operation. An 8-bit signed number has the range -80H .... 00H ---- +7FH. Any result, out of this range causes an overflow.

If OVR = 1: There was an overflow in the result.
If OVR = 0: There was no overflow in the result.

Overflow is determined by doing an

(7) Ex-or between the 2nd last carry (C_6) and the last carry (C_7). After an overflow, the sign (MSB) of the result becomes wrong.

Note: To understand this flag, we must know that what are signed & unsigned Number, only then we can understand overflow event.

→ So let's learn, what are signed and unsigned numbers first.