Name - Shubham Nemade.

class - SE9

Roll no - 23151 (G9)

Write a note on Timer 0, 1, 2 and 3.

Ans. 1) Timer 0

i) Timer control registers

— TCON is timer 0 control register.

— T0CON is an 8 bit register with following bits:

1) TMR0ON

2) T0 8 BIT

3) T0CS

4) T0SE

5) PSA

6) T0PS2

7) T0PS1 } Prescalar select bits

8) T0PS0

ii) Timer registers

— Timer 0 uses a 16 bit register represented by TMR0H (Timer 0 higher byte) as higher byte register & TMR0L (Timer 0 lower byte) as lower byte register.
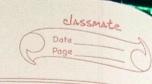
iii) Timer interrupt flag

— The interrupt flag bit for Timer 0 is TMR0IF which is a part of INTCON (interrupt control) register.

iv) Delay calculations.

a) Crystal frequency = X

b) Timer frequency = t = $\frac{X}{4}$, t/prescalar in case prescale ON

c) Timer period $= T = \frac{1}{t}$

d) Count $= FFFFH - (TMROH - TMROL) + 1 = C$

e) Time delay $= D = C \times T$

f) Time delay of half cycle $= 2 \times D$

2) Timer 1

i) Timer control registers.

- TICON is Timer1 control register
- TICON is an 8 bit register with following bits

1) RD16

2) NOT used

3) T16KPS1 ⎤
4) T1CKPS0 ⎦ Prescalar select bits.

5) T1OSCEN

6) T1SYNC

7) TMR1CS

8) TMR1ON

ii) Timer registers.

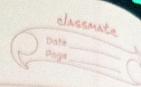- Timer1 uses a 16 bit register which is split into two bytes, referred as TMR1L (Timer1 lok byte) and TMR1H (Timer1 high byte)
- Timer1 can be programmed in16bit mode only.

iii) Timer interrupt flag.

- The interrupt flag bit for Timer1 is TMR1IF which is a part of R1R1 register.

iv) Delay calculations
a) Crystal frequency $= x$
b) Timer frequency $= t = \dfrac{x}{4}$

  $= t/\text{prescalar value}$, when prescale value > 1
c) Timer period $= T = \dfrac{1}{t}$
d) Count $= C = FFFFH - (TMRJH \cdot TMRIL) + 1$
e) Time delay $= D = TI \times C$
f) Time delay of half cycle $= 2 \times D$

3) Timer 2
i) Timer control register
 — T2CON is Timer 2 control register.
 — T2CON is 8 bit register
 — T2 CON contains following 8 bits.

i) Not used
ii) TOUTPS3 } Postscale select bits.
iii) TOUTPS2
iv) TOUTPS1
v) TOUTPS0
vi) TMR2ON
vii) T2CKPS1 } Prescale select bits.
viii) T2CKPS0

ii) Timer registers
 — The 8 bit register of Timer 2 is called TMR2.
 — Timer 2 also has an 8 bit register called period register (PR2)
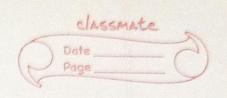 — The value of PR2 can be set to a fixed value & Timer 2 then increments till the same value in PR2

iii) Timer interrupt flag.
The interrupt flag bit of Timer2 is TMR2IF which is part of PIR1

iv) Delay calculations.
a) Crystal frequency $= x$
b) Timer frequency $= \frac{x}{4} = 1$
c) Timer period = postscale value $\times$ prescale value $\times \frac{1}{f} = T$

d) Count $= C = $ TMR2H $=$ PR$_2$
e) Time delay $= C \times T = D$
f) Time delay of half cycle $= 2 \times D$

4) Timer 3
i) Time control register
— T3CON is timer3 control register
— T3CON is 8 bit register with following bits.
i) RD16
ii) T3 CCP2 ⎱ — clock source for compare/ capture.
iii) T3 CCP1 ⎰   of CCP module
iv) T3 CKPS1 ⎱
v) T3 CKPS0 ⎰ → Prescale value
vi) T3 SYNC
vii) TMR3CS
viii) TMR3ON

ii) Timer registers.
Timer3 is 16 bit register split as TMR3L (Timer3 low byte) and TMR3H (Timer3 high byte)

iii) Timer interrupt flag
- The interrupt flag bit of Timer3 is called TMR3IF which is part of PIR2 register.

iv) Delay calculations.
a) Crystal frequency = X
b) Timer frequency = $f = X/4$
c) Timer period = $\frac{1}{f} \times$ prescale value = T.
d) Count = C = FFFFH - (TMR3H · TMR3L) + 1
e) Timer delay = C × T = D
f) Timer delay for half cycle = 2 × D