MICROCONTROLLER

UNIT–III

Lecture–I

TIMER PROGRAMMING

- The 8051 has two timers/counters, they can be used either as Timers to generate a time delay or as Event counters to count events happening outside the microcontroller
- Both Timer 0 and Timer 1 are 16 bits wide
- Since 8051 has an 8-bit architecture, each 16-bits timer is accessed as two separate registers of low byte and high byte.

Programming 8051 Timers

- The 8051 has two timers: Timer 0 and Timer 1.
- They can be used either as timers or as event counters.
- In this section we first discuss the timers' registers and then show how to program the timers to generate time delays.

Basic registers of the timer

- Both Timer 0 and Timer 1 are 16 bits wide.
- Since the 8051 has an 8 bit architecture, each 16 bit timer is accessed as two separate registers of low byte and high byte.
- Timer 0 registers:

  The 16 bit register of Timer 0 is accessed as low byte and high byte.

…contd.

- Timer 1:

  Timer 1 is also 16 bits and its 16 bit register is split into two bytes, referred to as TL1 (Timer 1 low byte) and TH1 (Timer 1 high byte).

  TMOD (timer mode) register:

  Both timers 0 and 1 use the same register, called TMOD, to set the various timer operation modes.

Contd.

- TMOD is an 8-bit register in which the lower 4 bits are set aside for Timer 0 and the upper 4 bits for timer 1.

M1, M0

- M0 and M1 select the timer mode.

M1	M0	Mode	Operating Mode
0	0	0	**13-bit timer mode** 8-bit timer/counter THx with TLx as 5-bit prescaler
0	1	1	**16-bit timer mode** 16-bit timer/counter THx and TLx are cascaded; there is no prescaler
1	0	2	**8-bit auto reload** 8-bit auto reload timer/counter; THx holds a value which is to be reloaded TLx each time it overfolws
1	1	3	**Split timer mode**

C/T (Clock/Timer)

- This bit in the TMOD register is used to decide whether the timer is used as a delay generator or an event counter.
- If C/T = 0, it is used as a timer for time delay generation.
- The clock source for the time delay is the crystal frequency of the 8051.

Clock source for timer

- Every timer needs a clock pulse to tick.
- If C/T=0, the crystal frequency attached to the 8051 is the source of the clock for the timer.
- The frequency for the timer is always 1/12th the frequency of the crystal attached to the 8051.
- Although various 8051-based systems have an XTAL frequency of 10 MHz to 40 MHz.

GATE

- The other bit of the TMOD register is the GATE bit. Every timer has a means of starting and stopping.
- Some timers do this by software, some by hardware, and some have both software and hardware controls.
- Instructions start and stop the timers as long as GATE=0 in the TMOD register.