Every week

- 2 hours (lecture)
- 2 hours (laboratory)
- 1 hour (tutorial)

100 degrees

- 60 Final exam
- 20 Practical
- 10 Midterm
- 10 Term work
The Basic Architecture of the Computer Systems

- Input Units
- Output Units
- Memory Unit
- CPU

Address Buses
Data Buses
Control Buses
The difference between Von Neumann and Harvard CPU architectures

- **Von Neumann CPU**
  - It has single path for its memories
  - Likes microprocessor 8086

- **Harvard CPU**
  - It has dual paths for its memories
  - Likes the most microcontrollers such as 8051
it's a CPU in a single integrated microchip.

It has 3 major units:

• Arithmetic Logic Unit (ALU)
• Group of registers
• Control Unit (CU).
it's a CPU in a single integrated microchip

In addition the following:

• Data memory
• Program memory
• Data ports
• Timers
• ADC & DAC (recently)
• PWM (recently)
Examples of the real Microcontrollers families

- PIC
- MCS-51
- ATmega
- ARM
- AVR
The AT89C51 is member of the MCS-51 Microcontroller family.

It invented by Intel corporation.

Recently, it fabricated by Atmel and more than 20 corporations.
The Pin configuration Of AT89C51
The alternate functions of Port3

<table>
<thead>
<tr>
<th>Port 3 pins</th>
<th>Alternate-functions</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3.0</td>
<td>RXD</td>
<td>serial input pin</td>
</tr>
<tr>
<td>P3.1</td>
<td>TXD</td>
<td>serial output pin</td>
</tr>
<tr>
<td>P3.2</td>
<td>INT0</td>
<td>external interrupt 0 pin</td>
</tr>
<tr>
<td>P3.3</td>
<td>INT1</td>
<td>external interrupt 1 pin</td>
</tr>
<tr>
<td>P3.4</td>
<td>T0</td>
<td>timer 0 external input pin</td>
</tr>
<tr>
<td>P3.5</td>
<td>T1</td>
<td>timer 1 external input pin</td>
</tr>
<tr>
<td>P3.6</td>
<td>WR</td>
<td>external data memory write enable pin</td>
</tr>
<tr>
<td>P3.7</td>
<td>RD</td>
<td>external data memory read enable pin</td>
</tr>
</tbody>
</table>
External access pin to select either the internal or external program memory.

Address latch enable pin to separate the address bus from the address/data bus.

Program strobe enable pin to connect with the chip select (CS) pin of external ROM.
If the \( EA = 0 \) then the AT89c51 will fetch their instructions from the external program memory only.

If the \( EA = 1 \) then the AT89c51 will fetch their instructions from the internal program memory and follows by external one.
The internal architecture of AT89C51

Diagram showing the components and connections of the AT89C51 microprocessor, including external interrupts, Interrupt Control, CPU, Internal Oscillator, ON-CMIP Flash Memory, 4Kbytes, ON-CMIP RAM, 256 Bytes, Timer Control, I/O parallel Ports, Serial Port, and Internal Buses.
The Basic Circuit for the AT89C51

Reset Circuit
Types of resetting

1- **Automatic restarting**
After Powering-on the 8051, positive pulse (with time duration > 2 machine cycles) will apply to pin “pin 9”.

2- **Manual restarting**
After pressing the push-button, positive pulse will apply to reset-pin “pin 9”.

Differential circuit
After resetting the AT89c51

The initial states of the AT89c51 after resetting it.

- All locations of internal RAM will load by “00h” except:
  1) All ports (P0, P1, P2, P3) will load by “FFh”.
  2) Stack pointer (SP) will load by “07h”.
- The 16-bit program counter (PC) will load by “0000h”.

**Important note**

In case of powering-on any microcontroller without resetting it, the PC will load by random address, therefore the CPU will start fetching any random instruction from the program memory.