Unit → 7

1.) Memory Organization...

The 8051 has two types of memory and There we program memory and data memory program memory (ROM) is used to permanently save the program being executed, while data memory (RAM) is used for temporarily storing data intermediate results created and used.

General Purpose RAM...

General purpose RAM is a memory area used for general data storage and manipulation by the microcontroller during program execution.

Example:- In the 8051 microcontroller, internal RAM from 30H to 7FH is general purpose RAM (80 bytes.

Bit Addresable RAM...

Bit addresable RAM is a special part of RAM where each individual bit can be directly accessed and manipulated.

Use case Example:- To set bit 04H (bit 4 in addres 20H), you can directly write.

Unit-4 (2nd topic)

Pin details of 8051 •••

Pin 32-39 - Port 0 :-

→ Similarly to P_2, if External memory is not used, these pins can be used and general input/outputs. Otherwise, P_0 is configured as address output (A_0-A_7) when the ACE pin eleven high (1) or as data output (data bus) when the ALE pin is driven low (0).

Pin 40 :- Vcc + 5v power supply.

Input/output ports (I/O ports) :-

→ All 8051 microcontroller have 4 I/O ports each compositing 8-bits which can be configures as inputs

as outputs.
Accordingly, in total of 32 input/output pin enabling the microcontroller to be connected to peripheral devices are available for use.
Chip address immediately after that, the ALU pin is returned its previous logic state & P_0 is how used as a data bus.

Pin 31 : EA :-

→ By applying logic zero to this pins P_2 & P_3 are used for data & address transmision with no regard to whether there is internal memory or not. It means that even there is a program written to the microcontroller, it will not be executed. Instead, the program written to external ROM will be executed. By applying logic one to the EA pins, the microcontroller will use both memories, first internal then external (if exists).

Pin 21-28 : port 2

→ If there is no intention to use external memory then these port pins are configured as general inputs/outputs In case external memory is used the higher address byte, i.e addreses $A_8 - A_{15}$ will apear on this port.
Even though memory with capacity of 64 kb is not used, which means that not all eight bits ports bits are used for its addresing, the reset of them are not available as input/outputs

Pin 29 = PSEN

→ If external ROM is used for storing program then a logic zero (0) appears on it every time the micro-controller reads a byte from memory.

Pin 30 = ALE

→ Prior to reading from external memory the microcontroller puts the lower address byte ($A_0 - A_7$) on P_0 & activates the ALE output. After

receiving signal from the ALE Pins, the external register (memorizes the state of P_0 & uses it as memory).

Pin 11 : TXD

→ Serial asynchronous communication output or serial synchronous communication clock output.

Pin 12 : INT0 (Interrupt 0 inputs).

Pin 13 : INT1 (Interrupt 1 inputs).

Pin 14 : T0 counter 0 clock input

Pin 15 : T_1 center counter 1 clock input.

Pin 16 : WR write to External (additional) RAM.

Pin 17 : Read from External RAM.

Pin 18, 19 :- x_2, x_1.

→ Internal oscillator input & output. A quartz crystal which specifies operating frequency is usually connected to the pins. Instead of it, miniature ceramic resonators can also used for frequency stability. Later version of microcontroller operates at a frequency of 0Hz upto 50Hz.

Pin 20 : GND Ground :-

Pin out description.

Pin 1-8 : Port 1 :

Each of these pins can be configured as an input or an output.

Pin 9 : Rs :-

A logic on this pin disables the microcontrollers & clears the contents of mast register. In other words, the positive voltage on this pin resets the microcontrollers By applying logic zero to this pin, the program starts execution from the begining.

Pin 10-17 : Port 3 :-

Similar to port 1, each of these pins can serve as general input or output. Besides, all of them have alternative functions.

Pin 10 :- RXD :-

Serial asynchronous communication i/p or serial synchronous communication o/p.

3.) Interfacing external data and code memory...

Microcontrollers like the 8051 have limited internal memory. To handle larger programs or data, external memory (RAM or ROM) can be connected.

★ External data Memory (RAM)...

- Purpose :- Stores variables, buffers, or data that the program needs to read/write during execution.

- Memory Type :-
  RAM (Static or Dynamic RAM)
- Address Range :-
  0000H to FFFFH (64 kB max)

How its Interfaced :-

- $\overline{RD}$ (Read) and $\overline{WR}$ (write) : Active low signals used for reading / writting.
- Uses MOVX instruction in assembly to access external data memory.

Signals used in Interfacing...

- EA (External Access)
- $\overline{PSEN}$ (Program store Enable)
- $\overline{RD}$ (Read control)
- $\overline{WR}$ (Write control)
- ALE (Address Latch Enable)

★ External Code Memory (ROM/EPROM)...

- Purpose :- Used to store program instructions (code), especially when the internal program memory (4kB in 8051) is not sufficient
- Memory Type :-
  Read Only Memory (ROM, EPROM, Flash)
- Address Range :-
  0000H to FFFFH (64 kb max)

How its Interfaced :-

- PSEN (Program store enable) :- Active low signals used to read from external program memory.
- EA (External Access) pins :-
  EA = 0 → Program completely from External ROM.

$\overline{EA} = 1 \rightarrow$ Internal ROM is used up to 4KB, External ROM used beyond.

Example Connection :

- ROM chip connected to Address Bus, Data Bus.
- Control Signals : $\overline{PSEN}$ (for read), ALE for (latch).