

Ques-1. Explain the addressing modes of 8051 with examples.

Ans → In 8051, there are six types of addressing modes.

- (1) Immediate addressing mode.
- (2) Register addressing mode.
- (3) Direct addressing mode.
- (4) Register Indirect addressing mode.
- (5) Indexed Addressing mode.
- (6) Implied Addressing mode.

(1) Immediate addressing mode → In Immediate addressing mode data is provided immediately after the opcode.

examples → `MOVA, #0AFH;`
`MOVR3, #45H;`
`MOVDPTR, #FE00H;`

In these instructions, the # symbol is used for immediate data.

(2) Register addressing mode → In the register addressing mode the source or destination data should be present in a register (R0 to R7).

examples → `MOVA, R5;`
`MOVR2, #45H;`
`MOVRO, A;`

(3) Direct Addressing mode → In the direct addressing mode, the source or destination address is specified by using 8-bit data in the instruction.

examples `MOV 80H, R6;`
`MOVR2, 45H;`
`MOVRO, 05H;`

- (4) Register indirect addressing mode → In this mode, the source or destination address is given in the register. The R0 and R1 are used for 8-bit addresses, and DPTR is used for 16-bit addresses, no other registers can be used for addressing purposes.

examples → `MOV 05H, @R0;` | `MOV @DPTR, A;`
`MOV @R1, 80H.`

In the instruction, the @ symbol is used for register indirect addressing.

- (5) Indexed addressing mode → In the indexed addressing mode, the source memory can only be accessed from program memory only.

examples → `MOV CA, @A+PC`
`MOV CA, @A+DPTR`

- (6) Implied addressing mode → In the implied addressing mode, there will be a single operand. These types of instruction can work on specific registers only.

examples → `RLA;`
`SWAP A;`

Ques → What is the 8051 operating clock crystal frequency in MHz?

Ans → 12 MHz.

Ques → What is the size of RAM and ROM in 8051?

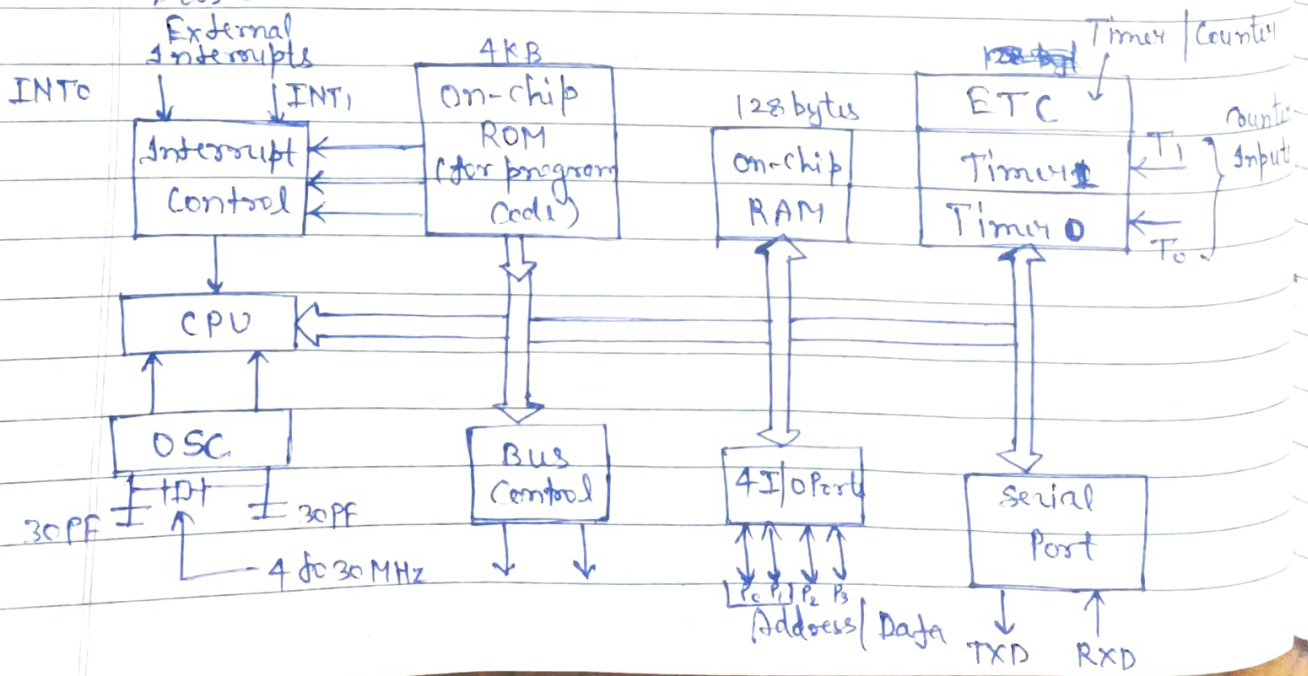
Ans → 8051 micro controller is designed by Intel in 1981. It is an 8-bit micro controller. It is built with 40 pins DIP (Dual inline package), 4KB of ROM storage and 128 bytes of RAM storage, 2 16-bit timers.

Ques- List the features and draw the block diagram of 8051 microcontroller?

Ans →

8051 micro controller is designed by Intel in 1981. It is an 8-bit micro controller. It is built with 40 pins DIP (Dual in line package), 4KB of ROM storage and 128 bytes of RAM storage, 2 16-bit timers. It consists of four parallel 8-bit ports, which are programmable as well as addressable as per the requirement. An on-chip crystal oscillator is integrated in the micro controller having crystal frequency of 12MHz.

Let us now discuss the architecture of 8051 microcontroller. In the following diagram, the system bus connects all the supporting devices to the CPU. The system bus consists of an 8-bit data bus, a 16-bit address bus and bus control signals. All other devices like program memory, ports, data memory, serial interface, interrupt control, timers, and the CPU are all interfaced together through the system bus.



Ques → Difference

Micro Controller's Internal Blocks →

- ① CPU (ALU, Registers, Oscillator/Clock, Bus Control)
- ② RAM (Data memory)
- ③ ROM / Program memory
- ④ I/O ports
- ⑤ Timer / Counters
- ⑥ Serial ports
- ⑦ Interrupts

Ques → Discuss the various SFRs of 8051.

Ans → The Internal RAM or Data memory of the 8051 micro Controller is divided into four types → General purpose registers, Bit addressable Registers, Register banks and Special function registers or SFRs.

⇒ The 8051 micro Controller special function registers are used to program and control different hardware peripherals like Timers, Serial port, I/O ports etc.

Out of these 128 memory locations (80H to FFH), there are only 21 locations that are actually assigned to SFRs. Each SFR has one byte address and also a unique name which specifies its purpose.

List of 8051 micro Controller special function registers →

⇒ A, B, DPL, DPH, IE, IP, P0, P1, P2, P3, PCON, PSW, SCON, SBUF, SP, TMOD, TCON, TLO, TH0, TL1, TH1.

	<u>Name of the Register</u>	<u>Function</u>
1.	A or ACC	Accumulator
2.	B	B Register (for Arithmetic)
3.	DPH	Addressing external memory.
4.	DPL	Addressing external memory.
5.	IE	Interrupt Enable Control.
6.	IP	Interrupt priority.
7.	PO	Port 0 latch
8.	PI	Port 1 latch
9.	P2	Port 2 latch.
10.	P3	Port 3 latch.
11.	PCON	Power Control
12.	PSW	Program Status Word.
13.	SCON	Serial Port Control.
14.	SBUF	Serial port data buffer.
15.	SP	Stack pointer.
16.	TMOD	Timer/Counter Mode Control.
17.	TCON	Timer/Counter Control.
18.	TLO	Timer 0 Low byte.
19.	TH0	Timer 0 high byte
20.	TL1	Timer 1 low byte
21.	TH1	Timer 1 high byte.

extra → Ans classify the different group of SFR's of 8051 microcontroller.

Ans The 21 special function registers are categorized into ~~six~~ ^{six} groups. They are →

- (1) Math or CPU Registers : A, B
- (2) Status Register : PSW (Program Status Word)
- (3) Pointer Registers : DPTR (Data pointer - DPL, DPH) and SP (Stack Pointer)
- (4) I/O port latches → P₀, P₁, P₂, P₃.
 (Port 0) (Port 1) (Port 2) (Port 3)

(5) Peripheral Control Registers; PCON, SCON, TCON, TMOD, IE and IP.

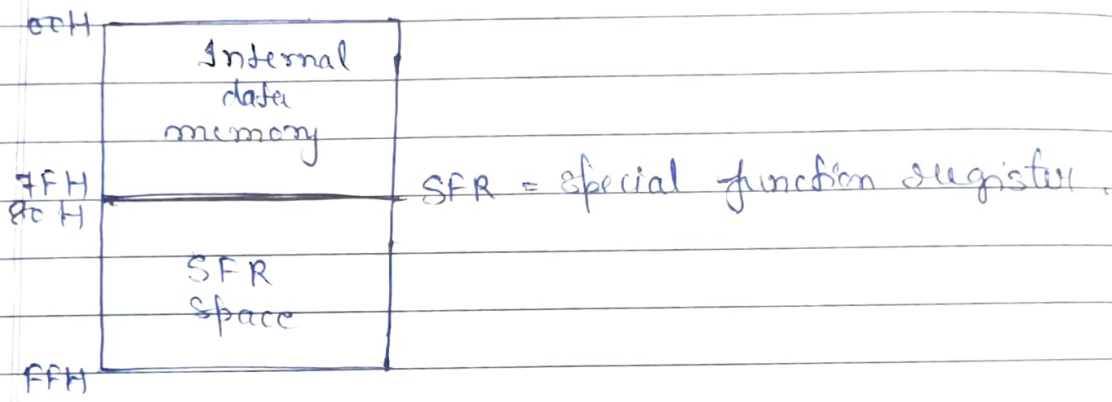
(6) Peripheral Data Registers; TLO, TH0, TL1, TH1 and SBUF.

Ans → Write an 8051 program to add the contents of R5 of bank 3 to R3 of bank 1. Save the result at memory location 5F4Ch.

Ans → Write a program to copy the value of R0 of bank 0 to R0 of Bank 1, R1 of Bank 2 and R2 of Bank 3.

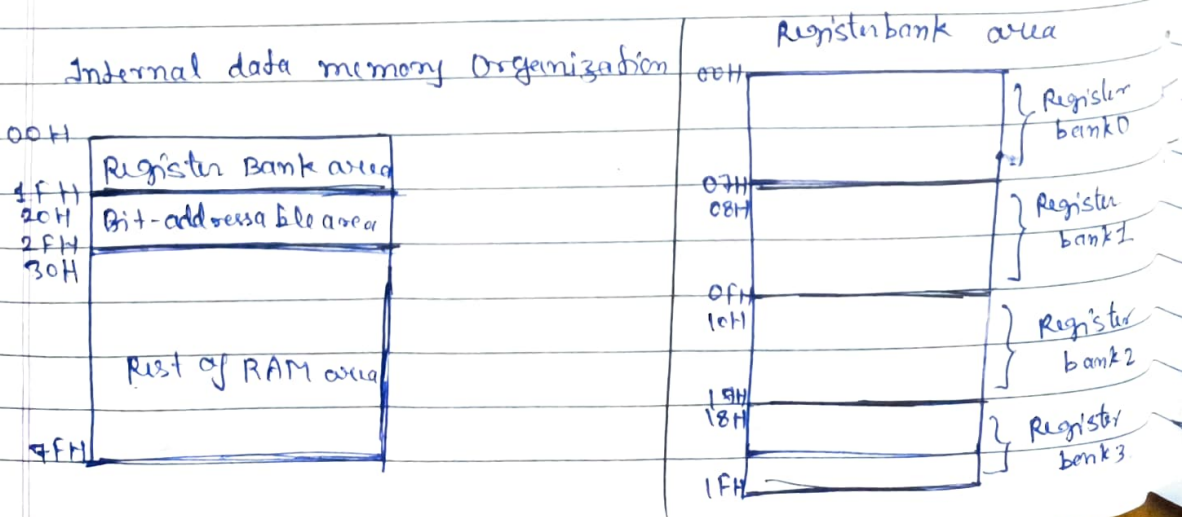
Ques → Explain the RAM structure of 8051 in detail?

Ans → Internal RAM of the 8051 microcontroller has two parts. First one for register banks, bit addressable memory locations, stacks (general purpose registers), another part is the SFR (special function register) area. Out of these 21 locations, 11 are bit-addressable SFR locations.



8051 provides four register bank.

Address Range	Register Bank
00H to 07H	Register Bank 0
08H to 0FH	Register Bank 1
10H to 17H	Register Bank 2
18H to 1FH	Register Bank 3



A register bank

R0
R1
R2
R3
R4
R5
R6
R7

* * * * *

Ques Explain the difference between Microprocessor & Micro Controller.

Ans

Microprocessor

- ↳ It is a processor where the memory and I/O component are connected externally.
- ↳ The circuit is complex due to external connection.
- ↳ It can't be used in compact system.
- ↳ It is not efficient.
- ↳ It has less number of registers.
- ↳ It has a zero status flag.
- ↳ It is generally used in personal computers.

Micro Controller

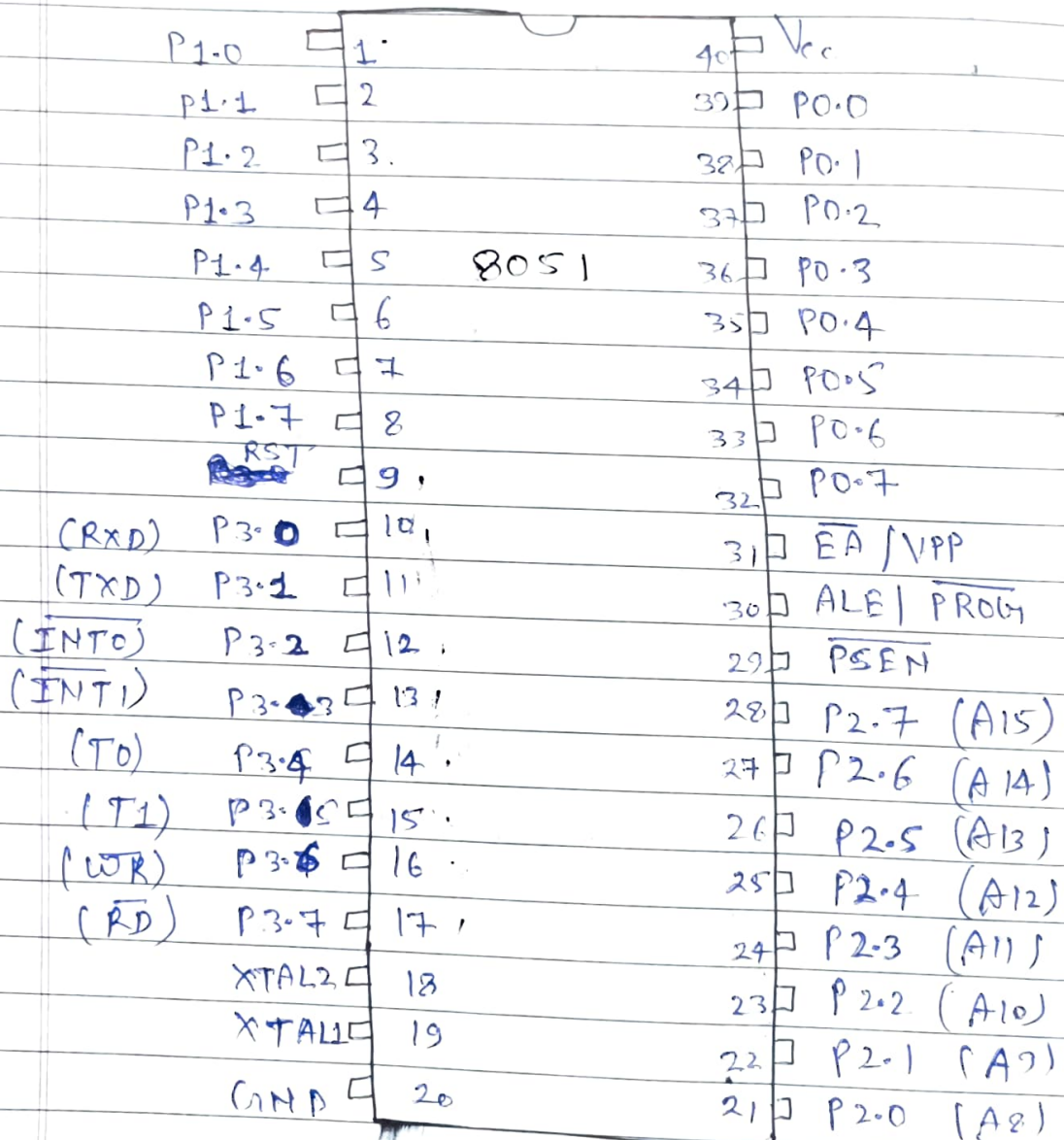
- ↳ It is a controlling device where in the memory and I/O component are present internally. (It is present on chip)
- ↳ The circuit is less complex.
- ↳ It can be used with a compact system.
- ↳ It is efficient.
- ↳ It does not have a zero status flag.
- ↳ It is generally used in washing machines, and air conditioners.

Ques

Explain the pin diagram of 8051 micro Controller in detail? and draw it?

Ans

8051 micro Controller has 40 pins. the pin diagram of 8051 micro Controller looks as follows →



- Pins 1 to 8 → These pins are known as Port 1. This port does not serve any other functions.
- Pin 9 → It is a RESET pin, which is used to Reset the microcontroller to its initial values.
- Pin 10 to 17 → These pins are known as Port 3. This port serves some functions like interrupts, timer input, control signals, Serial Communication - Signals RXD and TXD.
- Pins 18 & 19 → These pins are used for interfacing an external crystal to get the system clock.
- Pin 20 → This pin provides the power supply to the circuit. (GND)
- Pins 21 to 28 → These pins are known as Port 2. i.e. It serves as I/O port.
- Pin 29 → This is PSEN pin which stands for program store Enable. It is used to read a signal from the external program memory.
- Pin 30 → (EA) → This is EA pin which stands for external access input. It is used to enable/disable the ~~new~~ external memory interfacing.
- Pin 31 → This is ALE pin, which stands for Address Latch Enable. It is used to demultiplex the address-data signal of port.

- Pin 32 to 39 → These pins are known as Port 0. It serves a I/O port.
- Pin 40 → This pin is used to provide power supply to the circuit.

Minor-3 syllabus →

• Micro Controller → ① Pin diagram

② Block diagram

③ RAM structure (Bank 1, Bank 2)

④ Serial Communication or Port → Explain.

⑤ Addressing mode.