Architecture of Microcontroller-8051
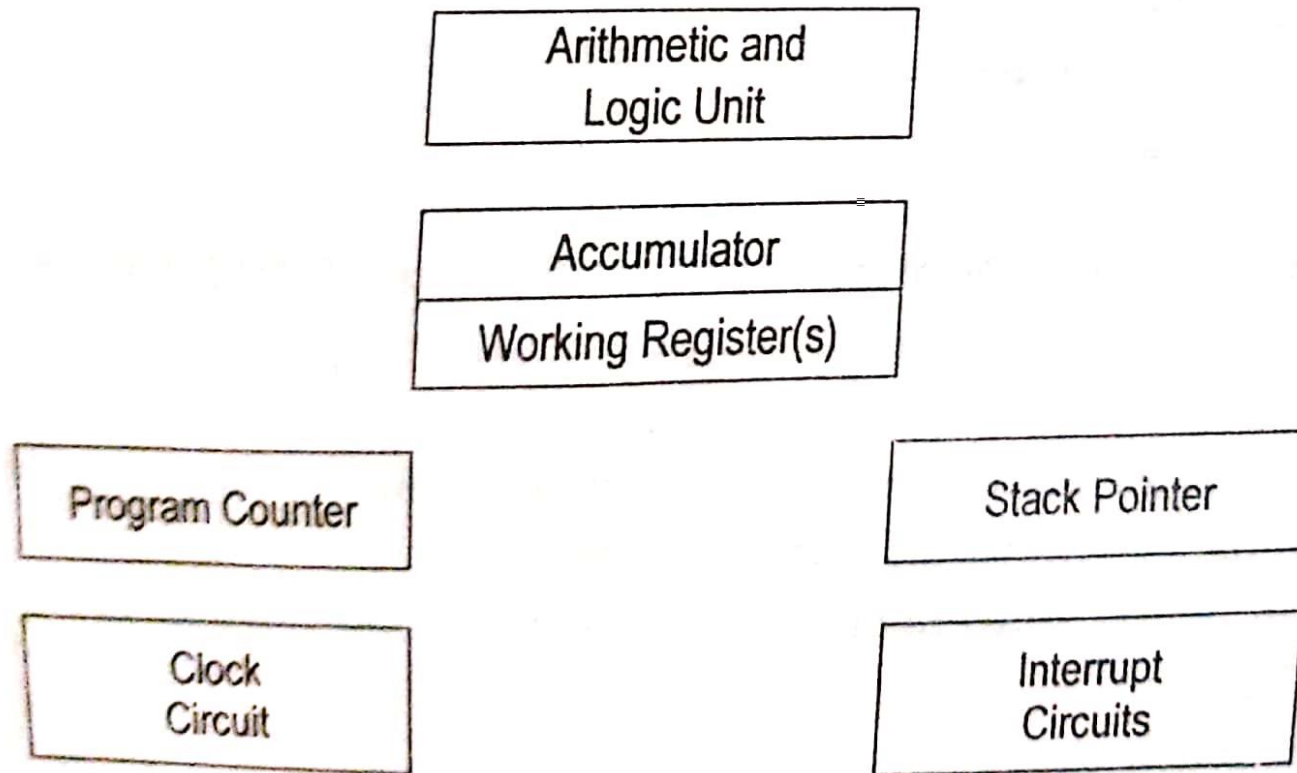
Microcontroller 8051

INTRODUCTION

- Microcontroller is a single chip microcomputer.

- Microcontroller is an integrated circuit, which includes a *microprocessor* and limited amounts of *ROM, RAM* and *I/O ports, timers,* etc.

- Microcontroller has the name because it is used to perform control functions.

# Comparison between Microprocessor and Microcontroller

| SN	MICROPROCESSOR	MICROCONTROLLER
1.	Consists of ALU, Registers and control unit.	Consists of ALU, Registers, Control unit, small RAM, ROM, I/O ports, timer (counter)
2.	There is no internal memory (memory is external).	There is a small internal memory (RAM and ROM)
3.	There are many opcodes to move data from external memory to CPU.	Only few opcodes.
4.	Concerned with rapid movement of data / opcodes from external address to chip.	Concerned with rapid movement of data / opcodes within the chip.
5.	Can function as a micro-computer with the addition of external I/O memory.	Can function as a micro-computer without any additional parts.
6.	It is a general-purpose device. Controls a system using program stored in *external* memory.	General-purpose device. Controls a system using programs stored in *internal* memory.

Block Diagram of Microprocessor

Block Diagram Of Microcontroller
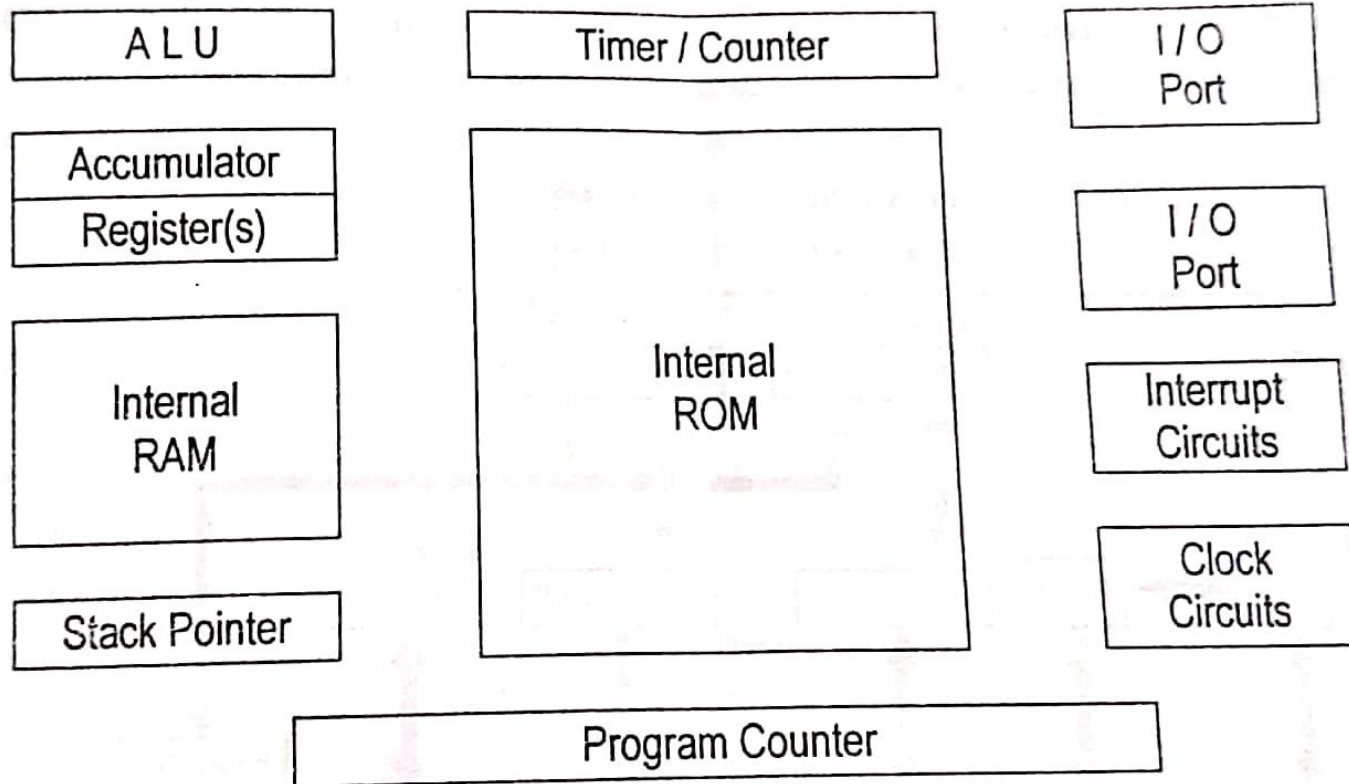
Architecture of 8051
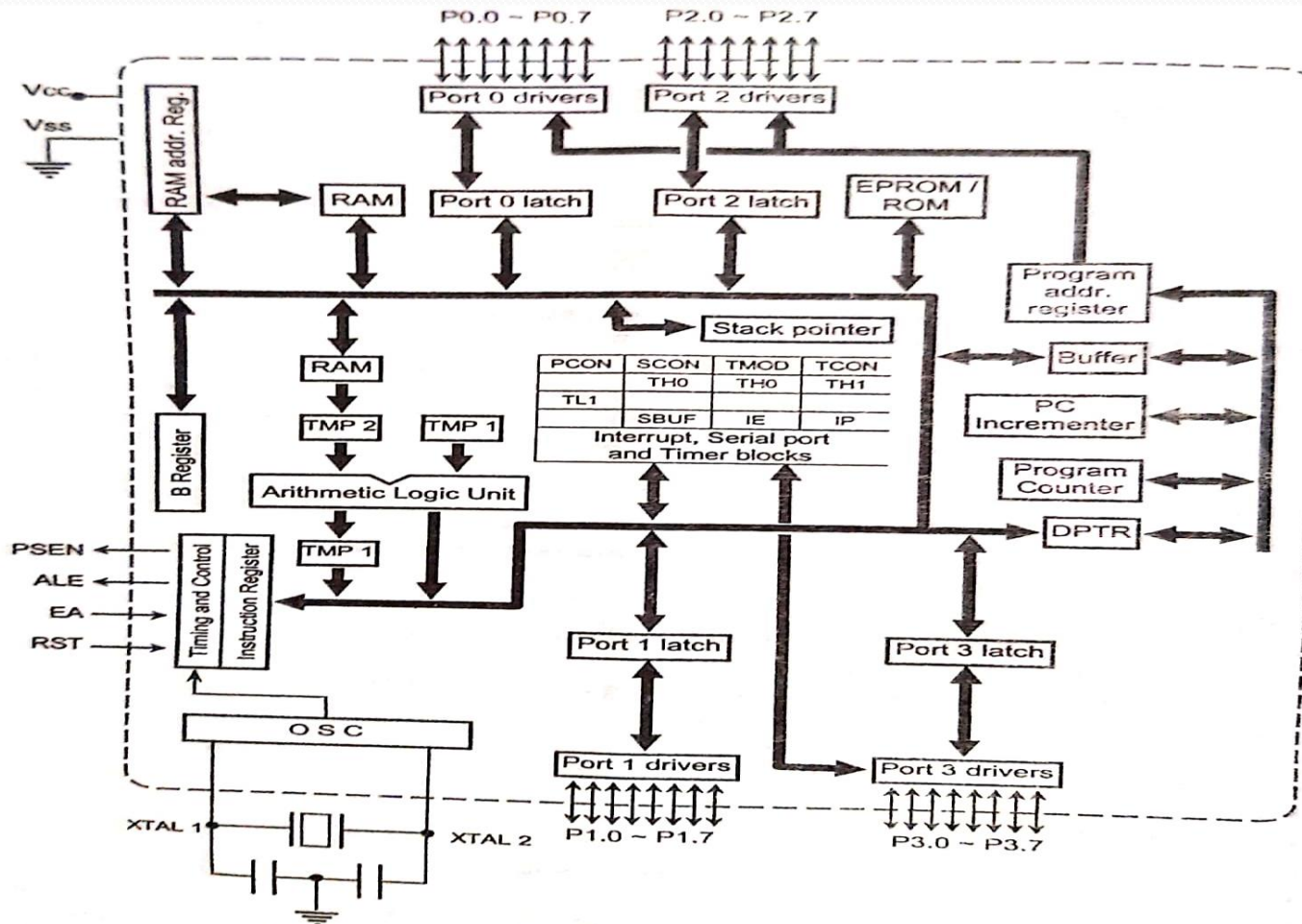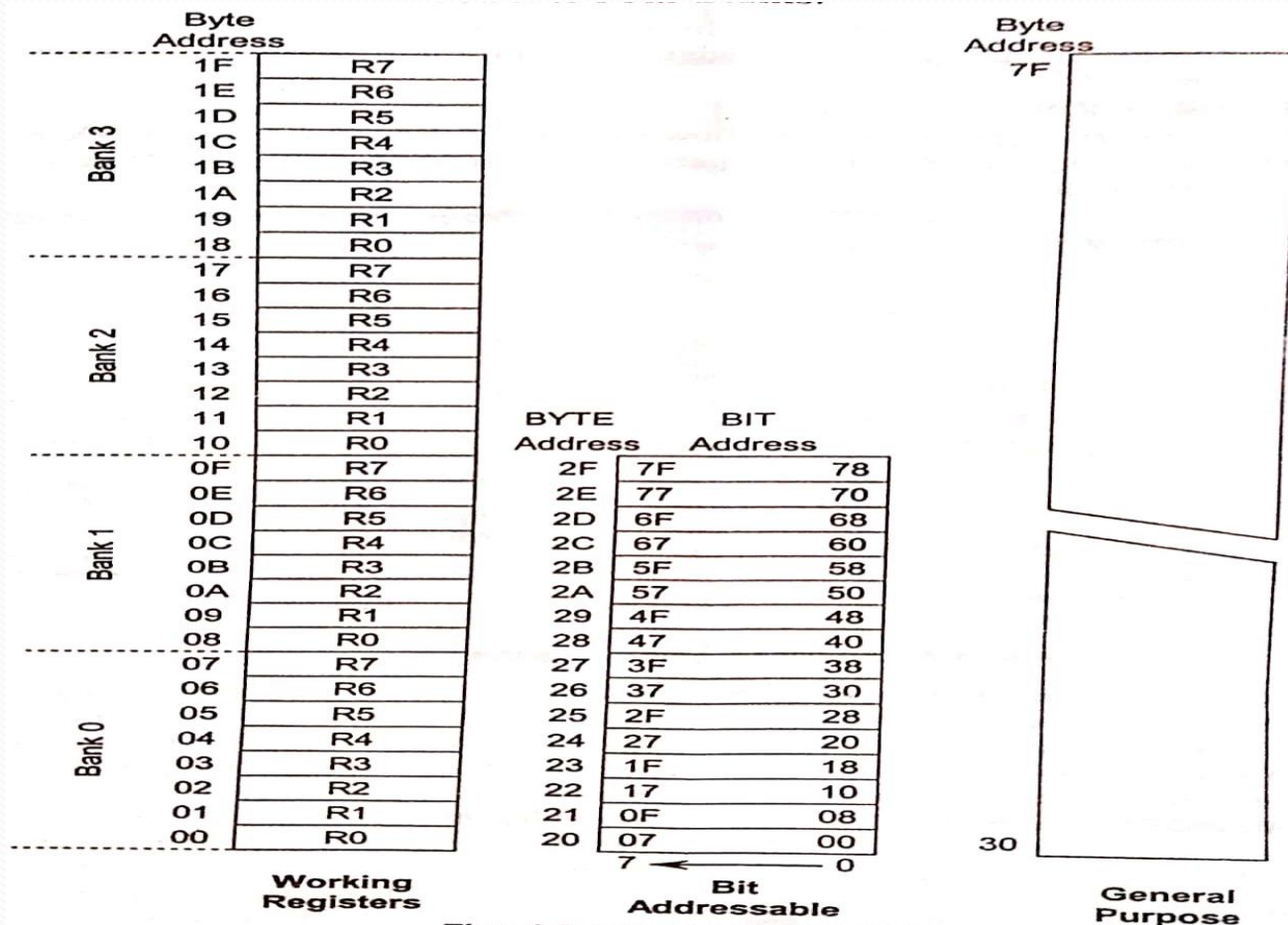
Memory Register map of 8051
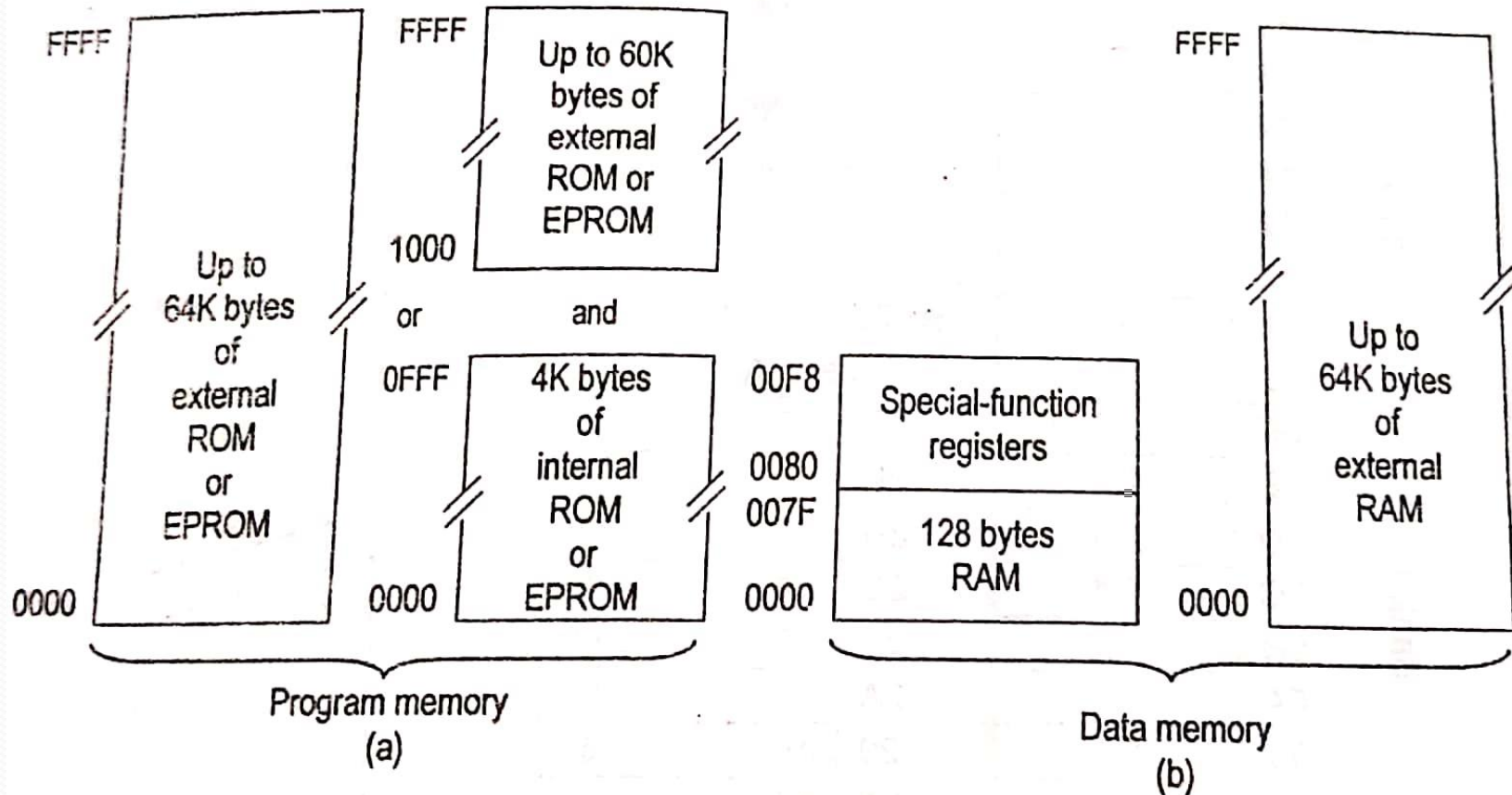
Internal RAM of 8051

Fig.: 1.5. Internal RAM (128 byte)

Special Function Registers

NAME	FUNCTION	Internal RAM Address (HEX)
A	Accumulator	OEO
B	Arithmetic	OFO
DPH	Addressing external memory	83
DPL	Addressing external memory	82
IE	Interrupt enable control	OA8
IP	Interrupt priority	OB8
PO	Input/output port latch	80
P1	Input/output port latch	90
P2	Input/output port latch	AO
P3	Input/output port latch	OBO
PCON	Power Control	87
PSW	Program Status Word	ODO
SCON	Serial port control	98
SBUF	Serial port data buffer	99
SP	Stack Pointer	31
TMOD	Timer/Counter mode counter	89
TCON	Timer/Counter control	88
TLO	Timer 0 low byte	8A
THO	Timer 0 low byte	8C
TL1	Timer 1 low byte	8B
TH1	Timer 1 high byte	8D

Processor Status Word of 8051

THE PROGRAM STATUS WORD (PSW) SPECIAL FUNCTION REGISTER

Bit	Symbol	Function
7	CY	Carry flag; used in arithmetic, jump, rotate & Boolean instructions
6	AC	Auxiliary Carry flag; used for BCD arithmetic
5	F0	User flag 0
4	RS1	Register bank select bit 1
3	RS2	Register bank select bit 2

RS1	RS0	
0	0	Select register bank 0
0	1	Select register bank 1
1	0	Select register bank 2
1	1	Select register bank 3

Bit	Symbol	Function
2	OV	Overflow flag; used in arithmetic instructions
1	–	Reserved for future use
0	P	Parity flag; shows parity of register A: 1 = Odd parity

Bit addressable as PSW.0 to PSW.7

IE Function Registers

THE INTERRUPT ENABLE (IE) SPECIAL FUNCTION REGISTER

Bit	Symbol	Function
7	EA	Enable Interrupts bit. Cleared to 0 by program to disable all interrupts; set to 1 to permit individual interrupts to be enabled by their enable bits.
6	–	Not implemented.
5	ET2	Reserved for future use.
4	ES	Enable serial port interrupt. Set to 1 by program to enable serial port interrupt; cleared to 0 to disable serial port interrupt.
3	ET1	Enable timer 1 overflow interrupt. Set to 1 by program to enable timer 1 overflow interrupt; cleared to 0 to disable timer overflow interrupt.
2	EX1	Enable external interrupt. Set to 1 by program to enable $\overline{INT1}$ interrupt; cleared to 0 to disable $\overline{INT1}$ interrupt.
1	ET0	Enable timer 0 overflow interrupt. Set to 1 by program to enable timer 0 overflow interrupt; cleared to 0 to disable timer 0 overflow interrupt.
0	EX0	Enable external interrupt. Set to 1 by program to enable $\overline{INT0}$ interrupt; cleared to 0 to disable $\overline{INT0}$ interrupt. Bit addressable as IE.0 to IE.7

IP Function Registers

THE INTERRUPT PRIORITY (IP) SPECIAL FUNCTION REGISTER

Bit	Symbol	Function
7	–	Not implemented.
6	–	Not implemented.
5	PT2	Reserved for future use.
4	PS	Priority of serial port interrupt. Set / cleared by program.
3	PT1	Priority of timer 1 overflow interrupt. Set / cleared by program.
2	PX1	Priority of external interrupt. Set / cleared by program.
1	PT0	Priority of timer 0 overflow interrupt. Set / cleared by program.
0	PX0	Priority of external interrupt 0. Set / cleared by program.

Note: Priority may be 1 (highest) or 0 (lowest).

Bit addressable as IP.0 to IP.7

TMOD

TIME MODE CONTROL REGISTER (TMOD) SPECIAL FUNCTION REGISTER

Symbol	Function
$C/\overline{T}$	1 means COUNTER action.
–	0 means TIMER action.
M1	Mode selection bit 1.
M0	Mode selection bit 0.

Note: TMOD register is NOT bit addressable.

TMOD

MODE CONTROL REGISTER (TMOD) special function Register

Symbol	Function
TF1	Timer 1 overflow flag.
TR1	Timer 1 run control bit.
TF0	Timer 0 overflow flag.
TR0	Timer 0 run control bit.
IE1	External Interrupt 1 biEdge Flag.
IT1	External Interrupt 1 type bit.
IE0	External Interrupt 0 biEdge Flag.
IT0	External Interrupt 0 type bit