UNIT-5
Microprocessor

Introduction :-

The microprocessor is a semiconducting device consists of electronic logic circuits manufactured by using either a large scale or very very large scale techniques. It is capable of performing various computing functions and making decisions to changes the sequence of program execution. It broad sense microprocessor is a multipurpose programmable logic device that reads binary instructions from a storage device called memory accept binary data as input processor data according to these instructions and provides resuet as output.

Microcomputer :-

Microcomputer are smaller in size. They contains only CPU which is usually a single integrated circuit called microprocessor. Once add ROM, RAM and ports to a microprocessor then it becomes microcomputer. They are used for small industrial control prices control and where storage and speed requirements are limited.

Microprocessor 8085 :-

Microprocessor 8085 is an 8-bit general purpose register. It has 16 address lines and 8 data line buses. The 8 LSB's of address are multiplexed with 8 lines of data i.e; $A_0 - A_7$ and $D_0 - D_7$ are multiplexed such as $AD_0 - AD_7$. It is a 40 - I_c. Two pins are four serial communication with 8085 through these pins serial data can be sent or received with other computer. This is how a programme can be loaded into an 8085 experimental kit from a personal computer. There are general purpose register such as flag register and pointer register. There is an important register called accumulator used to accumulate the result of various airthmatic and logical operation.

Description of Pins And Signals :-

The intel's 8085 has 40 pins, requires a +5 volt single power supply and can operate with a 3 mH_z single phase clock its version 8085 A-2 can operate at the max frequency of 5 - mH_z. There are 6 groups of sign also.

(i) Control and status signal
(ii) Address Bus
(iii) Data bus
(iv) Externally initiated signals
(v) Serial input / output ports
(vi) Power supply and frequency signals.

(i) Control and Status Signal :- $IO/\overline{M}$:-

Status signal used to differentiate b/w I/O and memory operations. $IO/\overline{M}$ high Indicates I/O operations. $IO/\overline{M}$ low Indicates memory operations. Microprocessor combines with this signal with $\overline{RD}$ and $\overline{WR}$ to generate I/O and memory signals.

$\overline{RD}$:- Read control signals Indicates that the selected Input / output or memory device is to be ~~used~~ read and data are available on data bus. It is active low (0) signal.

$\overline{WR}$:- write control signal Indicates that the data on the data bus are to be written Into selected Input or memory location. It is active low (0) signal.

ALE :- Address latch enables is a positive going pulse generated every time the microprocessor begins a machine cycle operation. Also It Indicates that the bits on AD_0 - AD_7 are address bits.

S_0 and S_1 :- Status signal can identify various operations but are rarely used In microprocessor based small system.

(ii) Address Bus :- It is a group of 16 lines commonly identified as $A_0 - A_{15}$. The address bus is unidirectional bits can flow in one direction between microprocessor and peripheral. It uses the address bus to identify and locate peripheral or memory location 8085 with 16 address lines is capable of carrying 64 k memory locations.

(iii) Data Bus :- Data bus is a group of 8 lines used for data flow. The data bus is bidirectional data flow in both direction between the microprocessor and memory ~~per~~peripherial devices. It is used for transfering binary information.

(iv) Externally Initiated Signal :- (a) RESET :- 8085 has two RESET signals i.e; $\overline{\text{RESET IN}}$ and $\overline{\text{RESET OUT}}$. When $\overline{\text{RESET IN}}$ signal goes low, the programe counter is set to zero, the buses are tristated and the microprocessor is RESET. RESET OUT signal indicates that the microprocessor is being reset, this ~~can~~ signal can be use to reset other devices.

(b) READY :- The 8085 uses this signal to sense whether a peripheral is ready to transfer data or not.

(c) INTR :- The 8085 can interrupted from the normal execution of instructions and asked to execution some other Instructions or programme referred as service Routine.

(d) HOLD :- 8085 uses this signal to relinquish the buses on the request of other devices on HOLD pin. When HOLD pins is activated by the external signal the microprocessor relinquishes the control of buses and allow external peripheral to use them.

(e) Serial I/O Ports :- 8085 has two signals to implement serial transmission serial Input data (SID) and serial output data (SOD). SID is data line for serial Input. The data on this line is loaded into 7th bit of the commutator when RIM Instruction is executed. The SOD data line is for serial output - 7th bit of the accumulator is output on SOD line when SIM Instruction is executed.

(f) Power supply and frequency signal :-

Vss : Ground Reference

Vcc : Power supply (+5 volt)

X_1, X_2 :- A crystal as a source of frequency is accounted at two pins. Since crystal oscillator generates two frequency signals clk & $\overline{CLOCK}$ so frequency is internally divided by 2.

Hence to operate a system at 3Hz, the crystal should have a frequency of 6MHz.

8085 Microprocessor Architecture :-

The architecture of 8085 mainly consists of ALU, timing and control unit and register.
Whenever we talk about the archetecture of a microprocessor we talk about the Internal arrangement of the microprocessor.

1. Airthmatic Logic Unit (ALU) :-

The airthmatic and logic unit Includes accumulator, temporary register. Airthmatic and logic circuits and a flag resister. The ALU performs all airthmatic and logical operations. additions, subtraction OR etc. The temporary register is used to hold the data during an operation. The result of the operation is stored In accumulator. Flags are set and reset A/c to result.

(1) Flag register :- 8085 has an 8 - bit flag register. The five are used to define the status of the microprocessor, three bits are unused. The combination of these 8 bits are also referred as the programme status word. Each of the used bit is basically a flip-flop. The flags are sets and resets which arise during airthmatic and logical operations. If

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flip-flop Indicates 1 respective flag is set, if Indicate 0 It is reset.

(ii) Carry Flag (CF):-
The carry flag is set if an airthmatic operation results In carry otherwise It is Reset.

(iii) Parity Flag (PF):-
If the result of the airthmatic and logical operation has an even number of 1's, This flag is set. If the result has an odd number of 1's the flag is reset.

(iv) Auxillary Carry (AC):-
Auxiliary carry is generated when In an airthmatic operation a carry is generated by digit D_3 and passed on D_4.; the flag is set. The flag is used only Internally for BCD operations and is not available for the programmer to change the sequence of a programe with a jimp Instruction.

(v) Zero Flag (Z):-
If the ALU result In 0 (zero) the zero flag is set and reset is the ALU result is not 0.

(vi) Sign Flag:- If the bit D_7 of the result of execution of an airthmatic or logical operation is 1, the sign flag is set. The signed flag is used with signed numbers. A one byte number is referred as negative if the bite D_7 of the byte is 1. If D_7 is 0, then the no, is referred as positive.

2] Timing And Control Signals:-

The timing and control untill generates the timing and control signal necessary for communi-cation between the microprocessor and peripherial. Also this until synchronize all the microprocessor operations with the clock.

3) Register Structure:-

Registers are used by the microprocessor for temporary storage and manipulation of data and Instructions.

(i) Six 8 bit General Purpose Registers:-

8085 has 6, 8 bits general purpose register to store 8 bit data temporarily during the programme execution. They can be combined as register pair BC, DE and HL for performing 16 bit operation.

(ii) Programme Counter (PC):-

It has an sixteen (16) bit register which deals with the sequencing the execution of Instructions. It is also referred as memory pointer.

Role of PC is to point memory address from which next byte is to be fetched. When a byte is being fetched the programme counter is increment by one point to next memory location.

(iii) Accumulator :- It is an 8-bit register that is a part of ALU. Accumulator is used to store 8 bit data and to perform airthmatic and logical operations. The result of any other operation is also stored in accumulator.

(iv) Stack Pointer :-

It is also a 16 bits register used as memory pointer. stack pointer points to a memory location in read/write memory called stack.

(v) Instruction Register :-

It holds the output code of the Instruction which is being decoded and executed. This is not accessible to programmer.

(vi) Temporary Register :-

It is used to hold the data during airthmatic and logical operation. This is not accessible to the programmer.

Soft-Ware Model :-

A programmer's model of a microprocessor is also referred as a software model. Fig. depicts the register structure or programmable register, which is referred as programmer model or software model of 8085. Programmable register means a programmer can use these registers to use or copy data from the register by using Instructions. To illustrate the concept of programmable register, the Instruction mov, A, B copies the data from B register to A register. We can say register can be viewed as a memory locations, except these register some modern microprocessor use memory space.

Memory Interfacing of 8085 :-

The 8085 has 16 address lines the memory size of 8085 is $2^N = 2^{16} = 2^{10} \times 2^6 = 1024 \times 64 = 1K \times 64$
$= 64K$.

where N is the number of address lines Since each address a location In memory containing a byte of Information.

Memory Map :-

A pictorial representation In which memory devices are located In entire range of address is referred as memory map. Memory address provide the location of various memory devices In the system and the Interfacing logic defines the range of memory address for each memory device.

Interfacing Model :-

During execution of programme the microprocessor needs to access memory quite frequently to read instructions codes and data stored In an Interfacing circuit enable that access. A set of control signal is needed for memory to write Into and read from its register.

The memory Interfacing process involves designing a circuit that will match the memory requirements with the microprocessor signals. The primary function of memory interfacing is that the microprocessor should be able to read from and write Into a given register of a memory chip.

To perform these operations microprocessor should be :-

1. Able to select the chip of memory.
2. Identify the register In memory chip.
3. Enable the appropriate buffer.

Address Decoding :-

An address decoder is used to decode the un-used address-lines and its output is connected to the chip select pin of memory chip. To decode the un-used address lines either a decoder or a NAND gate can be used. If n are the used address lines, N are the total number

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of address lines the number of un-used lines to be connected In N-n. Figure shows a NAND gate address decoder. Here the un-used lines are N-n are connected as Input to the NAND gate, and the output of the NAND gate is connected to the chip select signal of a memory.