Lecture-1

EEC- 503 MICROPROCESSORS			3 1 0
Unit	**Topic**	**Chapte/ Section**	**Proposed number of Lectures**
I	Introduction to Microprocessor, Microprocessor architecture and its operations, Memory, Input & output devices, Logic devices for interfacing, The 8085 MPU, Example of an 8085 based computer, Memory interfacing.	1.1, 3.1, 3.2, 3.3, 3.5, 4.1, 4.2, 4.3,	8
II	Basic interfacing concepts, Interfacing output displays, Interfacing input devices, Memory mapped I/O, Flow chart symbols, Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Writing assembly language programs, Programming techniques: looping, counting and indexing.	5.1, 5.2, 5.3, 5.4, 6.1, 6.2, 6.3, 6.4, 6.5, 7.1	8
III	Additional data transfer and 16 bit arithmetic instruction, Arithmetic operations related to memory, Logic operation: rotate, compare, counter and time delays, Illustrative program: Hexadecimal counter, zero-to-nine, (module ten) counter, generating pulse waveforms, debugging counter and time delay, Stack, Subroutine, Restart, Conditional call and return instructions, Advance subroutine concepts, The 8085 Interrupts, 8085 vector interrupts.	7.2, 7.3, 7.4, 7.5, 8.1, 8.2, 8.3, 8.4, 8.5, 9.1, 9.2, 9.3, 9.4, 12.1, 12.2	8
IV	Program: BCD-to-Binary conversion, Binary-to-BCD conversion, BCD-to-Seven segment code converter, Binary-to-ASCII and ASCII-to-Binary code conversion, BCD Addition, BCD Subtraction, Introduction to Advance instructions and Application, Multiplication, Subtraction with carry.	10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9	8
V	8255 Programmable peripheral interface, interfacing keyboard and seven segment display, 8254 (8253) programmable interval timer, 8259A programmable interrupt controller, Direct Memory Access and 8237 DMA controller. Introduction to 8086 microprocessor: Architecture of 8086 (Pin diagram, Functional block diagram, Register organization).	15.1, 15.2, 15.4, 15.5, 15.6, 2.11*, 2.12*	8
Text Book: 1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Penram International Publication (India) Pvt. Ltd. 2. * Douglas V. Hall, "Microprocessors and Interfacing", 2nd Edition, TMH, 2006.			
Reference Book: Kenneth L. Short, "Microprocessors and programmed Logic", 2nd Ed, Pearson Education Inc.			

Introduction to Microprocessor

Definition:

- ***"The microprocessor is a multipurpose, clock driven, register based, digital-integrated circuit which accepts binary data as input, processes it according to instructions stored in its memory, and provides results as output."***
- "Microprocessor is a computer Central Processing Unit (CPU) on a single chip that contains millions of transistors connected by wires."

Introduction:

- A microprocessor is designed to perform arithmetic and logic operations that make use of small number-holding areas called registers.
- Typical microprocessor operations include adding, subtracting, comparing two numbers, and fetching numbers from one area to another.

Components of Microprocessor

- Microprocessor is capable of performing various computing functions and making decisions to change the sequence of program execution.

- The microprocessor can be divided into three segments as shown in the figure, Arithmetic/logic unit (ALU), register array, and control unit.
- These three segment is responsible for all processing done in a computer

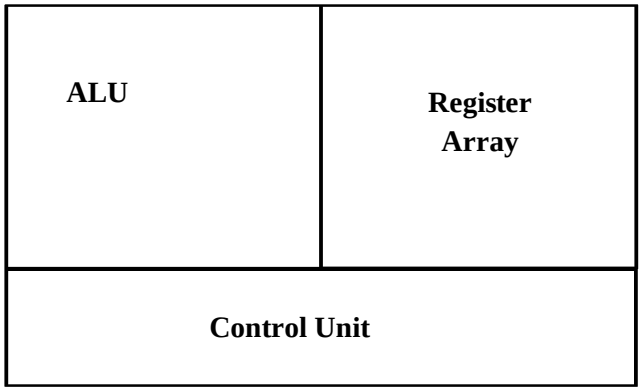

Fig. Components of Microprocessor

Arithmetic and logic unit (ALU)

- It is the unit of microprocessor where various computing functions are performed on the data.
- It performs arithmetic operations such as addition, subtraction, and logical operations such as OR, AND, and Exclusive-OR.
- It is also known as the brain of the computer system.

Register array

- It is the part of the register in microprocessor which consists of various registers identified by letters such as B, C, D, E, H, and L.
- Registers are the small additional memory location which are used to store and transfer data and programs that are currently being executed.

Control unit

- The control unit provides the necessary timing and control signals to all the operations in the microcomputer.
- It controls and executes the flow of data between the microprocessor, memory and peripherals.
- The control bus is bidirectional and assists the CPU in synchronizing control signals to internal devices and external components.
- This signal permits the CPU to receive or transmit data from main memory.

Microprocessor Systems with Bus Organization

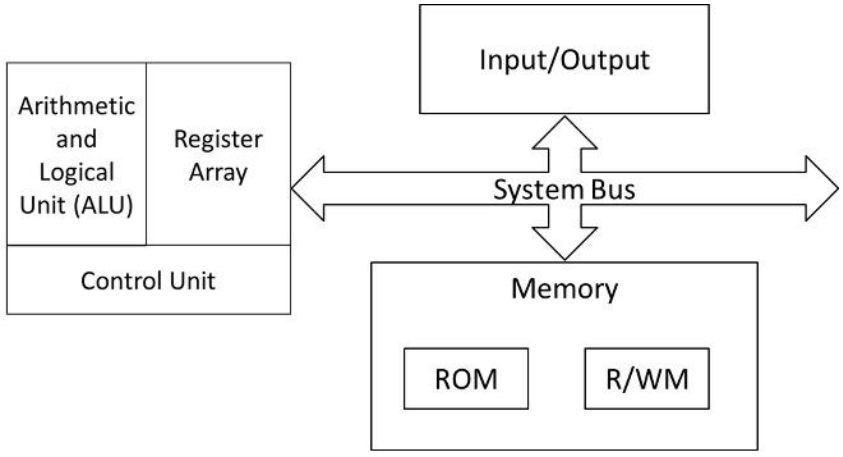

Figure: Microprocessor Systems with Bus Organization

- To design any meaningful application microprocessor requires support of other auxiliary devices.
- In most simplified form a microprocessor based system consist of a microprocessor, I/O (input/output) devices and memory.
- These components are interfaced (connected) with microprocessor over a common communication path called system bus. Typical structure of a microprocessor based system is shown in Figure.
- Here, microprocessor is master of the system and responsible for executing the program and coordinating with connected peripherals as required.
- Memory is responsible for storing program as well as data. System generally consists of two types of memories ROM (Read only and non-volatile) and RAM (Read/Write and volatile).
- I/O devices are used to communicate with the environment. Keyboard can be example of input devices and LED, LCD or monitor can be example of output device.
- Depending on the application level of sophistication varies in a microprocessor based systems. For example: washing machine, computer.

Microprocessor Overview-

Microprocessor is a controlling unit of a micro-computer, fabricated on a small chip capable of performing ALU (Arithmetic Logical Unit) operations and communicating with the other devices connected to it.

Microprocessor consists of an ALU, register array, and a control unit. ALU performs arithmetical and logical operations on the data received from the memory or an input device. Register array consists of registers identified by letters like B, C, D, E, H, L and accumulator. The control unit controls the flow of data and instructions within the computer.

Block Diagram of a Basic Microcomputer

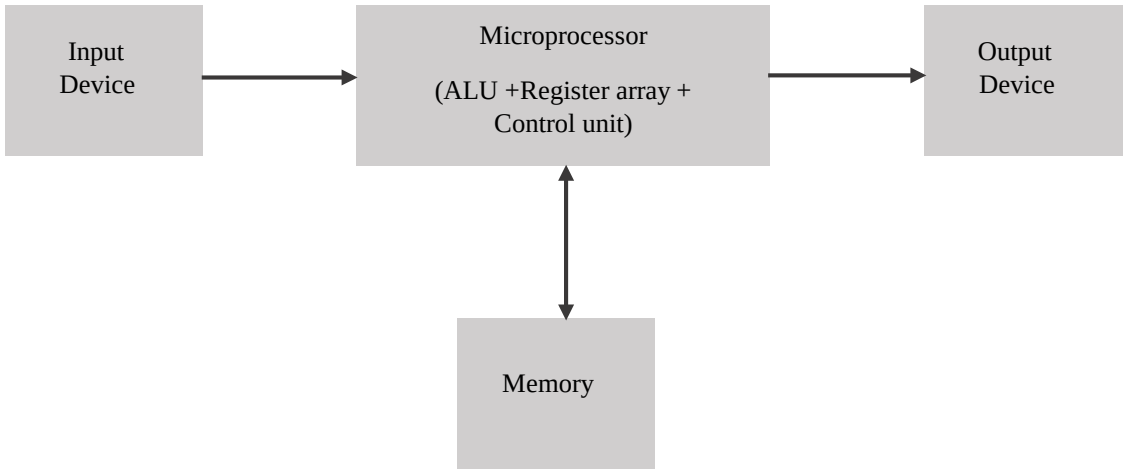

Fig. Block Diagram of Microcomputer

How does a Microprocessor Work?

The microprocessor follows a sequence: Fetch, Decode, and then Execute.

Initially, the instructions are stored in the memory in a sequential order. The microprocessor fetches those instructions from the memory, then decodes it and executes those instructions till STOP instruction is reached. Later, it sends the result in binary to the output port. Between these processes, the register stores the temporarily data and ALU performs the computing functions.

List of Terms Used in a Microprocessor

Here is a list of some of the frequently used terms in a microprocessor:

- **Instruction Set**: It is the set of instructions that the microprocessor can understand.
- **Bandwidth**: It is the number of bits processed in a single instruction.
- **Clock Speed**: It determines the number of operations per second the processor can perform. It is expressed in megahertz (MHz) or gigahertz (GHz).It is also known as Clock Rate.
- **Word Length**: It depends upon the width of internal data bus, registers, ALU, etc. An 8-bit microprocessor can process 8-bit data at a time. The word length ranges from 4 bits to 64 bits depending upon the type of the microcomputer.
- **Data Types**: The microprocessor has multiple data type formats like binary, BCD, ASCII, signed and unsigned numbers.

Features of a Microprocessor

Here is a list of some of the most prominent features of any microprocessor:

- **Cost-effective**: The microprocessor chips are available at low prices and results its low cost.
- **Size**: The microprocessor is of small size chip, hence is portable.
- **Low Power Consumption**: Microprocessors are manufactured by using metal-oxide semiconductor technology, which has low power consumption.
- **Versatility**: The microprocessors are versatile as we can use the same chip in a number of applications by configuring the software program.
- **Reliability**: The failure rate of an IC in microprocessors is very low, hence it is reliable.