Micro Processors & Micro Controllers:-

Processor:- A Processor is the logic circuitry that responds to and processes the basic instructions that drive a computer.

Micro Processor :- Incorporates the functions of a computer's Central Processing Unit (CPU) on single IC (or) at most a few IC's.

The Microprocessor is a Multipurpose, Programmable device that accepts digital data as i/p processes it according to instructions stored in its memory and provides results as o/p. (Eg:- Sequential logic design).

History :- ⊛ The first 4-bit microprocessor 4004 from Intel Corporation in 1971, which has been a silent revolution in the domain of digital system design.

⊛ → In this first microprocessor 4004 contained only ten thousand (10,000) transistors while Component density increased more than three fold in less than a decade's time.

⊛ → After 4004 µP (4-bit), Immediatly Intel Corporation has introduced first (8-bit) µP 8008 in 1972 (which are not successful).

⊛ → In 1974 Intel released the first general Purpose 8-bit microprocessor 8080 in which "CPU" was not functionally Complete.

⊛ → later on the first 8-bit functionally Complete "CPU" 8085 µP was introduced in 1977.

⊛ → The 8085 CPU is still the most Popular one amongst all 8-bit CPU's which provides good Performance utilizing an optimum set of registers and an reasonably Powerful ALU, where 8085 houses on-chip clock generator.

(*) → The Major limitations of 8-bit µP's are their limited memory addressing capacity, slow speed of execution, limited scratchpad registers and non-availability complex instruction set, and addressing modes.

(*) → The first 16-bit µP's from Intel was 8086 in 1978 results more Powerful efficient Computing machine.

In 8086 Contains 16-bit general purpose registers, supports 16-bit ALU's, a rich instruction set and Provides a segmented memory for addressing scheme.

(*) The Peripheral chips designed earlier for 8085 were Compatiable with microprocessor 8086 with slight (or) no modifications. Through there is considerable techniques difference b/w addressing memory in 8085 and 8086 µP.

*) Register :- Is a type of storage device which are used to store large amount of digital data.

Memories are made up of registers. Each register in memory is one storage location. Each location is identified by an address. Each location is accomodiate one (or) more bits.

The capacity is specified in terms of bytes (8bits = 1 byte). Each register Consists of storage elements (flipflops, Capacitors, magnetic domain) Each of bit stores one bit of data. A storage element is called cell.

The data stored in memory by process called writing and are retrived from memory by process is called "Reading".

"Refer to DICA Text book"

(1) Micro Processor :- The MP is a Programmable IC device that has Computing and decision making Capability.

→ It is a Program Controlled device, which fetches, decodes, and executes instructions.

→ The MP reads instructions from memory communicates with all peripheral (memory & I/O P's) using the system bus.

→ the MP Controls the timing of information flow Performs the Computing tasks specified in a Program.

(2) Evolution of microprocessors :-

(*) The first MP. Intel 4004 (4-bit) was introduced in 1971.

(*) Intel developed an improved 4-bit MP 4040, Enchanced version of Intel 4004 Many other Companies also introduced 4-bit MP such as PPS-4 by Rockwell International, T3472 by Toshiba etc...)

(*) In 1972 Intel first (8-bit MP) Intel 8008 MP developed so far used P-MOS technology these technology of P-mos used is slow, and not Compatible with TTL, circuits.

(*) In 1973 Intel introduced more Powerful 8-bit MP Intel 8080. used N-mos technology, and was faster, and Compatible with TTL circuits. The NMOS Process also offers higher density than P-mos Process.

→ the drawbacks of 8080 was that it required 3-Power Supplies

(*) In 1975 Intel introduced 8-bit MP 8085, which required only one +5V Power Supply.

(*) 8-bit µp's are Motorola MC6800, MC6809; Zilog's Z80, Z800;

MOS technologies 6500 series; National semiconductors (NSC 800) and Rockwell international's PPS-8.

(*) In 1978 Intel introduced first 16-bit µp 8086. Some other 16-bit µp are Intel 80186, Intel 8088, Intel 80186, Intel 80188, Intel 80286, Motorola's MC6800, 68010, & 68012; Fairchild 9440, Zilog's Z800; National semiconductors PACE & INS8900. These used HMOS technology (High density MOS). The HMOS technology offers better Speed Power Product (SPP) and Higher Packing density than N-MOS.

Speed Power Product (SPP) = Speed × Power
= nano seconds × Millipwatt
= Pico Joules.

→ SPP of HMOS is 4 times better than NMOS.
→ Circuit density provided by HMOS (4128 gates/mm^2) are approximately twice those of N-MOS (1852-5 gates/mm^2).
→ Intel 8088 was very popular and widely used in cheaper Personal Computers.
→ Intel 80286 was also very popular and was used in costlier and more powerful personal Computers.
→ Intel 80186 and 80188 were not popular for general purpose Computers but very used for industrial control.
→ MC 6800 was very popular & was used in Mini Computers.

→ In 1980's, many 32-bit MP have been introduced. Intel introduced its first 32-bit MP IAPX 432, which is not Popular. and it is discontinued.

→ In 1985' Intel introduced more Powerful 32 bit MP Intel 80386. became very Popular and widely used for desktop Computers.

→ Some other 32 bit MP are · Intel 80486, Pentium, Pentium Pro, Pentium II, Pentium III, Pentium IV, Advanced micro devices (AMD's) K5, K6, K7, National semiconductors 32032, 32332, and 32C532. Intel 486 was very Popular and widely used for desktop Computers.

→ Motorola's 68020, 68030, and 68040 are very Popular and were used for build minicomputers.

→ Now Pentium III and advanced versions of MP are used in desktops and servers. These are fabricated using the low Power version of HMOS technology called HCMOS.

→ Recently 64 bit microProcessors have also been developed Some examples are SUN's ULTRA SPARC, PowerPC 620, MIPS R400. R500, R10000 and 1200 III.

8-bit MicroProcessor's	16-bit MicroProcessor's
1) Simple Architecture	1) Advanced Architecture
2) Slow Speed of Execution	2) More Processing Capability
3) Low Memory addressing Capability	3) Larger memory addressing Capability
4) Less Powerful instruction set	4) More Powerful Instruction set
5) fabricated using P-MOS & NMOS Technology	5) Fabricated using Hmos technology.

Historical (or) Processor	Year of the Introduction	No: of transistors	Intial clock speed	Address bus in bits	Databus in bits	Addressable Memory.
4004	1971	2300	108 KHz	10	4	640 bytes
8008	1972	3500	200 KHz	14	8	16 Kbyte
8080	1974	6000	2 MHz	16	8	64 Kbyte
8085	1976	6500	3 MHz	16	8	64 K byte
8086	1978	29000	5 MHz	20	16	1MB
8088	1979	29000	5 MHz	20	8	1MB
80286	1982	1,34,000	8 MHz	24	16	16 mega
80386	1985	2,75,000	16 MHz	32	32	4 Giga
80486	1988	1.3 mega	25 MHz	32	32	4 Giga
Pentium	1993	3.1 mega	60 MHz	32	32 (or) 64	4. Giga
Pentium Pro	1995	3.5 mega	150 MHz	32	32 (or) 64	64 Giga
Pentium 2	1997	8.8 mega	230 MHz	36	64	64 Giga
Pentium 3	1999	9.5 mega	650 MHz	36	64	64 Giga
Pentium 4	2000	4.2 mega	1.4 GHz	36	64	64 Giga

5.) Applications:
Data acquisition system,
Numerical Control,
Automatic testing system.
i) Limited no: of General Purpose registers.

6.) Applications:
Control System, Traffic Controllers,
Intelligent terminals & instruments.
ii) More no: of GPR's.