**INTRODUCTION TO MICROPROCESSORS**

**Microprocessor**

* **Microprocessor:** It is a programmable electronic chip with computing ability.
* Similar to CPU.
* It is **clock driven** & **register array** based IC.

Material analysis:-

* Microprocessor contains number of **transistors** & is made from **silicon**.
* Silicon is a semiconductor.
* **Semiconductor manufacturing technologies** are used for it. Like:-
  + Transistor-transistor logic (TTL)
  + Emitter coupled logic (ECL)
  + Complementary metal-oxide semiconductor (CMOS)

Classification based on **data bus size**:-

* Based on data bus size: **There are 4-bit, 8-bit, 16-bit, 32-bit etc type microprocessors.**

Classification based on **application**:-

* **General purpose microprocessors:**
  + Used in generally used computers.
  + Programmers use it for various applications.
  + **Example:** 8085 & Intel Pentium etc.
* **Microcontroller microprocessor:**
  + **Example:** 8051
* **Special-purpose processors:**
  + Built for being used in **specific applications**.
  + **Example:** Digital signal processors.

**History of Microprocessors**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Year** | **Bitwise** | **Clock Speed** | **Number of Transistors** | **Execution Speed/sec** |
| **Intel 4004** | **1971** | **4-bit** | **740 KHz** | **2,300** | **60,000 instructions** |
| **Intel 4040** | **1974** | **4-bit** | **-** | **-** | **-** |
| **Intel 8008** | **1972** | **8-bit** | **500 KHz** | **-** | **50,000 instructions** |
| **Intel 8080** | **1974** | **8-bit** | **2 MHz** | **6,000** | **500,000 instructions** |
| **Intel 8085** | **1976** | **8-bit** | **3 MHz** | **6,500** | **770,000 instructions** |
| **Intel 8086** | **1978** | **16-bit** | **4.77 MHz** | **29,000** | **2.5M instructions** |
| **Intel 8088** | **1979** | **16-bit** | **-** | **-** | **-** |
| **Intel 80186 & 80188** | **1982** | **16-bit** | **6 MHz** | **-** | **-** |
| **Intel 80286** | **1982** | **16-bit** | **8 MHz** | **-** | **-** |
| **Intel 80386** | **1986** | **32-bit** | **-** | **-** | **-** |
| **Intel 80486** | **1989** | **32-bit** | **16-100 MHz** | **1.2M** | **-** |
| **Intel Pentium** | **1993** | **32-bit** | **66 MHz** | **-** | **-** |
| **Intel Pentium Pro** | **1995** | **32-bit** | **-** | **-** | **-** |
| **Intel Pentium II** | **1997** | **32-bit** | **-** | **-** | **-** |
| **Intel Pentium II Xeon** | **1998** | **32-bit** | **-** | **-** | **-** |
| **Intel Pentium III** | **1999** | **32-bit** | **-** | **-** | **-** |
| **Intel Pentium IV** | **2000** | **32-bit** | **-** | **-** | **-** |
| **Intel Dual Core** | **2006** | **32-bit** | **-** | **-** | **-** |
| **Intel Core 2** | **2006** | **64-bit** | **-** | **-** | **-** |
| **Intel Core i7** | **2008** | **64-bit** | **-** | **-** | **-** |
| **Intel Core i5** | **2009** | **64-bit** | **-** | **-** | **-** |
| **Intel Core i3** | **2010** | **64-bit** | **-** | **-** | **-** |

**Basic Terminologies**

* **Word:** Minimum **bit size** that a processor can process.
* **Bus:** Group of wires carrying information.
* **System bus/ data bus:** Bus used for communication of processor & peripherals.
* **Address bus:** Unique binary code used to identify memory address.
* **Control bus:** Used in identifying memory address & recognise direction of data and also sync it.

**Language of Microprocessors**

* Provided by the manufacturer to the user.
* It is in two forms: **Binary code & mnemonics**.
* **Mnemonics** forms the **assembly language**.
* **Assembler:** Application which converts assembly code to binary.

**Microprocessors v/s Microcontrollers**

|  |  |
| --- | --- |
| **Microprocessors** | **Microcontrollers** |
| **Heart of computer system.** | **Heart of embedded system.** |
| **Memory and peripherals are connected externally.** | **Memory and peripherals are connected externally & also has external processor.** |
| **Large circuit.** | **Small circuit.** |
| **Expensive.** | **Comparatively less expensive.** |
| **High power consumption.** | **Low power consumption.** |
| **No power saving features.** | **Has idle mode & power saving mode.** |
| **Operation done externally & hence slow.** | **Operation done internally & hence fast.** |
| **Has less registers & thus uses external memory.** | **Has more registers & stores programs written there.** |
| **Based on Von Neuman model (program & data are stored in same memory).** | **Based on Harvard model (program & memory are kept separately).** |
| **Used in PCs, super computers etc.** | **Used in washing machine, Arduino etc.** |