

Unit 2

OVERVIEW AND ORGANIZATION OF COMPUTER

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OVERVIEW AND ORGANIZATION OF COMPUTER

2.1. Introduction:

History and the development of computer help the students to keenly observe the evaluation of the computer. This unit describes different parts of computer and their working and coordination among each other. It includes different components of the computer like Bus, Port, Microprocessor, Main Memory.

2.2. Objectives:

After completing this unit, the students will be able to:

- Describe history and development of computer.
- Distinguish different generations of the computer.
- Classify different types of computers.
- Have knowledge about applications and different parts of the computer.

2.3. History and Development of Computer:

The word 'history' means the activities or the events that have been passed away. The history of computer describes the advancements and growth of computer technology. It is divided into different eras and has its roots starting from pre-history era.

2.4. Pre-History Era 4th Century B.C. to 1930s

2.4.1. Abacus Machine

The abacus is a mechanical device which can perform basic arithmetic problems like addition etc. This was the first machine invented in 4th century B.C.



Figure-1: Abacus Machine

2.4.2. Napier's Bones

John Napier a Scottish theologian and mathematician invented logs in 1614 which was able to perform multiplication and division.



Figure-2: John Napier's Bones

2.4.3. Wilhelm Schickard,

Wilhelm Schickard, built a mechanical calculator in 1623 which was able to perform the process of multiplication. This device supported 6-digit capacity.



Figure-3: Wilhelm Schickard Mechanical Calculator

2.4.4. Blaise Pascal

Blaise Pascal, a French mathematician, built a mechanical calculator in 1642 which could add and subtract two numbers directly and multiply and divide by repetition. This device supported 8-digit capacity.



Figure-4: Blaise Pascal Mechanical

2.4.5. Charles Babbage

Charles Babbage, designed a “Difference Engine” in 1820, which could perform mathematical and statistical tables. In 1842, Charles Babbage invented another device with the name of “Analytical Engine”, a mechanical computer that was able to perform basic mathematical problem at an average speed of 60 additions per minute.



Figure-5: Charles Babbage Difference Engine

2.5. Generations of Computer

With the passage of time, several changes were made in computer technology to meet the challenges of the age. These changes or modifications were classified into different periods and later on these periods were also named as “Generations” of the Computer.

2.5.1. First Generation of Computer (1951 – 1958)

- The first generation computers used vacuum tubes technology.

Vacuum tubes were like fragile glass tubes, which consumed more electricity due to more glowing time. First generation computers also used punched card and magnetic tape as an input device. Magnetic tapes were able to access large data but they process it sequentially.

- The sequential processing called Batch processing technique where data was processed in the form of bundles or batches.
- First generation computer relied on machine language, which consisted of binary instructions of 0 or 1 codes. Later the Assembly language was introduced which used special names

instead of codes called mnemonics.

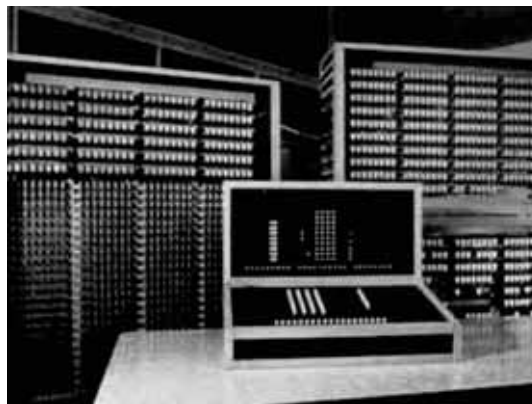


Figure-6: First Generation Computer.

2.5.1.1. Limitations

- Vacuum tubes generated much heat and covered a lot of space.
- Punched cards technology consumed large number of cards even for

small programs.

- Magnetic tapes were unable to retrieve large amount of data quickly, being a sequential medium.

2.5.2. Second Generation of Computer, 1959 – 1964

- In 2nd generation of computers, Transistors replaced vacuum tubes. Transistor is an electronic component, which is used for amplification and switching of electric signals.
- Punched cards were used as an input device to feed the computer programs (instructions).
- Magnetic tapes were also used as an input/output storage.
- Some high level languages like FORTRAN, COBOL and BASIC were also used. Due to close resemblances with English language, these languages are called high level languages.



Figure-7: Second Generation Computer.

2.5.2.1. Advantages

- Transistors were much more reliable and have greater computational speed.
- Transistors required no warm-up time and consumed less electricity.

2.5.3. Third Generation (1965 – 1970):

- In 3rd generation of computers, Integrated Circuit(IC) replaced transistors. Integrated circuit was consisted of thousands of transistors fabricated in a single silicon chip.
- ICs were smaller in size and had better performance than transistors.
- Keyboard and monitors were used as input and output devices.
- PASCAL was used as a high level language.

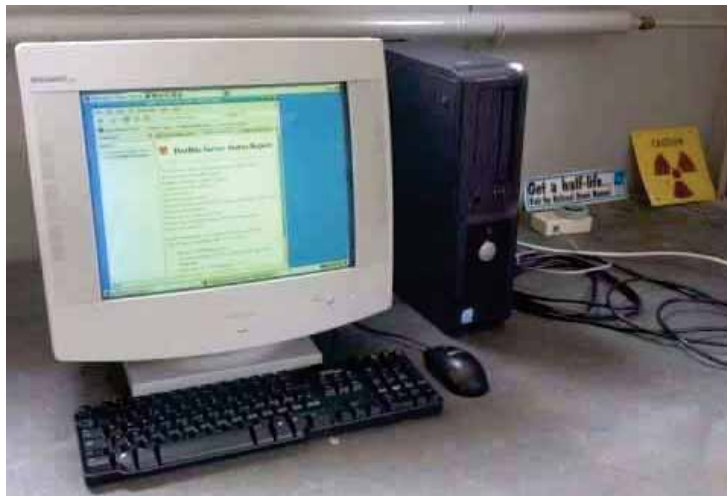


Figure-8: Third Generation Computer.

2.5.3.1. Advantages:

- Integrated circuits were more reliable.
- Silicon chips were cheap because of their small size and they also consumed less electricity.

2.5.4. Fourth Generation (1980)

- Fourth generation of computer was based on two technologies, Large Scale Integration (LSI) and Very Large Scale integration (VLSI). In LSI technology, about 30,000 electronic components were fabricated in a single chip, while in VLSI technology about one million electronic components were fabricated in a single chip.
- Keyboard and monitors were used as primary input /output devices
- Magnetic tape was also used as an input/output storage devices.

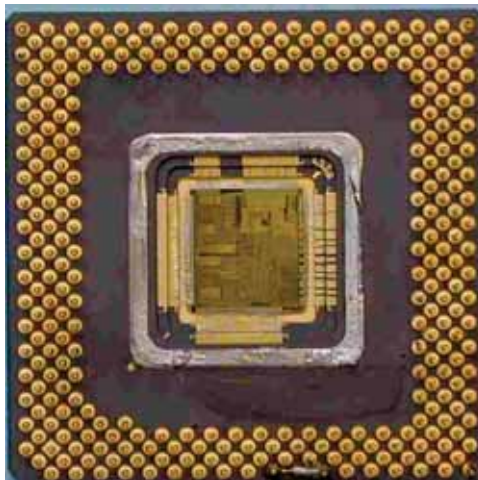


Figure-9: 4th Generation Technology.

2.5.5. Fifth Generation (late 1990's)

- In Fifth generation computers Voice recognition was used as an additional special feature. Voice recognition is also called speech recognition. It is the ability of a device to receive and interpret dictation.
- Optical fiber technology was introduced for communication. Optical fiber is normally made of glass, through which light can be transmitted.
- Artificial Intelligence technology was also introduced. Artificial Intelligence acts like a human being, for example Robot Artificial Intelligence made the computers to have thinking power and reasoning.



Figure-10: 5th generation computer.

2.6. Classification of Computer

Classification of computer fall into two broad categories

- Size (Physical Appearance)
- Purpose.(Objectives)

2.6.1. Size

Size deals with the physical appearance. According to size computers are further classified into following sub classes.

2.6.1.1. Microcomputer

A Microcomputer is derived from the word micro which means smaller in size. It is also called a personal computer, because it is mostly used in the homes for general purpose tasks like to make drawings, budget, listening music etc. Micro computer uses microprocessor as its central processing unit.



Figure-11: A Microcomputer.

2.6.1.2. Laptop Computer

Laptop computers are also called notebook computers. This type of computer is portable and compact in size. Laptops are popular because they are easy to carry anywhere for example in traveling etc. It can also be used with the help of its internal battery.

All components like keyboard, mouse, etc of the laptop are placed in one unit. Laptops are usually expensive as compare to Microcomputers.



Figure-12: A Laptop Computer.

2.6.1.3. Minicomputer

A minicomputer usually falls between a microcomputer and a mainframe. A minicomputer supports hundreds of users simultaneously.

Examples: Pec Master, Toshiba DS1 and AS400



Figure-13: A Minicomputer.

2.6.1.4. Mainframe

Mainframes were in cupboard size computers than PC/mini computers /laptop computers. These were expensive and their processing speed was extremely high. Mainframe computers were used to store, manage, and process large amounts of data that need to be reliable, secure, and centralized. The main feature of mainframe computer was capable of supporting thousands, of users simultaneously. A mainframe computer had the capability to execute many programs run at the same time.

Examples: IBM – 360, NEC Mainframe



Figure-14: A Mainframe Computer.

2.6.1.5. Handheld Computer

Handheld computers are very much smaller in size, which can be easily carried out in hands. These computers use small keyboards and screens. Mostly handheld computers are mainly designed to facilitate personal information manager functions, such as a calendar and address book. Handheld computers are also called PDAs, palmtops and pocket computers. Examples: CS40 ,CK70,CK71 etc.



Figure-15: A Handheld Computer.

2.6.1.6. Palmtop

These are the computer which can be easily carried out in hands or palm and that is why these are called palmtop computers. Palmtops are specifically designed for special functions like phonebooks and calendars. Palmtops use a special device called a pen as an input device.

Examples: Nokia 9500, Nokia E90 etc



Figure-16: A Palmtop Computer.

2.6.1.7. PDA (Personal Digital Assistant)

PDA stands for Personal Digital Assistant. PDA is a type of palmtop computer or handheld device which contains features of the computing, telephone/fax, and networking. A PDA can also perform function of a cellular phone, fax sender, and personal organizer. PDAs also use pen based device as an Input rather than keyboard.

Examples: Nokia 770, Nokia N800 etc.



Figure-17: A Personal Digital Assistant.

2.7. Purpose

According to purpose computers are divided into following sub classes.

- 2.7.1 Digital Computer
- 2.7.2 Analog Computer
- 2.7.3 Hybrid Computer

2.7.1. Digital Computer:

Digital computer processes information in the form of characters and digits.

It displays output in the form of characters, digits, charts & graphics.

Digital computers are also called personal or general purpose as daily life problems such as making home budget, playing games, listening music etc can be solved.



Figure-18: A Digital Computer.

2.7.2. Analog Computer

Analog computers are specifically used for special purpose applications such as wheel balancing, measuring temperature, velocity etc. These type of computers deal with continuous type of data rather than digits.

These computers display their output in the form of electrical waves rather than digits. Therefore these computers are mostly used in the scientific laboratories.

2.7.3. Hybrid Computer

Hybrid computers have the capability to process both the digital data as well as analog data. The hybrid computers are especially helpful in the science laboratory where both analog and digital data is required for processing.



Figure-19: A Hybrid Computer.

2.8. Applications of Computer:

Due to the remarkable progress of the computer technology, it is useful almost in every aspect of life. Some of the important fields are as under:

2.8.1 Education

2.8.2 Business

2.8.3 Banking

2.8.4 Defense

2.8.5 Entertainment

2.8.1. Education

Computer technology is playing a very vital role in education sector; College students get their study notes, tutorials and even text books and solution manuals with the help of internet technology. It also enhances the student's learning and help to improve the quality of education. One of the great

revolutions in education is the e-learning.



Figure-20: Computer in Education.

2.8.2. Business

Computer technology is playing a very important role in productivity and competitiveness of Businesses. Sales and Marketing departments are very important in any business sector and internet has become a very vital tool for the sale and marketing. A customer can now easily buy and purchase products and the payments can be made just by using smart cards, internet banking, and electronic deposit or even can pay his bills online.



Figure-21: Computer in Business

2.8.3. Banking

Banking sector is also getting great benefit from using computer technology. Internet banking is an example of modern banking where a customer can easily check balance while sitting at his home, and can transfer funds without any queuing or physical fatigue. In fact computer technology has enormously saved the user time.

ATM (any time money) is another example of modern banking sector. A user can now draw money through ATMs anywhere and anytime that is round the clock.



Figure-22: Computer in Banking Sector

2.8.4. Defence:

The computer technology has productive application in defense. Computer technology is used in Intercontinental Ballistic Missiles, Rocket etc that uses GPS(Global Position System) to help the missile to hit the specified target.

Computer technology is used to track incoming missiles and also help the weapons systems to locate incoming target.

Computer technology is also used in tanks and aeroplanes and ships to target the specified targets of the opponent.

More important the computer technology has the capability to design and test new systems.



Figure-23: Computer in Defense

2.8.5. Entertainment:

Computer technology has also provided enormously high opportunities for entertainment and pleasure. In restaurants, the computer technology has now changed the trend to order the food items. Instead; a person sitting on the computer directly enters your required food items and their respective cost and finally gives you a computerized receipt. For example “Savour Foods” restaurant, where a man sitting on his computer gets your order and enter into the computer and then hand over a printed receipt to the customer. The customer then shows his receipt and collects his items.

In movies, computer technology has brought a great revolution in movies or cinema sector by introducing 3-D technology, which enhances the quality of graphics.

2.8.6. Sports

In sports, computer technology is used for record keeping. Computer is used to collect and analyze the statistics and displays the updated score. Computer also helps to sell tickets, create training programs and even suggests diets for athletes.

2.9. Important Terms:

2.9.1. Buses:

Buses are the electrical paths through which data is transferred from one location to another location within a computer system.

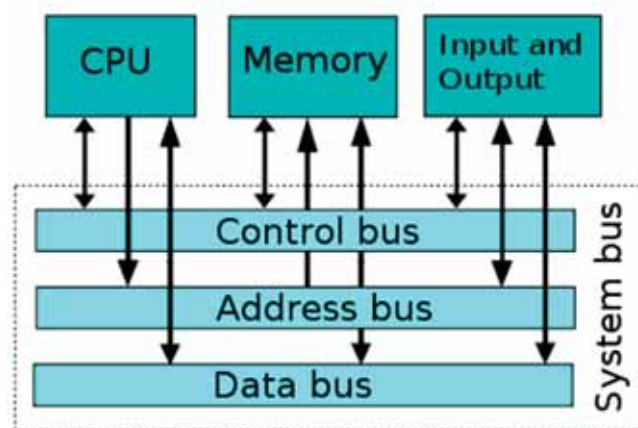


Figure-24: Computer Buses

There are number of different computer buses, which are as follows:

2.9.1.1. Data Bus:

Data bus uses the combination of wires, to transfer the data. Data bus is bi-directional.

2.9.1.2. Address Bus.

An Address bus is also called memory bus. It carries the memory addresses, which are required by the microprocessor for reading and writing the data.

An Address bus works only in one direction.

2.9.1.3. Control Bus:

Control bus is also called Command bus. It carries all kind of travelling within the computer. This bus works in both directions.

There are two important terminologies which are used to define the operations of computer buses. This includes the followings

- **Width:**

The size of the bus is also called its width. Width means; how much data can be transferred at one time.

- **Clock speed:**

Every bus has its own speed, which is called a clock speed. It is measured in Mega Hertz (MHz)

For example: If a bus is of 8 bits, it means that it can transfer 8 bit of data at one time.

- **Computer Ports:**

Computer ports are basically an interface or a link through which data or information is communicated. There are three types of ports:

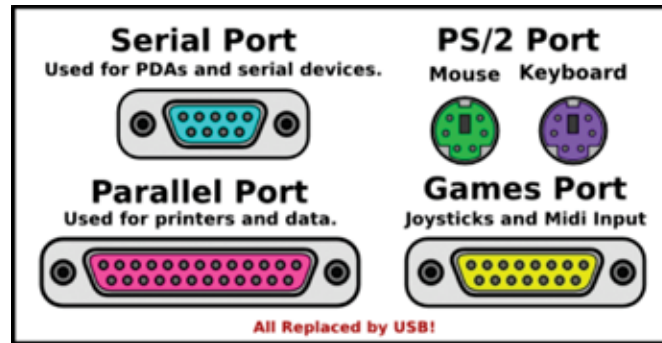


Figure-25: Computer Ports

- **Serial Port**
- **Parallel Port**
- **USB Port**

- **Serial Port:**

Serial port is also called male port. Normally serial port uses 9 to 24 pins which are used for keyboard and mouse. Serial port transfers data one bit at a time; that is why it is slow in processing. Serial ports are also known as communication ports or RS232C ports. Serial ports are used to connect devices like mouse and modem.

- **Parallel Port**

Parallel port is also known as female port. It consists of 25 pins. This port is normally used for connection of printers and scanners etc. Parallel port is capable to transfer 8 bits of data at one time but parallel to each other. Therefore Parallel port is faster than serial port.

- **USB (Universal Serial Bus)**

Universal Serial Bus does not use the concept of Pins like serial or parallel

port. USB is easy to use and portable; that is why every device is now converted to USB port like printer, scanner, digital camera etc.

2.9.2. Microprocessor

Microprocessor is also called brain of computer. Microprocessor is normally in the form of a silicon chip containing millions of transistors fabricated on it and is called CPU (Central Processing Unit). Intel and Motorola are well known brand of microprocessors. Microprocessor consists of the following different components

2.9.2.1. ALU (Arithmetic & Logical Unit)

The Arithmetic & Logical Unit is an important part of a CPU which has the capability to do arithmetic and logical operations. Arithmetic operations are simple mathematical operations.

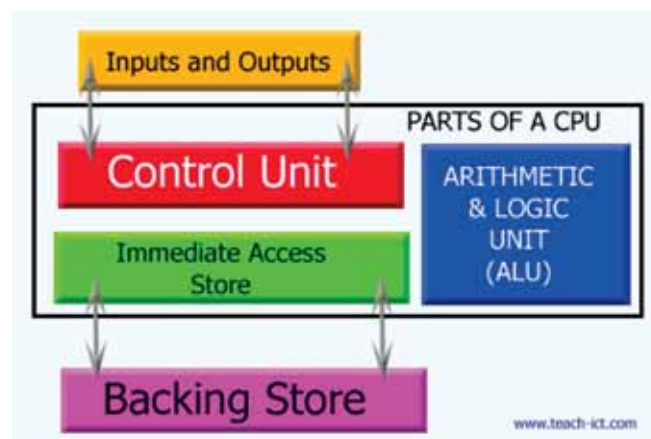


Figure-26: CPU Parts

For Example:

$$2 + 5 = 7$$

$$6 - 5 = 1$$

Logical operations are different because these operations are based on some conditions or criteria

For Example:

IF $A > B$

print A

else

Print B

In this example if the value of A is greater than B then computer will print A otherwise print value of B

2.9.2.2. Control Unit:

Control unit supervises all the components of the computer. First of all control unit selects the input /output device and then it flows the data between the I/O devices and the memory device.

Control unit brings instructions from memory unit and then executes them in an appropriate order.

2.9.3. Memory:

Memory is the place where the data or programs are stored temporarily, which are needed during the data processing.

Memory is further divided into two types

2.9.3.1. Primary Memory

Primary memory is also called main memory of the computer. Primary memory keeps several storage locations, which are called locations or cells and the data or programs are stored in these memory locations. Primary memory is called volatile, because when a computer system is shutdown all the data existing in memory is erased. Normally a computer memory is measured in term of bytes. Byte is the combination of 8 bits. Bit is a single binary digit in the binary codes that is 0 or 1.

Primary memory is further divided into the following categories

- **Dynamic Random Access Memory(DRAM)**
- **Static Random Access Memory(SRAM)**

- **DRAM**

DRAM stands for *Dynamic Random Access Memory*. DRAM is a kind of main memory which is cheaper & dynamic in the sense that it is refreshed after every few milliseconds. It is refreshed after sometime while static RAM is not refreshed & this memory is expensive. DRAM is slower than SRAM memory, because DRAM memory has to be refreshed many times. The capacity of DRAM's data reading is 60 nano seconds.



Figure-27: DRAM

- **SRAM**

SRAM stands for Static RAM. It does not need refreshing. Static RAM is generally used for cache memory, which can be accessed more quickly than DRAM. SRAM is faster than DRAM because it is not refreshed as DRAM.



Figure-28: SRAM

2.9.3.2. Secondary Memory:

Secondary memory is also called secondary storage or auxiliary storage. These devices are used to store large amount of data permanently. These are called non volatile memory, because after shutting off the computer, the data is not erased. These are further divided into the following categories.

Types of Storage Media

- **Hard Disks**
- **Optical Disks**
- **Magnetic Tape**

- **Hard Disks**

A **hard disk** is part of a computer system, which is also called a hard drive or **fixed** drive. Hard disk is primarily used to store large amount of data and also provides a very quick access to retrieve the data or programs. Hard disk is available in different sizes. Like 320 GB (Giga byte) & 400 GB etc.



Figure- 29: Hard Disk

- **Optical Disk**

An **optical disk** is used as an electronic data storage medium, which can be written and read using a low-powered laser beam.

Optical disks are available in the following Formats:

- **Compact Disk (CD)**
- **Digital Versatile Disk (DVD)**

- **Compact Disk(CD):**

A **compact disk** is non volatile storage medium, which is used for recording, storing, and playing back audio, video, and computer data.

Compact disks are available in the following types:

- **CD-R**
- **CD-RW**

- **CD-R**

CD-R - is a compact disk on which data can be written only once and therefore CD-R is called read-only memory. Data cannot be erased from CD-R.



Figure-30: CD-R

- **CD-RW**

CD-RW (CD-Re-writeable) is used to write the data more than one time and can also erase the previous contents of data. CD-RW are little bit expensive than CD-R.



Figure-31: CD-RW

- **DVD:**

DVD (Digital Versatile Disk) has the capability to store large amount of data,

movies etc than CD. DVDs are rapidly replacing CDs just because of their higher capacity and performance



Figure- 32: DVD-ROM

DVDs are further classified into the followings.

- **DVD-R (Recordable)**

DVD-R is used to record the data only one time. It can't be recorded or rewritten again due to the nature of DVD-R.



Figure-33: DVD-R

- **DVD-RW(Rewriteable)**

DVD-RW is used to record the data multiple times. However previous data can also be erased from it.



Figure-34: DVD-RW

2.9.4. Motherboard of Computer system:

The circuit board of the computer is called a mother board of the computer. It is called motherboard because it contains the key elements or components due to which a computer can't work properly. The key elements mounted on motherboard include microprocessor, computer memory, serial & parallel ports and expansion slots etc.

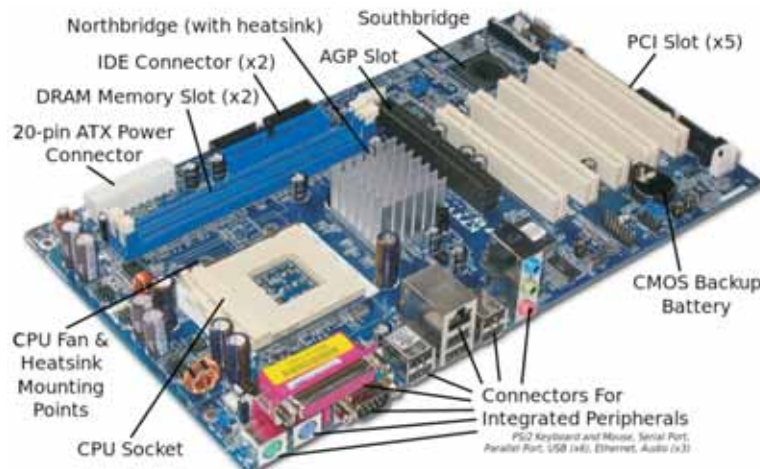


Figure-35: Mother Board

2.9.5. SELFASSESSMENT QUESTIONS

Q.No.1. What is computer? Describe basic five operations performed by the computer.

Q.No.2:

a) Write full form of the followings.

i. ALU

ii. CU

iii. CPU

b) Define Volatile & Non Volatile Memory? Explain with proper examples.

Q.No.3:

a) What is the importance of Port in Computer System? Name any four Computer ports.

b) Can Computer buses play an important role in communication of data? How?

Q.No.4. In what respect Digital computer is better than Hybrid computer?

Q.No.5. Discuss the classification of computer with examples.

Q.No.6. Explain some important computer applications.

Q.No.7. What is the difference between memory and the hard disk?

Q.No.8. Clarify the difference between History and generation of

computer.

Q.No.9. Explain briefly first four computer generations with proper examples.

Q.No.10. Define and explain the followings with proper examples.

i. Microprocessor ii. Secondary storage devices iii. Input devices.

2.9.6. SELFASSESSMENT ACTIVITIES:

- 1 Describe important applications of computers in education and practically show them to your teacher.
- 2 Explore the different computer buses on the motherboard and practically show their results to your teacher.
- 3 Observe the working of different input devices.
- 4 Describe motherboard of the computer and show the result.