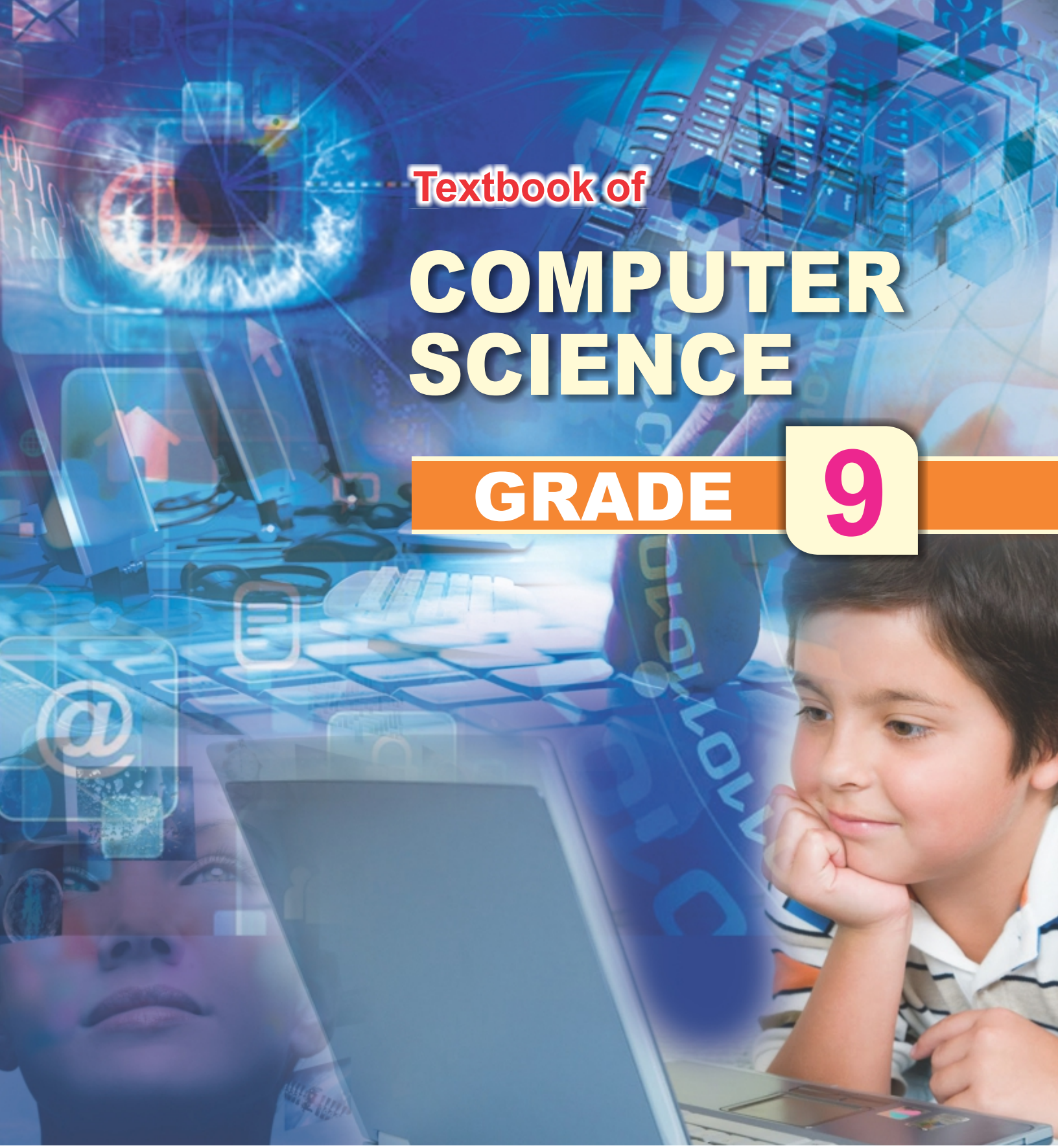

Textbook of

# COMPUTER SCIENCE

## GRADE 9

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# COMPUTER SCIENCE

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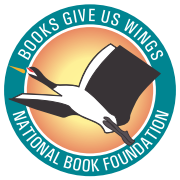


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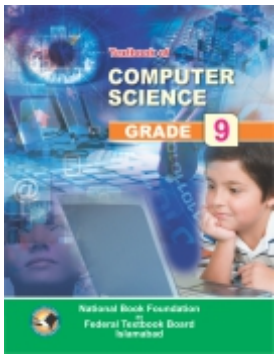


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|---|---|---|
| Content Authors | : | **Mohammad Sajjad Heder, MS (Computer Science), USA**<br>**B.E (Mechanical Engineering), Korea**<br>**Mohammad Khalid, MS (Computer Science), B.Ed.**<br>**University of Peshawar, Pakistan.** |
| Elaborator / Designer | : | **Hafiz Rafiuddin, Shahzad Ahmad** |
| Editor | : | **Mr. Majeed-ur-Rehman Malik** |
| Desk Officer | : | **Dr. Zulfiqar Ali Cheema (EO) CD & TP Wing** |
| Management of | : | **Mr. Ishtiaq Ahmed Malik** |
| Supervision of | : | **Prof. Dr. Attash Durrani (T.I., S.I.) Advisor FTBB (NBF), Member National Council** |

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# PREFACE

The textbook of COMPUTER SCIENCE for GRADE - 9 has been developed according to the National Curriculum 2009. This book is an Introduction to Computer Science consisting of six chapters.

Computer has become integral part of our daily life as it plays vital role in every field. In today's modern world, people are highly dependent on computer for daily activities. Students must have computer education to understand how computer systems work. Computer education teaches computational thinking and problem solving skills applicable in any industry. Jobs of the future will demand computer literacy from just about any individual. Therefore, it is paramount to take drastic steps in the application and education of this subject to ensure the bright future of our country.

This textbook is developed with due care using simple language, supporting pictures to make it understandable by secondary school students. Keen efforts have been made to minimize the errors and omissions. This will surely enhance the confidence and comprehension of the students and general readers in the subject. Yet there is always room for improvement and any suggestion with regard to the quality of work will be warmly welcomed at our end. The test items given in the exercises are for learning reinforcement. The examination questions are to be prepared according to the SLO's and the Bloom's Taxonomy.

Quality of Standards, Pedagogical Outcomes, Taxonomy Access and Actualization of Style is our motto. With this slogan the textbook is presented again. It will be revised accordingly in the light of feedback.

**Dr. Inam ul Haq Javeid**
(Pride of Performance)
Managing Director
National Book Foundation

# *TABLE OF CONTENTS*

1

# FUNDAMENTALS OF COMPUTER

**After completing this lesson, you will be able to:**

- Know about the evolution of computer
- Describe brief history and generations of computer
- Define the types of computers (Analog, Digital and Hybrid)
- Differentiate between mainframe, mini and microcomputers
- Describe the use of computers in various fields
- Know the scope of the careers in the field of Information Technology
- Describe the components of computer (input/output devices, system unit and computer memory)
- Differentiate between port, expansion slot and expansion card
- Explain the input/output, processing and storage operations
- Define operating system, device drivers, utility programs and language processors
- Identify the use of productivity, business, entertainment and education software
- Elaborate open source software, shareware and freeware

## UNIT INTRODUCTION

This Unit “Fundamentals of Computer” covers a foundational understanding of computer hardware and software along with how to get the most value and impact from computer technology. In this unit the history of computer is discussed so that students can understand how computers have evolved from very simple calculating devices to the modern electronic computing. It also provides material on application of computers in various fields to describe the role of computer in modern society and its impact on our daily life.

# 1.1 INTRODUCTION TO COMPUTER

Today's world is an information-rich world and it has become a necessity for everyone to know about computers. A computer is a general-purpose programmable machine. Computer is

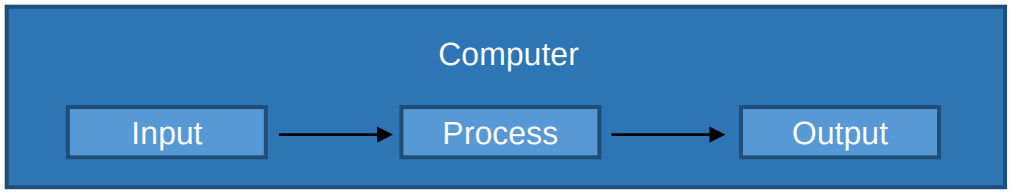


**Fig.1-1 Computer processing system**

an advanced electronic device that takes raw data as input from the user and processes it under the control of set of instructions (called program), gives the result (output), and saves it for the future use. It has the ability to store, retrieve and process data. It processes data at very high speed according to the instructions given to it and produces accurate results. The instructions given to a computer to perform a particular task is known as computer program. Computer processing system is shown in Fig.1-1.

## 1.1.1 EVOLUTION OF COMPUTER

Evolution of computers means how the computers evolved from the first mechanical device, abacus, to electromechanical and then to the modern electronic digital computers.

### Abacus

Abacus was the earliest calculating device most probably invented in China.

**TITBITS**
Abacus is still seen at some toy shops, made of plastic or wood for small children.

It consisted of a wooden frame having parallel rods as shown in Fig.1-2. These rods had a number of wooden beads which could slide freely along the length of rods. While performing calculations, beads were moved up and down with fingers. Abacus was used to perform addition, subtraction, multiplication and division. It has been used in China and some other Asian countries till the end of 20$^{th}$ century.

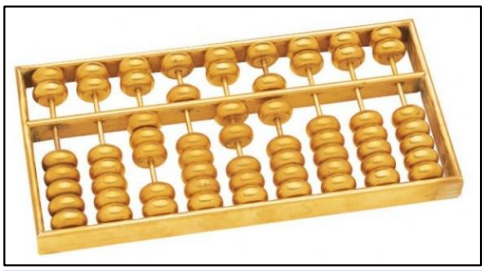

**Fig.1-2 Abacus**

### Napier's Bone

John Napier, a Scottish mathematician invented a calculating device called Napier's Bone in 1614 which is shown in Fig.1-3. It consisted of a wooden box containing rotating cylinders each of which had the digits from 0 to 9. It could multiply, divide and find square roots of numbers by using simple addition and subtraction. His biggest achievement was the invention of logarithm.

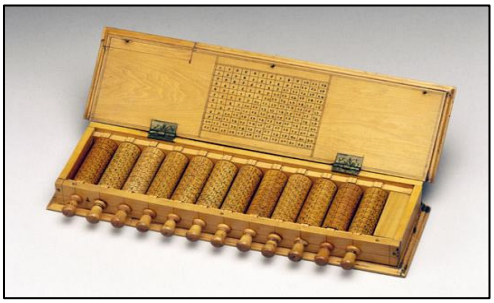

**Fig.1-3 Napier's Bone**

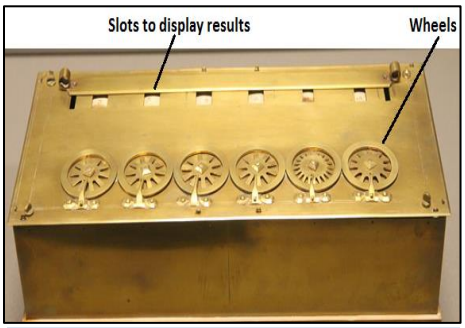


Fig.1-4 Pascaline

## Pascaline

Blaise Pascal, a French mathematician invented a calculating machine called Pascaline in 1642 when he was only 19 years old. Pascaline used rotating wheels as shown in Fig.1-4. Each wheel had ten parts having digits from 0 to 9. Calculations were performed by the rotation of wheels. When one wheel completes a rotation, the next wheel moves by one digit. It had a number of small slots for displaying the result. It could perform addition and subtraction on whole numbers.

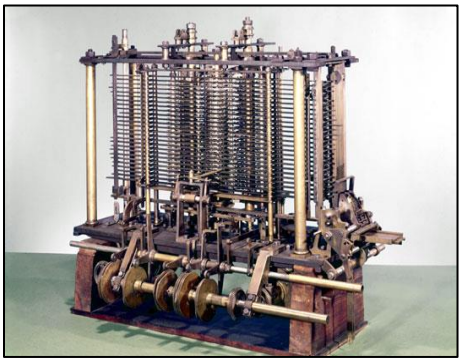

Fig.1-5 Analytical Engine

## Difference Engine and Analytical Engine

In 1822, the English mathematician Charles Babbage started working on a big calculating machine about the size of a room. He called it Difference Engine.

Babbage worked for many years on this machine but he could not complete it. Later, he came up with idea of Analytical Engine which is shown in Fig.1-5. He could not complete it because the technology was not advanced enough but he laid the foundation stone of modern digital computers. Today's modern digital computers are based on the idea of analytical engine. Charles Babbage is known as the father of modern digital computers.

Fig.1-6 Hollerith Desk

## Hollerith Desk

In 1890, Herman Hollerith built a tabulating machine called Hollerith Desk as shown in Fig.1-6. This machine was invented to help with the census of 1890 in America. Hollerith Desk consisted of a card reader which sensed the holes in the cards, a gear driven mechanism which could count and a large set of dial indicators to display the results. After building Hollerith Desk, Hollerith started a company by the name of Tabulating Machine Company. Eventually this company changed its name to International Business Machines (IBM).

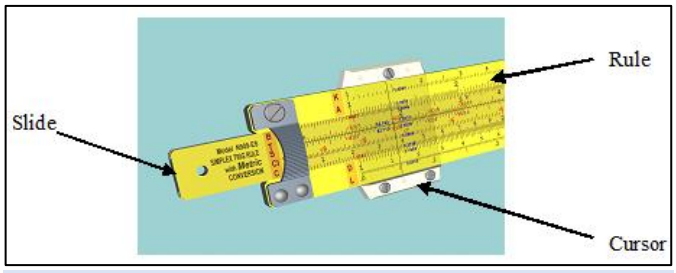


Fig.1-7 Slide Rule

## Slide Rule

Based on the idea of logarithm, English mathematician, William Oughtred developed a device called Slid Rule in 1920s. It was very useful for solving problems that involved

multiplications and divisions. It has three parts, slide, rule and a transparent sliding cursor as shown in Fig.1-7.

**DO YOU KNOW?**
Slide rule was replaced by electronic pocket calculator in the early 1970s.

### Mark-I

The next successful computing machine invented was a digital computer known as Mark-I. It was invented by Howard Aiken in 1944. Mark-I could add three numbers having eight digits in one second. It could print out its results on punched cards or on an electric typewriter. Mark-I was 50 feet long, 8 feet high and weighed about 5 tons. It used 3,000 electric switches. Mark-I is shown in Fig.1-8.


**Fig.1-8 Mark-I Computer**

Since computer evolution is a continuous process, it has not stopped in the modern era. New systems are being developed to provide voice recognition and understand natural languages. ***High performance computing (HPC***) is being used in today's data centers for fast data processing. High-performance computing (HPC) is the use of parallel processing for running advanced application programs efficiently, reliably and fast.

The concept of "***Cloud Computing***" has been introduced. In the simplest terms, cloud computing means storing and accessing data and programs over the Internet instead of computer's hard drive. The current advancements in computer technology are likely to transform computer into intelligent machine having thinking power. The evolution of computers will probably continue till their processing capabilities have become equal to human intelligence or even beyond that.

## 1.1.2 HISTORY AND GENERATIONS OF COMPUTER

History of computers is a chain that runs from the ancient abacus and the analytical engine of the nineteenth century, through the modern computers of present age. It is generally divided into five generations. Each generation of computers is characterized by major technological developments of that time.

### First Generation Computers (1940 – 1956)

Vacuum tubes were used in the first generation computers. Vacuum tubes generated so much heat that they had to be cooled by air conditioner. Vacuum tubes burnt out very often and it was difficult to repair and maintain the computers of first generation. A vacuum tube is shown is Fig.1-9.

**Fig.1-9 Vacuum Tube**

The following are the characteristics of first generation computers.

- First generation computers used vacuum tubes.
- Speed was slow and memory was very small.
- They were huge in size taking up entire room.

- First generation computers were very expensive and unreliable.
- They consumed a lot of power and generated a lot of heat.
- Input was based on punched cards.
- Output was obtained on printouts through electric typewriter.
- Machine language was used in these computers.

Some examples of first generation Mini/Mainframe computers are ENIAC, UNIVAC I, IBM 604, Mark-I and EDSAC.

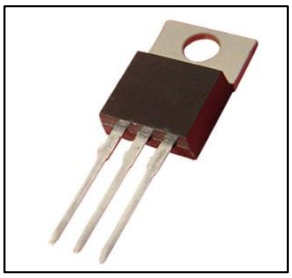

Fig.1-10 Transistor

## Second Generation Computers (1956 – 1963)

In 1947, three scientists, William Shockley, John Bardeen and Walter Brattain invented transistor shown in Fig.1-10. Transistor functions like a vacuum tube. It replaced the vacuum tubes in the second generation computers. Transistor was faster, more reliable, smaller and much cheaper than vacuum tube.

The following are the characteristics of second generation computers.

- Transistors were used instead of vacuum tubes.
- Transistors reduced the size of computers and increased the speed and memory capacity.
- Computers became more reliable and cheaper.
- Second generation computers used punch card readers, magnetic tapes, magnetic disks and printers.
- Assembly language was used in these computers.
- High level programming languages, FORTRAN and COBOL were introduced in this generation of computers.

Examples of second generation computers are UNIVAC II, IBM 7030, 7780 and 7090, NCR 300 series, General Electric GE 635 and Control Data Corporation's CDC 1604 computers.

## Third Generation Computers (1963 – 1971)

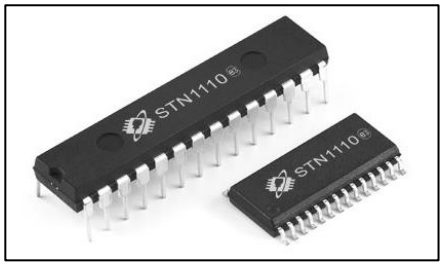


Fig.1-11 IC Chips

Integrated Circuits (ICs), also known as semiconductor chips were used in third generation of computers instead of transistors. IC chips were developed in early 1960s. A single IC chip contains a large number of transistors. IC chips increased the power and decreased the cost of computers. Invention of IC chips was a great breakthrough in advancing computer technology. IC chips are shown in Fig.1-11.

The following are the characteristics of third generation of computers.

- Third generation computers used IC chips.
- IC chips improved the speed and memory of computers.
- Computers consumed less electricity, became smaller, cheaper and more reliable than second generation computers.
- Keyboard and monitor were used with the computer.
- These computers could run different application programs at the same time.

**DO YOU KNOW?**
Intel invented the world's first microprocessor, the Intel 4004 in November, 1971.

Some examples of third generation computers are Burroughs 6700, IBM System/360, System 3 and Control Data Corporation's 3300 and 6600 computers.

## Fourth Generation Computers (1971 – Present)

In this generation of computers LSI (Large Scale Integration) and VLSI (Very Large Scale Integration) chips having millions of transistors were developed. Microprocessor was also developed in fourth generation of computers. A microprocessor is a single chip that can handle all the processing of a computer. A microprocessor is shown in Fig.1-12.


**Fig.1-12 Microprocessor**

The following are the characteristics of fourth generation of computers.

- Microprocessor was developed which resulted in the development of microcomputers.
- Fourth generation computers are very fast, have large storage capacity and use advanced input/output devices.
- Microcomputers are very small in size, very reliable, consume less power and are affordable.
- Large variety of software is available for use in microcomputers.
- Operating system having Graphical User Interface (GUI) was developed in this generation.
- These computers support multimedia software that combines text, image, sound and video.
- These computers support modern programming languages such as Visual Basic, C++, Java and Python for developing powerful software.
- Fourth generation computers support a large variety of portable and wireless input/output devices.

Some examples of microprocessors developed in fourth generation of computers are Intel Pentium series, Dual Core, Core2 Duo, Core i3, i5, i7 and AMD Athlon.

Some examples of fourth generation computers are IBM ThinkPad series, HP Pavilion series, Dell Inspiron series and Apple's MacBook Pro and MacBook Air series.

## Fifth Generation Computers

The goal of fifth generation of computers is to develop devices that can understand natural languages and have thinking power. This is a big challenge for computer developers and programmers to design such systems and software for them.

The following are the characteristics of fifth generation of computers.

**For your Information**
Artificial Intelligence is the branch of computer science concerned with making computer behave like humans.

- Fifth generation computes are based on Artificial Intelligence (AI).
- In the fifth generation of computers, AI will minimize the need to write programs.
- These computers will allow users to give commands in any natural language such as English.

Examples of fifth generation computers are robots and expert systems.

## 1.1.3 TYPES OF COMPUTERS

On the basis of data representation, processing, Input and Output, Computers can be classified into the following three types.

**Fig.1-13 Analog computer**

- Analog Computers
- Digital Computers
- Hybrid Computers

### Analog Computers

Analog computers represent and process data by measuring quantities such as voltage and current to solve a problem. They work on supply of continuous signals as input and display output simultaneously. Analog computers are special purpose devices, designed to perform single specific task. Mostly these devices are used in engineering and scientific applications. The accuracy of analog computers is low but they are faster in speed as compared to digital computers. They mainly consist of electrical devices such as resisters, capacitors, transistors, etc. An analog computer with volt meter is shown in Fig.1-13.

### Digital Computer

Digital computer works with digits. Everything in a digital computer is represented with binary digits 0s and 1s. It manipulates them at very fast speed. Data and instructions are fed into the digital computer through an input device in the form of 0s and 1s. The computer performs calculations on data according to the instructions given in a computer program. The results of calculations are displayed on monitor or printed on printer. A digital computer is shown in Fig.1-14.

**Fig.1-14 Digital Computer**

Digital computers can store and process large amount of information at high speed. The results produced by digital computers are reliable and accurate. Digital computers are general-purpose computers, used in various fields.

### Hybrid Computers

Hybrid computers are the combination of analog and digital computers. They combine the characteristics of both analog and digital computers. Hybrid computers are mainly used for scientific applications. These computers are used in spaceships, missile systems, scientific research, hospitals and for controlling industrial processes.

A hybrid computer known as Vital Sign Monitoring Unit is shown in Fig.1-15. It is used in hospitals to monitor patient's important data such as blood pressure, temperature, respiration and heartbeat.


**Fig.1-15 A Hybrid Computer (Vital Sign Monitoring Unit)**

## 1.1.4 CLASSIFICATION OF DIGITAL COMPUTERS

Digital computers are classified into mainframe, minicomputer and microcomputer based on their size, speed, storage capacity and the number of users they can support.

### Mainframe Computer

Mainframe computers were developed in early 1940s. A mainframe computer is a very large, very powerful and expensive computer that can support hundreds and even thousands of users at the same time. Therefore, these computers are used in large organizations.

The modern mainframe computers that use cutting edge technology are the foundation of today's business in banking, insurance, education, air travel, research, health care, government and many other public and private organization. These computers can execute more than trillion instructions per second (TIPS). Some examples of mainframe computers are IBM's z Enterprise EC12, EC 196, HP 16500 Series and HP Integrity Superdome. A mainframe is shown in Fig.1-16.

**Fig.1-16 Mainframe computer**

## Minicomputer

Minicomputer was introduced in the 1960s when IC chips were introduced. A minicomputer is bigger than a microcomputer but smaller than a mainframe. These computers can execute billions of instructions per second (BIPS). Therefore, they can process more data than microcomputers. Today, minicomputers with cutting edge technology are playing an important role in business organizations for their data processing requirements. These are used in organizations that have hundreds of users such as PIA, NADRA, police departments, hospitals, etc. A minicomputer is shown in Fig.1-17. Examples of minicomputers are IBM System/36 and HP 3000.

**Fig.1-17 Minicomputer**

## Microcomputer

Microcomputers are the smallest and the low cost computers. These computers are most commonly used in homes and offices. Microcomputer was introduced in 1970s when microprocessor was developed. A microprocessor is a single chip that controls the operations of the entire computer system. Modern microcomputers have large storage capacity and they can execute millions of instructions per second (MIPS). A variety of software is available for use in these computers.

**Do you know?**
Today, microprocessor is not only used in microcomputers, they are also used in the devices including mobile phones, microwave ovens, cameras, washing machines, televisions, etc.

Microcomputers are available in various forms such as desktop, laptop and tablet as shown in Fig.1-18. Some popular companies that manufacture microcomputers are IBM, Dell, HP, Toshiba and Acer. A microcomputer is also known as Personal Computer or PC. IBM Lenovo series, Dell XPS series and HP Envy series are some popular microcomputers.

**Fig.1-18 (a) Desktop** **(b) Laptop** **(c) Tablet Microcomputer**

# 1.2 ROLE OF COMPUTER

Computer plays important role in modern society and it has changed it in many ways. It is the best invention ever made in the history of modern technology. It has brought advancement in various fields of life.

## 1.2.1 USE OF COMPUTERS IN VARIOUS FIELDS

### Education

Role of computers in education has been given a lot of importance in the recent years. Computer technology eases the process of learning. Many programs are available for students to learn the subjects of Physics, Mathematics, Chemistry, Biology, etc. Multimedia software makes the process of learning interactive and interesting. It combines text, graphics, sound and video for effective learning. Internet has enormous information on a wide variety of subjects. Students can refer to Internet to find information on any topic. Nowadays computers with multimedia projectors are being used in classrooms for effective teaching. All the activities related to examinations are also being controlled using computers. Therefore, it plays an important role in education. Today, computer education is a part of curricula from elementary to university level. Use of computer in education is shown in Fig.1-19.

**Fig.1-19 Use of computer in education**

Fig.1-20 Use of computer is business

## Business

Computers are used in all types of businesses as shown in Fig.1-20, to improve productivity. They help in running business activities efficiently. They are used to prepare business documents, reports, charts, presentations, invoices, etc. They help in staying in contact with employees and customers. The following are some important business areas where computers are used.

- Computer technology has revolutionized the banking business. Deposits and withdrawals are instantly logged into a customer's account. Accurate monthly bank statements are generated with the help of computer. Computer networks allow amount of bill to be transferred from customer's bank account to the store. People can obtain cash any time anywhere through Automated Teller Machine (ATM).
- Computers are used in retail stores. Bar code readers are linked to computer system that are used to read the bar code printed on each product sold to prepare the bill. With the use of computers at retail stores, the checkout process is faster and the bill produced is accurate.
- Electronic commerce, also known as e-commerce allows to sell products and services by means of computer networks such as Internet.
- Computers are very helpful in running many other types of businesses that include hotel, hospital, school, travel agency, real estate, stock exchange, etc.

Fig.1-21 Use of computer in cockpit of fighter plane

## Defense

There are various applications of computer technology in defense. Computers are used in tanks, planes and ships to target enemy forces. They help in tracking missiles and destroying them. Modern defense weapons and other equipment are controlled by computers. Computers are used for designing and testing of weapons. Computers are also used in communication systems in defense. Fig.1-21 shows application of computer in a fighter plane.

### Media

Computers have lot of applications in print and electronic media. Print media refers to mass communication through printed material. Computer technology helps in preparation and production of newspapers, magazines, booklets and brochures, flyers, press releases and books. Electronic media refers to broadcast media that includes radio broadcast, cable and satellite television broadcast and the new-age media like Internet and mobile devices. Computer is used for television broadcasting as shown in Fig.1-22.

**Fig.1-22 Use of computer in television broadcasting**

### Manufacturing

Now days, computer technology is widely used in manufacturing industry. It has improved the accuracy, quality and speed of manufacturing. Computers are used for product design and automation of manufacturing process in factories as shown in Fig.1-23. This is known as Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM). CAD involves the use of computer hardware and graphics software to create product designs. CAM involves the use of computer in planning and management of production operation. It helps in automatically producing finished products. CAD/CAM technology has been applied in many industries, including automobile, electronics, machine components, textiles, fashion, etc.


**Fig.1-23 Computer controlled manufacturing machines**

## 1.2.2 CAREERS IN INFORMATION TECHONOLOGY (IT)

### Software Engineer

Software engineer is a highly skilled person in the field of IT whose responsibilities involve the analysis, design, implementation and maintenance of computer software. Software engineer can be further classified into programmer and system analyst.

- **Programmer**

Computer programmers are IT professionals who have extensive knowledge and expertise in programming languages. They program the computer by writing step-by-step instructions that tell the computer what to do. Computer programmers write programs to solve problems related with business, education, engineering, government offices, hospitals, entertainment, etc.

- **System Analyst**

System analysts analyze the data processing requirements of organizations and develop information systems to implement them. They investigate problems, plan solutions, and recommend the type of hardware and software required for implementing the solution. They also coordinate with the programmers and database administrators in developing information systems.

### Hardware Engineer

Hardware engineers design and manufacture computer hardware. Their work also involves repair and maintenance of computer hardware. They have in-depth knowledge of internal working of computers, processors, circuit boards and other electronic equipment.

### Network Administrator

Network administrators are responsible for installation, configuration and maintenance of computer networks in organizations. They are in charge of maintenance of computer hardware and software that make up a computer network. They assign passwords to network users so that unauthorized people do not have access to network.

### Database Administrator

Database administrator is a person who is responsible for the design, implementation and maintenance of a database in an organization. He is also responsible for maintaining security and monitoring the performance of database.

### Web Designer

Web designer is a person whose job is to plan and create websites. He designs web pages that include text, images, sound, video clips and make the website interactive. HTML (Hypertext Markup Language) is the most commonly used language for creating websites.

### Multimedia Designer

Multimedia designers are people who organize and present information in an easy to understand and attractive manner. They combine text, graphics, animation, audio and video. Multimedia designers create digital images and arrange them in sequence for animation using computer software. They have the skills to edit and manipulate audio/video files. They usually work in film/TV industry, computer software companies and advertising companies.

### Information Security Analyst

Information security analyst is a person whose job is to protect information and information systems from unauthorized access, use, modification, recording or destruction. He implements procedures and policies to ensure information security within the organization.

### Computer Teacher

Computer teacher teaches the subject of computer science to students to make them computer literate. He conducts lessons on how to operate computers and the working principles and concepts of computer hardware. He also teaches how to develop computer programs using various programming languages.

# 1.3 COMPUTER HARDWARE

Computer hardware refers to the physical components that make up a computer system.

## 1.3.1 HARDWARE COMPONENTS OF COMPUTER

Hardware components of a computer system are classified into input devices, system unit, storage devices, output devices and memory.

### INPUT DEVICES

All the devices used to feed data into the computer are known as input devices. Input devices allow us to communicate with the computer. Some commonly used input devices are keyboard, mouse, microphone, scanner, barcode reader, digital camera and touch screen.

**POINT TO PONDER:**
Why the keys on keyboard are not arranged in alphabetical order?

- **Keyboard**

**Fig.1-24 A standard keyboard**

It is the main input device to communicate with the computer. It allows the computer user to enter letters, numbers and special symbols into the computer. A keyboard is shown is Fig.1-24.

- **Mouse**

It is a hand-held device used to control the movement of cursor or pointer on the screen. It has two or three buttons at the front that allows the computer user to make selection in menu, draw graphics or open files, folders and programs. A mouse is shown is Fig.1-25.

**Fig.1-25 Mouse**

- **Microphone**

It is a device that allows computer user to input audio into the computer. It changes audio signals into electrical signals which are translated into digital form by the sound card for processing in the computer. A microphone is shown in Fig.1-26.

**Fig.1-26 Microphone**

Fig.1-27 Scanner

- **Scanner**

It is a device that captures images from photographs, magazines, books etc. and stores them in computer in digital form. These images can be edited, displayed on the screen or inserted in documents. A scanner is shown in Fig.1-27.

- **Barcode Reader**

It is a device that reads the barcode printed on products that represents product code, description and price. This information is used by the computer to print bill for the customer. A barcode reader is shown in Fig.1-28.

Fig.1-28 Barcode Reader

Fig.1-29 Digital Camera

- **Digital Camera**

It is a device used to capture pictures and store them in digital form. These pictures can be downloaded to computer for editing, viewing or inserting in documents. A digital camera is shown in Fig.1-29.

- **Touch Screen**

It is a pressure-sensitive display screen that is used to interact with the computer by touching pictures or words with finger. Touch screen is more commonly used with mobile phone and tablet. A touch screen is shown in Fig.1-30.

Fig.1-30 Touch Screen

## SYSTEM UNIT

System unit is the main part of computer. It includes motherboard, power supply and drives (such as DVD and hard disk) inside the computer casing. All the input/output devices of a computer are connected to system unit through the ports.

- **Motherboard**

Motherboard is the main circuit board inside the system unit. It contains microprocessor, main memory, expansion cards, many IC chips, connectors and other electronic components. It has many buses (electric pathways) printed on it. These are used to transmit information between various components of the computer. All the input/output devices are connected to the motherboard. A motherboard is shown in Fig.1-31.

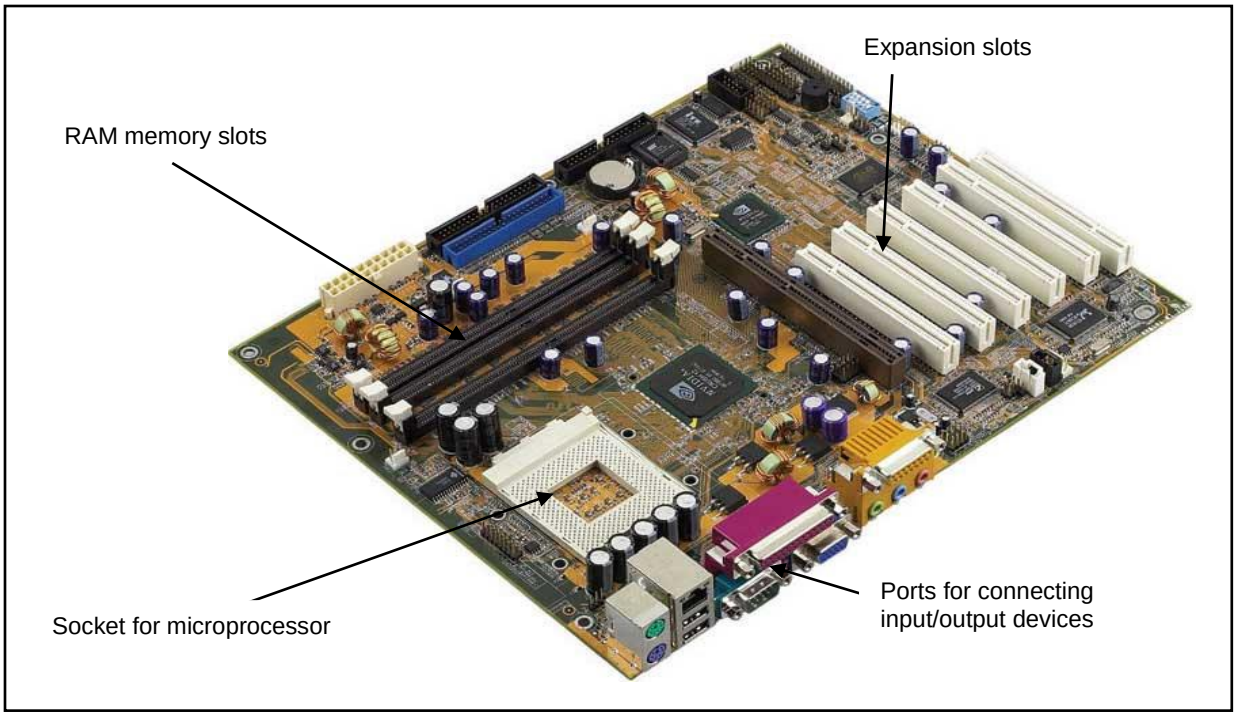


**Fig.1-31 Motherboard**

- **Microprocessor**

A microprocessor is the main chip on the motherboard that controls all the activities of the computer. It is also known as Central Processing Unit (CPU) or simply processor. It contains Control Unit (CU), Arithmetic Logic Unit (ALU) and registers. A microprocessor and the block diagram of CPU are shown in Fig.1-32.

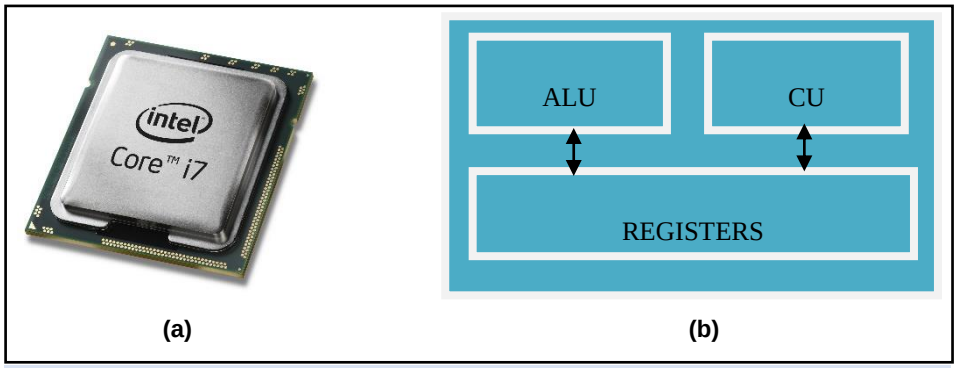


**Fig.1-32 (a) Microprocessor (b) Block diagram of microprocessor**

**ALU** is the part of the computer that performs all the calculations and comparisons. It consists of arithmetic unit and logic unit. Arithmetic unit performs all the arithmetic operations such as addition, subtraction, multiplication and division. Logic unit performs logical operations which include comparisons of numbers or alphabets.

**Control unit** controls the operations of all the components of the computer. It controls the working of all the input/output devices, storage devices and ALU. CU loads programs into memory and executes them. It consists of very complicated circuits.

**Registers** are small memory units inside the microprocessor used to temporarily store some information during the execution of a program. Some commonly used registers are Instruction Register, Accumulator Register, Data Register and Memory Address Register.

## STORAGE DEVICES

Storage devices are used to store programs and data that are not currently used by the computer. They have huge storage capacity. Therefore, they are also known as mass storage devices or secondary memory. Hard disk is the most commonly used storage device that is fixed inside the system unit. Portable storage devices are CD, DVD, memory cards and USB flash drive. Portable storage devices have less storage capacity than hard disk but they are cheap and easy to carry.

- **Hard Disk**

A hard disk is a magnetic storage device used to store computer data. It has storage capacity of hundreds of Gigabyte (GB). It is fixed inside the computer casing. Portable hard disk is also available that is attached to USB port.

- **CD**

CD stands for Compact Disk. It is a portable optical storage device with a storage capacity of 700 Megabytes (MB). A CD is 1.2 millimeter thick with a diameter if 120 millimeters. CD drive is used to read data from or write data to a CD.

- **DVD**

DVD stands for Digital Versatile Disk. It has the same thickness and diameter as CD but has more storage capacity. Its storage capacity is in the range of 4 to 16 GB. A DVD writer is installed in the computer to read data from or write data to a DVD. A CD can also be used in a DVD writer.

- **Memory Card**


**Fig.1-33 Memory Card**

Memory card is a small storage device having storage capacity of few Gigabytes. It is available in different sizes and storage capacities. Memory cards are generally used in laptop computers and portable devices such as mobile phone and digital camera for storing pictures, audio and video. A memory card is shown in Fig.1-33.

- **USB Flash Drive**

USB flash drive is a small portable drive that is connected to computer through USB port. It is also known as USB memory. It is very fast in operation and its storage capacity is up to 128 GB till now. A USB flash drive is shown in Fig.1-34.

**Fig.1-34 USB Flash Drive**

## OUTPUT DEVICES

Output devices are used to display text, graphics, and images on the monitor or to print information on paper. Information displayed on monitor is known as softcopy and anything printed on paper is known as hardcopy or printout. Commonly used output devices are monitor, printer, plotter and speaker.

- **Monitor**

It is an output device that has a screen on which information is displayed. It has two common types i.e. CRT (Cathode Ray Tube) monitor and LCD (Liquid Crystal Display) monitor. CRT monitor is very similar to old television. It is almost obsolete due to its big size and low display quality. LCD monitor is slim, uses less power and has better display quality than CRT monitor. CRT and LCD monitors are shown in Fig.1-35.

(a) (b)

**Fig.1-35 (a) CRT Monitor (b) LCD Monitor**

- **Printer**

Printer is an output device that prints text and graphics on paper which is known as hardcopy. There are two types of printers which are impact and non-impact printers.

**FOR YOUR INFORMATION:**
The first high-speed printer was developed in 1953 by Remington Rand (an early American business machines manufacturer) for use on UNIVAC computer.

***Impact printer***

Impact printer uses electro-mechanical mechanism which causes the character shape to strike against the paper and leave an image of the character on the paper. Dot matrix printer is the most commonly used impact printer. The printing speed varies from 50 to 500 cps (characters

(a) (b) (c)

**Fig.1-36 (a) Dot Matrix Printer (b) Inkjet Printer (c) Laser Printer**

per second). Their printing is very cheap but print quality is poor. They produce lot of noise while printing. These printers are still in use for printing invoices, bank statements, utility bills, etc. A Dot matrix printer is shown in Fig.1-36(a).

***Non-Impact printer***

Non-Impact printer prints without striking the paper. There are two types of non-Impact printers which are inkjet and laser printers. Inkjet printer stores ink in cartridge and sprays on paper through fine nozzles on the print-head. Laser printer uses technology similar to photocopying machine. Laser printer is more expensive, faster and has very high print quality compared to inkjet printer. Inkjet printers are used in all sectors such as homes and simple businesses. Laser printers are perfect for large scale businesses. Inkjet and laser printers are shown in Fig.1-36.(b,c).

- **Plotter**

Plotter is an output device used for printing engineering drawings, machine parts, building designs, maps, charts and panaflexes etc. on large size papers/sheets. Such large size printing is not possible on printers. It is more expensive than printer. There are two types of plotters, that is, ink plotter and pen plotter. Ink plotter is used for printing images whereas pen plotter is used for printing engineering drawings, machine parts, building designs, etc. Plotter is a slow output device but its printing quality is good. A plotter is shown in Fig.1-37.

**Fig.1-37 Plotter**

**Fig.1-38 Speakers**

- **Speaker**

Speaker is a device used to produce audio output. A pair of speakers is attached to the sound card on the motherboard. Speakers are commonly used with multimedia software and for playing music and videos on computer. A pair of speakers is shown in Fig.1-38.

## MEMORY

Memory unit stores data and programs that are being executed by the computer. It also stores the results produced by the ALU after processing the data. There are three types of memories on the motherboard which are ROM (Read Only Memory), RAM (Random Access Memory) and Cache. These are known as main memory or primary memory of computer.


**Fig.1-39 ROM chip**

### ROM (Read Only Memory)

ROM is a single IC chip which is installed on the motherboard as shown in Fig.1-39.

It stores the Basic Input/Output System (BIOS) of computer that controls input/output devices and the start-up or boot process. BIOS

programs test the computer's components when it is turned on and then load the operating system into the RAM to make the computer ready for operation.

BIOS programs are permanently stored in ROM when it is manufactured. It is non-volatile memory, that is, the programs stored in it are not lost when the computer is turned off. There are three common types of ROM which are PROM (Programmable ROM), EPROM (Erasable Programmable ROM) and EEPROM (Electronically Erasable Programmable ROM).

### RAM (Random Access Memory)

RAM is high speed memory installed on the motherboard. It is READ/WRITE memory. Information can be read from or written into it. Programs are loaded into RAM from secondary storage devices such as hard disk or USB flash drive for execution by the microprocessor. It is volatile memory which means information stored in it, is lost when the computer is turned off.

RAM modules are installed in the memory slots on the motherboard. RAM modules are shown in Fig.1-40

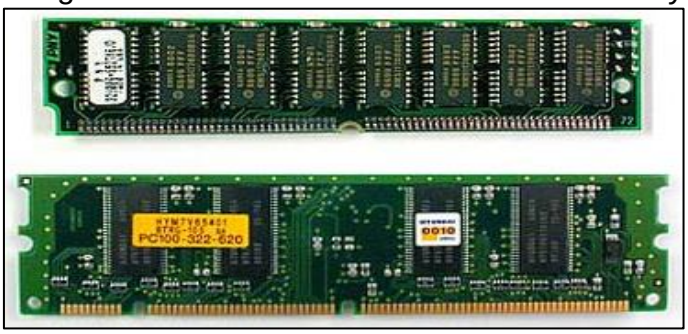

**Fig.1-40 RAM modules**

### Cache Memory

Cache is a very small amount of extremely fast memory inside the microprocessor or on the motherboard. It is faster and more expensive than RAM. It stores information that is most frequently used by the computer. The purpose of using cache is to improve the processing speed of computer.

There are three types of cache memories which are Level 1 (L1), Level 2 (L2) and Level 3 (L3) as shown in Fig.1-41. L1 cache is built inside the microprocessor whereas L2 and L3 are on the motherboard. L1 cache is faster than L2 and L3 cache.

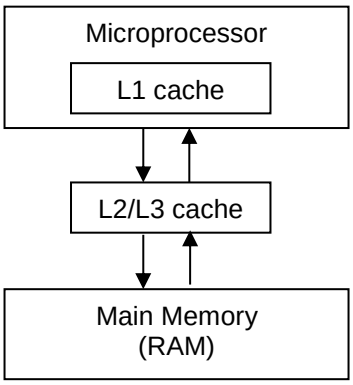


**Fig.1-41 L1, L2 and L3 Cache Memories**

## 1.3.2 PORTS, EXPANSION SLOTS AND EXPANSION CARDS

### PORTS

Port is an interface for connecting various devices to the system unit. These are located on the motherboard and are usually seen at the back of the system unit. There are various types of ports for connecting keyboard, mouse, monitor, microphone, speakers and other input/output devices as shown in

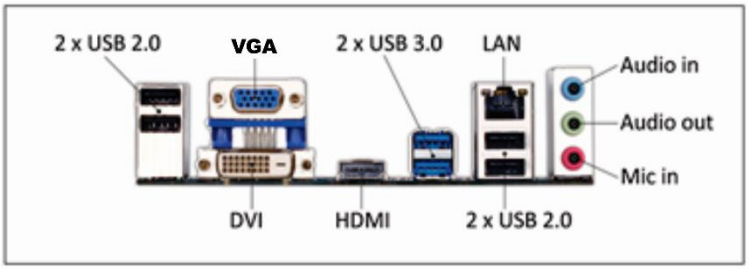


**Fig.1-42 Ports on motherboard**

Fig.1-42(a). In modern computers, USB (Universal Serial Bus), HDMI (High Definition Multimedia Interface), DVI (Digital Visual Interface), Audio and LAN (Local Area Network) ports are used for connecting various devices to the computer. These devices include digital camera, scanner, printer, external hard disk or DVD writer and USB memory, etc.

### EXPANSION SLOTS AND EXPANSION CARDS

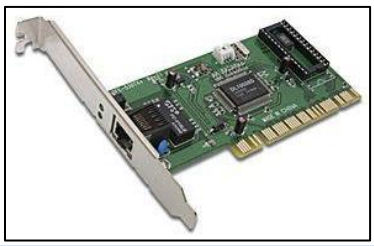

**Fig.1-43 Network card**

Expansion slots are long narrow sockets on the motherboard used for installing expansion cards. Expansion cards are small circuit boards. These cards add new capabilities to the computers. Commonly used expansion cards are sound card, graphics card, modem card and network card. In modern computers these cards are built-in on the motherboard. A network card is shown in Fig.1-43.

## 1.4 BASIC OPERATIONS OF A COMPUTER

The following four basic operations are performed by computers which are shown in Fig.1-44.

- Input operation
- Processing operation
- Storage operation
- Output operation

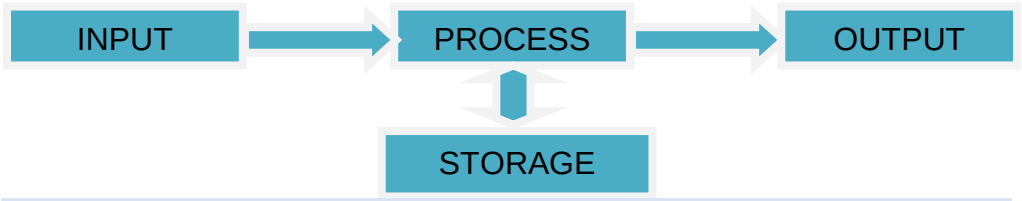


**Fig.1-44 Basic operations of a computer**

### Input Operation

A computer is a data processing machine. Users enter data and instructions into the computer through keyboard or mouse. It can also be provided to the computer from a storage device such as hard disk, CD or USB memory. The input data/instructions are stored in memory for further processing.

### Processing Operation

Microprocessor processes the data according to the instruction given to it. The microprocessor fetches the data/instructions from the memory and stores it in instruction register. The control unit then decodes the instruction to find out which operation is to be performed. After decoding the instruction, it sends signals to other parts of the computer to execute it.

### Storage Operation

The results produced after processing are stored in memory before they are sent to the output device or permanent storage device like hard disk.

### Output Operation

The results of data processing stored in memory must be output so that they can be seen by the user. The control unit displays the results on the monitor or prints it on the printer. Results can also be saved in a storage device such as hard disk for use in the future.

## 1.5 COMPUTER SOFTWARE

Computer programs are known as computer software. Computer program is a set of instructions that tells a computer what to do and how to do. It is classified into two categories, system software and application software.

### 1.5.1 SYSTEM SOFWARE

System software is a collection of programs which makes the use of computer easy and efficient. Highly experienced computer programmers develop system software. Following are the types of system software.

- Operating system
- Device drivers
- Utility programs
- Language processors

### Operating System

An operating system is system software that is responsible for the management and coordination of all the activities performed by the computer. It provides the environment in which the user can interact with the computer hardware to operate the computer. The most popular operating system used in microcomputers is the Windows.

The following tasks are performed by the operating system.

i. It loads programs into memory and executes them.
ii. It controls the operation of input/output and storage devices.
iii. It manages files and folders.
iv. It allows to create password to protect computers from unauthorized use.
v. It detects hardware failures and displays messages to fix them.

### Device Drivers

A device driver is system software that controls the operation of a computer device. When users attach a device such as printer or scanner to their computer, they should install its driver also to make it operational. Device drivers are provided by device manufacturers.

### Utility Programs

Utility programs perform specific tasks that are related to the management of the computer.

The following are some commonly used utility programs that perform specific tasks.

- Windows Explorer: It is used to manage files and folders.
- Backup utility: It is used to make backup of data.

- WinZip utility: It is used to compress files.
- Diagnostic utility: It is used to detect hardware and software problems.
- Antivirus software: It is used to detect and remove viruses.

### Language Processors

A language processor is a system program used to translate computer programs into machine language. Machine language is directly understood by the computer. Therefore, all the programs must be translated into machine language before execution by the computer. Compiler and interpreter are language processors used to translate high level language programs into machine language. A program called assembler is used to translate assembly language programs into machine language.

## 1.5.2 APPLICATION SOFTWARE

Application software is developed for computer users to solve their problems such as preparing a letter, creating a presentation or managing a database. Commonly used application software includes productivity software, business software, entertainment software and education software.

### Productivity Software

Productivity software includes word-processing, spreadsheet and database management software packages. These software packages are used by individuals to speed up their daily routine tasks by doing their work in an organized and efficient way.

### Business Software

Any software that helps in running business in a more efficient way to improve productivity is known as business software. Some examples of commonly used business software are accounting, sales and marketing, inventory control, project management and payroll software.

### Entertainment Software

Software developed to entertain people is known as entertainment software. Video games are one of the most popular forms of entertainment software. Many games are lot of fun to play but sometimes they can also help to improve skills such as typing or reading. The term edutainment merges games and education software into single software. Edutainment software is used mainly for entertainment but it educates as well.

### Education Software

Software developed for educational purpose is known as education software. A large variety of education software has been developed. Education software includes typing tutor, spelling tutor, language learning, medical and healthcare, driving test and flight simulation software, etc.

## 1.5.3 OPEN SOURCE SOFTWARE, SHAREWARE AND FREEWARE

### Open Source Software

It is computer software that is available in the form of source code that allows users to study, change and improve it. Open source software is free for use, modification and distribution. Some examples of open source software are Linux operating system, OpenOffice (office productivity software), Flight Gear (flight simulator) and Java programming language, etc.

### Shareware

Shareware is distributed free of cost for a limited period, usually one or two months. It is trial version of software given to people to decide whether they would like to buy the full version of the software. Some shareware is installed on new computers when they are sold. Examples of shareware are antivirus software and computer games, etc.

### Freeware

Freeware is given free of cost and it is full version of software for an unlimited period of time. It may have some restrictions such as allowed for personal or academic use only.

Examples of freeware are Google Chrome, Mozilla Firefox, VLC media player, etc.

### Key Points

- Computer is a general-purpose programmable machine that has the ability to store, retrieve and process data that is represented in the form of 0s and 1s.
- First generation computers used vacuum tubes and their period was from 1940 to 1956.
- Second generation computers used transistors and their period was from 1956 to 1963.
- Third generation computers used IC chips that were developed in early 1960s and their period is from 1963 to 1971.
- Fourth generation computers use LSI and VLSI chips and their period is from 1971 to present.
- Fifth generation of computers is concerned with development of devices that can understand natural languages and have thinking power.
- Analog computer represents and processes data by measuring quantities such as voltage and current to solve a problem. It works on supply of continuous signals as input and displays output simultaneously.
- Digital computer works with binary digits 0 and 1. Data and instructions are fed into digital computer through an input device such as keyboard. The computer performs

calculations on data according to the instructions and displays results on monitor or prints on printer.

- Hybrid computer is a combination of analog and digital computers. It combines the characteristics of both analog and digital computers.
- Mainframe computer is a very large, very powerful and expensive computer that can support hundreds and even thousands of users at the same time.
- Minicomputer is bigger than microcomputer but smaller than mainframe. It is used in organizations that have hundreds of users.
- Microcomputer is the smallest and the low cost computer. It is the most commonly used computer in homes and offices.
- Software engineer is a highly skilled person in the field of IT whose responsibilities involve the analysis, design, implementation and maintenance of computer software.
- Computer programmer is an IT professional who has extensive knowledge and expertise in programming languages. He programs the computer by writing step-by-step instructions that tell the computer what to do.
- System analyst analyzes the data processing requirements of organizations and develops information systems to implement them.
- Hardware engineer is an IT professional who designs and manufactures computer hardware.
- Network engineer is a person who is responsible for installation, configuration and maintenance of computer networks in organizations.
- Database administrator is a person who is responsible for the design, implementation and maintenance of a database in an organization.
- Web designer is a person whose job is to plan and create websites.
- Multimedia designer is a person who designs multimedia software by combining text, graphics, animation, audio and video.
- Information security analyst is a person whose job is to protect information and information systems from unauthorized access, use, modification, recording and destruction.
- Computer teacher is a person who teaches the subject of computer science to students.
- Computer hardware refers to the physical components that make up a computer system.
- Computer software is a set of instructions that tells a computer what to do and how to do.
- System software is a collection of programs which makes the use of computer easy and efficient.
- Operating system is system software that is responsible for the management and coordination of all the activities performed by the computer.

- Application software is developed to solve the problems of computer users such as writing letter, creating presentation or managing a database.
- Open source software is a program that is freely available in the form of source code that allows users to study, change and improve it.
- Shareware is trial version of software that is distributed free of cost for a limited period, usually one or two months.
- Freeware is software given free of cost for an unlimited period of time.

## Exercise

**Q1. Select the best answer for the following MCQs.**

i. Who invented logarithm?

A. Blaise Pascal
B. John Napeir
C. Charles Babbage
D. Herman Hollerith

ii. Which generation of computer used transistor?

A. 1st Generation of Computers
B. 2nd Generation of Computers
C. 3rd Generation of Computers
D. 4th Generation of Computers

iii. In which generation of computer microprocessor was introduced?

A. 1st Generation of Computers
B. 2nd Generation of Computers
C. 3rd Generation of Computers
D. 4th Generation of Computers

iv. Which of the following computer supports thousands of users at the same time?

A. Microcomputer
B. Minicomputer
C. Mainframe computer
C. Laptop computer

v. Who is responsible for protecting information and information systems from unauthorized people in an organization?

A. System Analyst
B. Information Security Analyst
C. Network Administrator
D. Hardware Engineer

vi. Which of the following is the fastest memory?

A. USB flash drive
B. RAM
B. ROM
D. Cache

vii. What type of software a device driver is?

A. Application software
B. Business software
C. System software
D. Productivity software

viii. Which of the following is volatile memory?

A. RAM
B. ROM
C. USB flash drive
D. Hard disk

ix. Which software is distributed free of cost for a limited period as a trial version?

A. Open source software
B. Shareware
C. Freeware
D. Productivity software

x. When were IC chips developed?

A. Early 1960s
B. Early 1970s
C. 1980s
D. 1990s

## Q2. Write short answers of the following questions.

i. Describe Napier's Bone and Slide Rule.
ii. Compare 1st and 3rd generation computers.
iii. Differentiate between analog and digital computers.
iv. Ahmed, a class IX student is asking his father to replace his home computer CRT monitor with LCD monitor. How will you justify his demand?
v. What will happen if storage devices are removed from a computer?
vi. Differentiate between systems software and application software.
vii. How a student can use computer to improve academic performance?
viii. Give any three uses of computers in a school library.
ix. Name few house hold appliances in which microprocessor is used.
x. What are the tasks performed by operating system?

## Q3. Write long answers of the following questions.

i. Describe the five generations of computers.
ii. Write a note on mainframe, minicomputer and microcomputer.
iii. Explains the basic operations of a computer.
iv. Write short note on the following.

a. Hardware Engineer
b. Network Administrator
c. Database Administrator
d. Web Designer

e. Multimedia Designer

v. Describe the following types of application software.

a. Productivity software
b. Business software
c. Entertainment software
d. Education software

## Lab Activities

**Activity 1:** Demonstrate how input/output devices are connected to the system unit of the computer.

**Activity 2:** Students should be shown components of computer such as RAM, ROM, microprocessor, ports, expansion slots and power supply attached to the computer system.

2

# FUNDAMENTALS OF OPERATING SYSTEM

**After completing this lesson, you will be able to:**

- Know the objectives of operating system
- Get familiar with functions of operating system
- Differentiate between common types of operating systems (Command Line Interface, Menu Driven Interface and Graphical User Interface)
- Define single user and multi-user operating systems
- Describe batch processing, time-sharing processing and real-time processing
- Identify the basic icons of operating system having graphical user interface
- Manage data (files/folders)
- Install operating system
- Install office automation software
- Install anti-virus software

## UNIT INTRODUCTION

Computer user must know how to give commands to the computer to operate it properly. Therefore, this unit is dedicated to provide basic knowledge about operating system. It teaches the user how to use the operating system to run programs and manage files and folders. It describes the steps involved in installation of operating system, office automation software and antivirus software in computer. It presents material about the operating system used in modern computers and those used in the past. This will teach the user about the advantages of modern operating system over the old operating systems.

# 2.1 INTRODUCTION

Operating system is a collection of system software that controls the working of computer system. It acts as an interface between the computer user and computer. It facilitates program execution and helps in developing application programs.

## 2.1.1 OBJECTIVES OF OPERATING SYSTEM (O.S.)

The main objectives of the operating system are convenience and efficiency. It makes the computer more convenient to use. It allows computer resources such as CPU, memory, input/output devices and Internet to be used in an efficient manner. It can be viewed as a resource manager.

## 2.1.2 FUNCTIONS OF OPERATING SYSTEM

The following are the main functions of operating system.

- Process Management
- Memory Management
- Input/Output Management
- File Management
- Resource Management
- User Management

### Process Management

Process management is an essential part of operating system (OS). A process is a program in execution. In computer system multiple processes are executing concurrently or waiting for their turn to be executed. A process in execution needs resources like processing resource, memory and I/O resources. The OS must allocate resources to processes, enable processes to share and exchange information, and protect the resources of each process from other processes.

### Memory Management

Memory management is the process of allocating memory space for user programs in main memory. When programs are run by users, the operating system allocates portions of free memory to programs. When a program is closed, operating system will free the memory portion used by that program for reuse. The operating system automatically loads user programs in available memory space and executes them.

### Input/Output Management

Input/output management is the process of controlling the operation of all the input/output devices attached to computer. User communicates with computer through various input/output devices such as keyboard, mouse, monitor printer, etc. Management of these devices is the responsibility of operating system. Operating system uses Input/Output controller to manage and coordinate the operation of all the input/output devices.

### File Management

File management system is part of operating system that organizes stores and keeps track of computer files and folders. Computer files can be documents, programs, images, videos, etc. Operating system controls the common operations performed on files. These operations include creating, opening, editing, renaming, moving, copying, deleting and searching files.

### Resource Management

Operating system automatically manages the resources of a computer when application programs are executed by computer user. The resources of a computer include microprocessor, memory and all the devices attached to the computer. Operating system allocates resources of a computer to the application program according to the user's requirement in an efficient way to improve the performance of the computer.

### User Management

User management is an important feature of operating system for maintaining a secure computer system. The operating system gives full control over a computer system to a person known as administrator. Administrator installs various programs on the computer system for users. He also creates and manages user accounts. When a user account is created, the user is assigned a user name and a password. Administrator allows the users to run various application programs that are installed on the computer. A user can login to the computer system by entering the user name and password, run programs and save his files in his personal folder. Operating system does not allow the users to install programs or create new users.

## 2.1.3 COMMON TYPES OF OPERATING SYSTEMS

There are three types of operating systems based on ways of interaction with computer (interface). The three types of interfaces are:

- Command Line Interface
- Menu Driven Interface
- Graphical User Interface (GUI).

### Command Line Interface (CLI)

In CLI, commands are given to computer with keyboard. It is based on textual input. The user types in a command and presses the Enter key to execute it. Two commonly used operating systems that use CLI are DOS (Disk Operating System) and UNIX. CLI is difficult to use because users have to remember the commands to perform any task.

- **Disk Operating System (DOS)**

DOS was the most popular CLI operating system. DOS displays the prompt (C:\>) to enter commands. User must know the syntax of the command. DOS commands are difficult to remember. Some DOS commands are still supported by the new Windows operating system. It is a single user and single task operating system.

The following are some examples of DOS commands with their description

| | |
|---|---|
| DIR | Display the contents of current directory (folder) |
| FORMAT D: | Format the D drive |
| CD\PICS | CD stands for Change Directory, which makes PICS the current directory |

**DO YOU KNOW?**
Microsoft introduced the MS DOS in 1981 and it was replaced by Windows 3.0 in 1990.

Some DOS commands are shown in Fig.2-1.

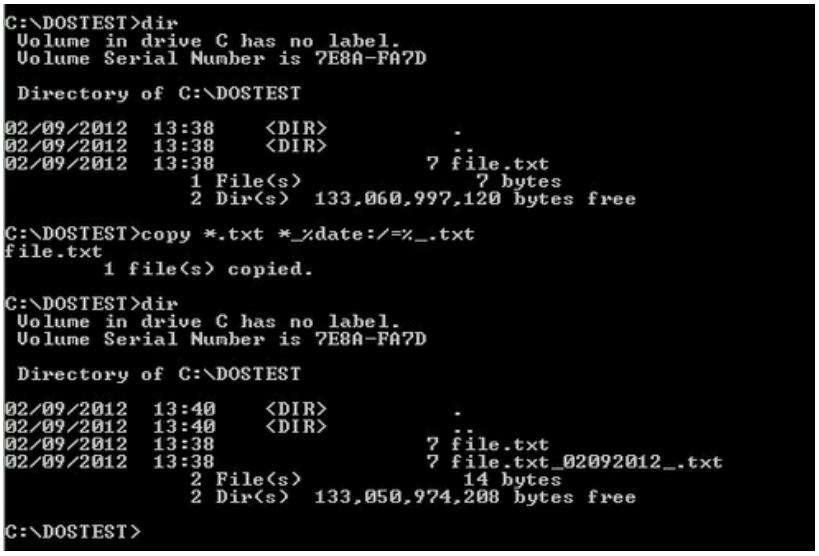


**Fig.2-1 DOS Interface**

- **UNIX**

UNIX is a multi-user CLI operating system introduced in 1969. It allows multiple users to run different programs at the same time. UNIX was developed for use on large computer system


**Fig.2-2 UNIX Interface**

(Mainframe). It uses a command line interface but later Graphical User Interface was also introduced. UNIX commands are shown in Fig.2-2.

## Menu Driven Interface

Menu driven interface presents a menu on the screen, user makes a choice and then the next menu appears. The user makes another choice and so on. Menu driven interface is easy to use as compared to CLI. The user reads the options and makes his choices. Menus contain the commands to use the operating system. Menu driven interface is also used in some application programs and other devices such as mobile phone and iPod.

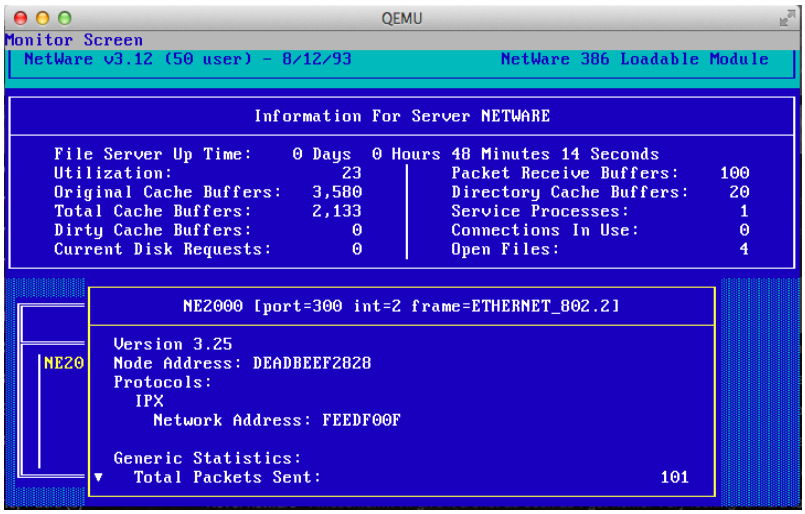


**Fig.2-3 Novell Netware Interface**

The following are two common menu driven operating systems

- **Novell's Netware**

Novell's Netware was a menu-driven operating system that was used in the past. Its first version was released in 1993. Novell's Netware interface is shown in Fig.2-3.

- **ProDOS**

ProDOS was another menu-driven operating system that was used on some Apple computers. ProDOS interface is shown in Fig.2-4.


**Fig.2-4 ProDOS Interface**

## Graphical User Interface (GUI)

GUI is a graphical interface for computer users to interact with computer. It uses windows, icons, menus and pointer. Window is a rectangular portion of monitor in which information is displayed. Icon is a graphical symbol that represents a file, folder, program, device, etc. To perform a task, the user has to select icons or make choices in menus using a pointing device such as mouse.

The following are the advantages of GUI.

i. Much easier to learn and use
ii. No need to memorize the commands
iii. Allows users to run more than one program at the same time
iv. Most of the GUIs provide good help facilities
v. Many application programs also use a similar interface so it is easy to use a new program

The following are the disadvantages of GUI.

i. Takes up lot of memory.
ii. Needs faster computer as compared to other interfaces.

Examples of operating systems that use GUI are Macintosh, Linux and Windows.

- **Macintosh Operating System**

Mac OS is a series of operating systems developed by Apple Incorporation for their Macintosh computers. It was introduced in 1984 with the original Macintosh computer and has GUI. The latest version is Mac OS X. It is a UNIX based user-friendly operating system. There are some specialized versions of Mac OS X used on devices such as iPhone, iPod, iPad and new Apple TV. Mac OS X interface is shown in Fig.2-5.


**Fig.2-5 Mac OS X Interface**

- **Linux Operating System**

Linux is free open-source operating system introduced by Linus Torvalds in 1991. It is faster but difficult to use as compared to Macintosh and Windows operating systems. It is not a popular operating system. Linus Torvalds started the development of Linux operating system and laid its foundation. Millions of programmers around the world work on Linux to improve it

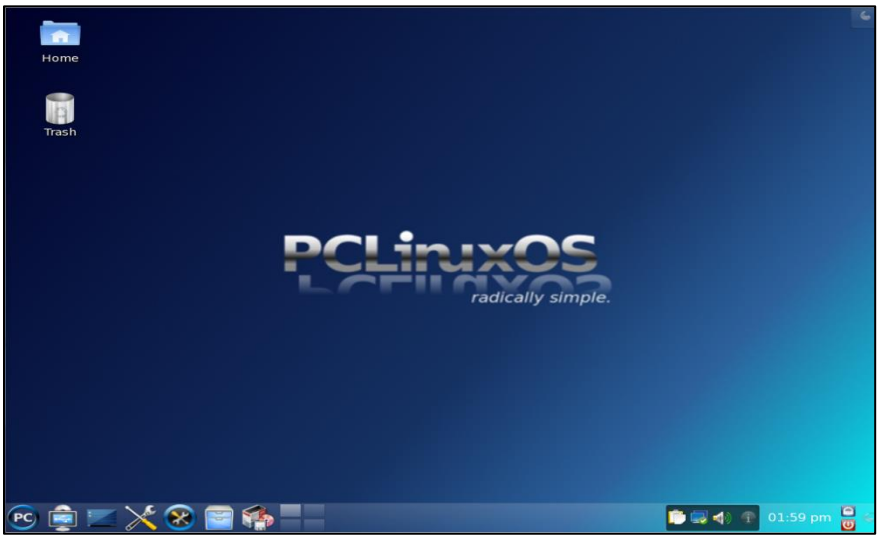


**Fig.2-6 Linux Interface**

Its source code is freely available on Internet. Programmers can view, edit and publish an improved version.

Linux OS can be installed on PCs, laptops, netbooks, mobile and tablet devices, video game consoles, servers, supercomputers and more. The Linux OS is frequently packaged as a Linux distribution for both desktop and server use, and includes the Linux kernel (the core of the operating system) as well as supporting tools and libraries. Popular Linux OS distributions include Debian, Ubuntu, Fedora, Red Hat and openSUSE. Linux operating system interface is shown in Fig.2-6.

- **Windows Operating System**

Windows is the most popular operating system used on microcomputers. It was developed by Microsoft. Many different versions of Windows operating system were developed and used successfully in the past. Some of these versions are Windows 95, Windows 98, Windows Millennium, Windows XP, Windows Vista, Windows 7, 8 and 10. The latest version is Windows 10. Windows 10 interface is shown in Fig.2-7.


**Fig.2-7 Windows 10 Interface**

# 2.2 OPERATING SYSTEM

## 2.2.1 CLASSIFICATION OF OPERATING SYSTEM

Operating systems can be classified into two major categories, single-user and multi-user operating systems.

### Single-user Operating System

Operating system that is used by a single user at a time is known as single-user operating system.

- It allows a single user to login and use the computer at a time. It is easy to use.
- Resources of the computer, such as CPU, memory and input/output devices are not shared with other computers.
- It is used on microcomputers.
- User can open many programs at the same time and switch among them as required.
- It requires less memory and costs less.
- Some examples of single-user operating systems are DOS, Windows 95, Windows XP, Windows 7, etc.

### Multi-user Operating System

Operating system that allows many users to use a computer at the same time is known is multi-user operating system.

- It allows many users to login to a single big computer and run different programs at the same time.
- It shares the resources of the computer with other users over the network.
- It is used on minicomputers and mainframes.
- Users can communicate with each other and share files.
- A person known as administrator is responsible for assigning and managing user names and passwords.
- It requires a powerful CPU, large memory and large hard drives.
- It supports multiprogramming and time-sharing.
- Windows NT, UNIX and Linux are popular multi-user operating systems.

## 2.2.2 TYPES OF OPERATING SYSTEMS

There are three types of operating systems. These are batch processing, Time-sharing and real-time operating systems.

### Batch Processing System

In a batch processing system, jobs are grouped in batches and the computer executes them one.by.one. When the current job terminates, the computer automatically loads the next job and starts executing it. Batch processing operating systems greatly improved the use of computer system.

Batch processing systems are suitable for tasks where large amount of data has to be collected and processed on a regular basis. For example, in credit card billing systems, all the data of credit card holders is collected and held until processed as a batch at the end of billing cycle. As another example, in examination report card system, all the data of students' examinations is collected and processed as a batch for printing report cards.

### Timesharing System

Timesharing system is a feature of operating system in which multiple users can run different programs on a large-scale computer. It allows many users to have access to a computer at the same time and share the computer's time. In a timesharing system, the central processing unit is switched rapidly between the programs so that all the user programs are executed simultaneously. The operating systems used in minicomputers and mainframe computers support timesharing. Timesharing operating systems are used in organizations such as airline, bank, hotel, university, etc. where many users need access to the central computer at the same time.

For example, hundreds of students access the university's mainframe computer at the same time and they run different programs in a timesharing system in interactive mode.

### Real time Systems

Real time operating systems must process information and produce a response within a specified time. These operating systems are developed for special applications.

These are used to control industrial processes such as oil refining. Real time operating systems are used to supply immediate response within limited time. For example, a measurement from an oil refinery indicating that temperatures are getting too high might demand quick response to avert an explosion.

There are a number of real-time operating systems used in military and space research programs. For example, real-time operating system is used to monitor the position of rocket in the space. Many cities are installing real-time traffic control systems to facilitate smooth flow of traffic at busy intersections.

## 2.3 GETTING STARTED WITH GUI OPERATING SYSTEM

A GUI Operating System provides a user-friendly interface. This makes it easier for people with little computer skills to operate the computer. A GUI combines four elements which are Window, Icon, Menu and Pointer. All the information displayed on the screen is presented inside a window. Small graphical symbols known as icons are used to represent files, folders, drives, programs and commands. Menus present various commands from which the user makes a selection with a pointing device. Mouse or touchpad is used as pointing device for performing different tasks such as selecting an option or opening a file, folder or program.

## 2.3.1 BASIC ICONS OF GUI OPERATING SYSTEM

An icon is a small graphical symbol that represents a file, folder, application or device. There are some special system icons such as Recycle Bin and Computer that are kept on the desktop. Icon has a label at the bottom describing its name.

The basic icons of Windows 7 are shown in Fig.2-8 and are described below.


**Fig.2-8(a) Recycle Bin, (b) Computer icon, (c) Folder icon, (d) File icon (e) Program icon (f) Shortcut icons**

### Recycle Bin

It is a temporary place (folder) for items that the user deletes from the hard disk. When a file or folder is deleted from a hard disk it goes to the Recycle Bin. The user can restore it to its original location. User can also delete a file or folder permanently from the Recycle Bin.

**Tip:** You can delete a file from your hard disk without sending it to **Recycle Bin** by clicking the file and then pressing Shift + Delete keys.

### Computer Icon

Computer icon allows the user to access the contents of computer drives and manage files and folders. When user double-clicks on Computer icon, it will open a window similar to the one shown in Fig.2-9 that displays the drives present in the computer. It is used to navigate and manage the computer resources.

### Folder Icon

Folder icon resembles a physical file folder. It is used to store files. A folder can have another folder inside it which is known as subfolder. Folders are used to keep files in an organized manner on a storage device such as hard disk so that they can be accessed easily.

**Tip:** Right click a shortcut icon, select **Properties** and click **Open File Location** to know the location of program, file or folder to which a shortcut belongs.

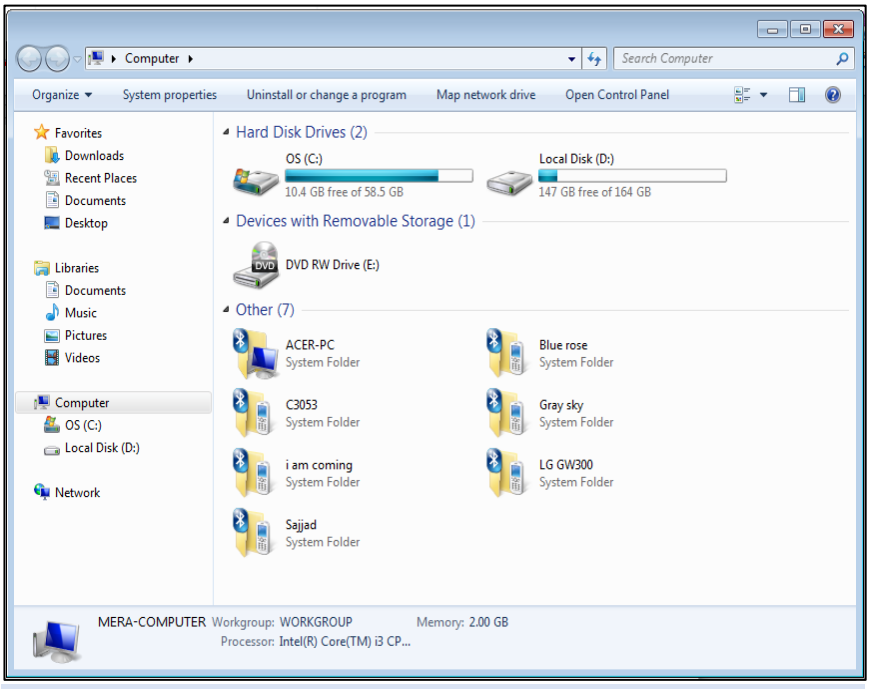


**Fig.2-9 Computer-Icon window**

### File Icon

In a GUI, files are also represented by icons. A file may contain text, image, music or video. Users recognize a file by its icon. Icon of a Microsoft Word file is shown in Fig.2-8(d).

### Program Icon

Executable program files are also represented by icons. Different graphical symbols are used for different program icons. Program icon of Acrobat Reader is shown in Fig.2-8(e).

### Shortcut Icon

Shortcut icons are created to access a program, file or folder quickly. They have an arrow at the bottom left corner and the name below it. Shortcut icon of Google Chrome is shown in Fig.2-8(f).

## 2.3.2 MANAGING DATA (FILES/FOLDERS)

Managing data means storing files in secondary storage devices such as hard disk or USB flash drive, in an organized way. This helps in finding files easily and quickly. Files are stored in folders. The Document folder in Windows is the default folder where the user saves files.

**Tip:** You can create a new folder in Windows Explorer by simply pressing the Ctrl+Shift+N keys and then rename it.

File management tools of GUI operating system provide facilities to quickly and easily create folders and copy or move files into them. It also allows the user to delete files and folders that are not needed any more.

The following are the steps to create a new folder.

1. Go to the location where a folder is to be created.
2. Right-click a blank area, point to **New** in the shortcut menu and then click **Folder** as shown in Fig.2-10.

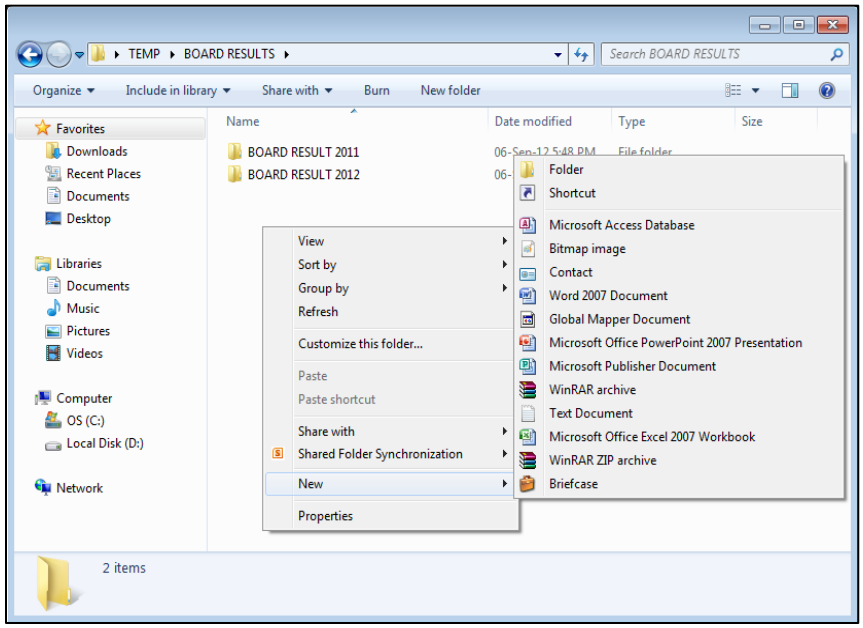


**Fig.2-10 Shortcut menu to create a folder**

3. Type a name for the new folder and then press **Enter** key.

The following are the steps to copy or move files.

1. Go to the location from where files are to be copied or moved.

2. Select the files to copy or move.

To select consecutive group of multiple files or folders, create a selection around the outside of all the items by dragging the mouse pointer.

To select non-consecutive group of files or folders, press and hold down the **Ctrl** key and then click each item one by one.

To select all the items in a window, click **Organize** on the toolbar and then click **Select all**.

3. Right-click on any selected file icon and then select copy or move from the shortcut menu as shown in Fig.2-11.

**DO YOU KNOW?**

There are six different versions of Windows 7. These are Starter, Home Basic, Home Premium, Professional, Enterprise and Ultimate.

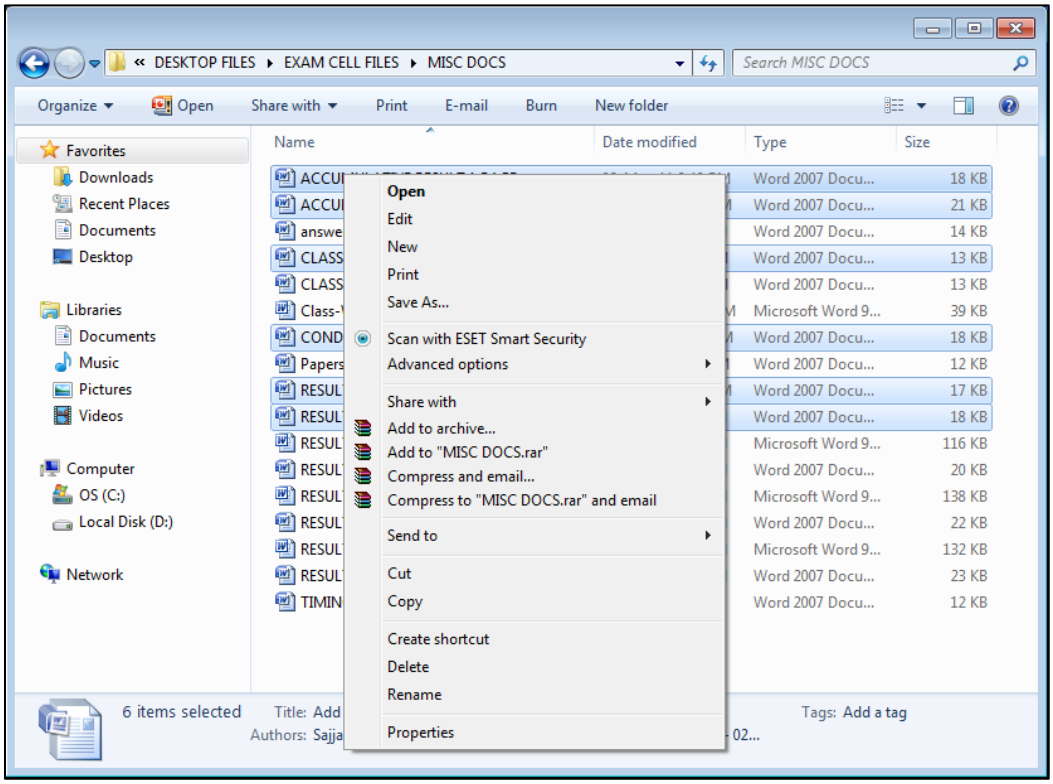


**Fig.2-11 Shortcut menu for copying or moving files**

4. Go to the location where the files are to be copied or moved.
5. Right-click a blank area and click **Paste**.

The following are the steps to delete files or folders.

1. Go to the location from where files or folders are to be deleted.
2. Select the items to delete as describe earlier.
3. Right-click any selected item and then click **Delete** in the shortcut menu.

## 2.4 SYSTEM INSTALLATION

A computer system consists of hardware and software. Before the use of computer, user must install the operating system and other required software.

## 2.4.1 INSTALLATION OF WINDOWS 10 OPERATING SYSTEM

The following are the steps for installation of Windows 10 operating system.

1. Turn on the computer and insert the Windows 10 DVD and boot the computer. Make sure DVD is set as the first boot device.
2. When the screen shown in Fig.2-12 appears, select the Language, Time and currency format, Keyboard or input method and click Next.


**Fig.2-12 Screen to select language and time and currency format**

3. Click Install now in the screen shown in Fig.2-13 to start installation of Windows 10.


**Fig.2-13 Screen to Install now**

4. Wait for a few seconds for the setup to start (Fig. 2-14).

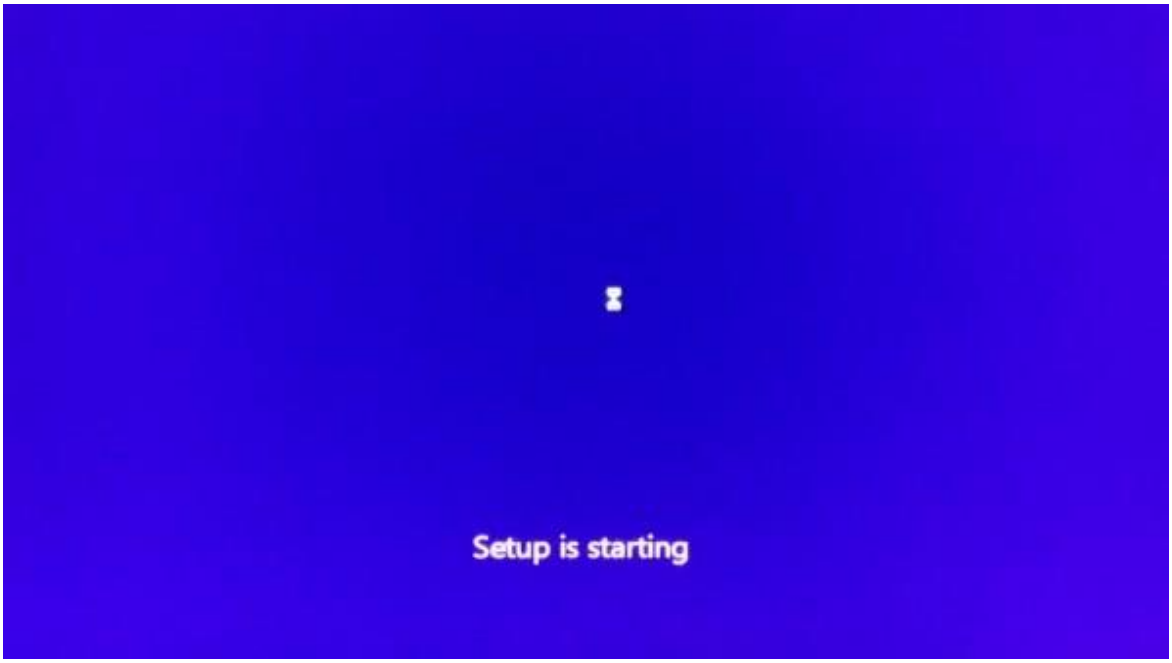


**Figure 2-14**

5. If you have a product key, enter it, otherwise click on Skip (Fig. 2-15).

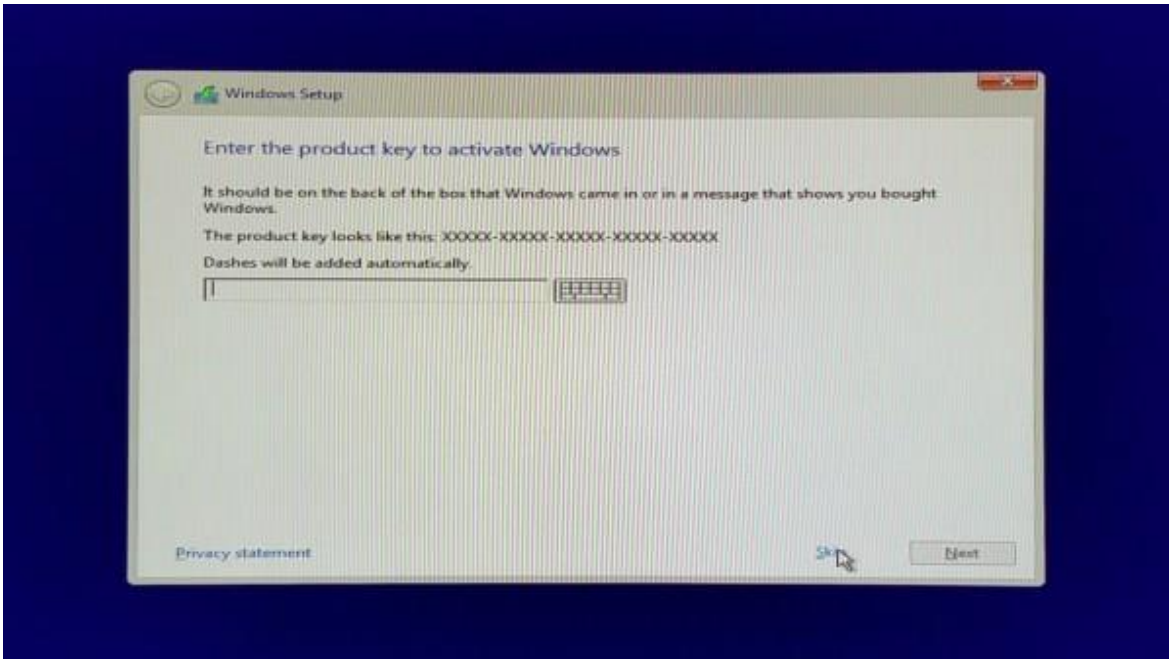


**Figure 2-15**

6. Accept the license terms and click on Next (Fig. 2-16).

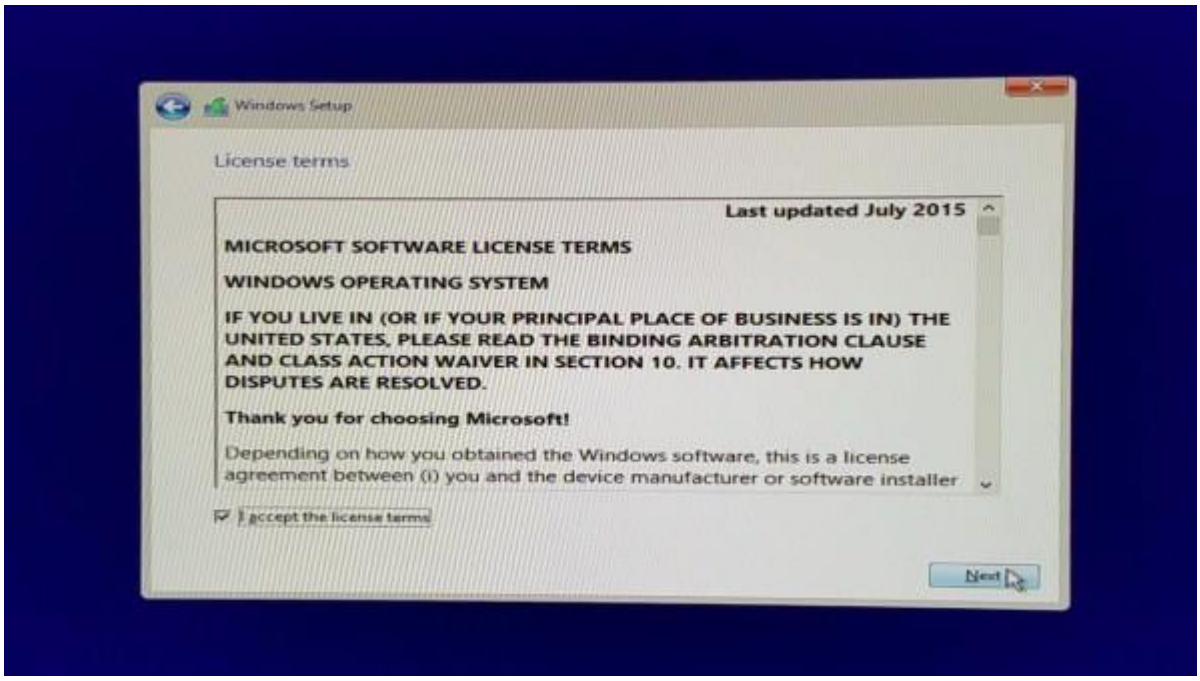


**Figure 2-16**

7. Select “Custom: install Windows only ( Advanced )” (Fig. 2-17)

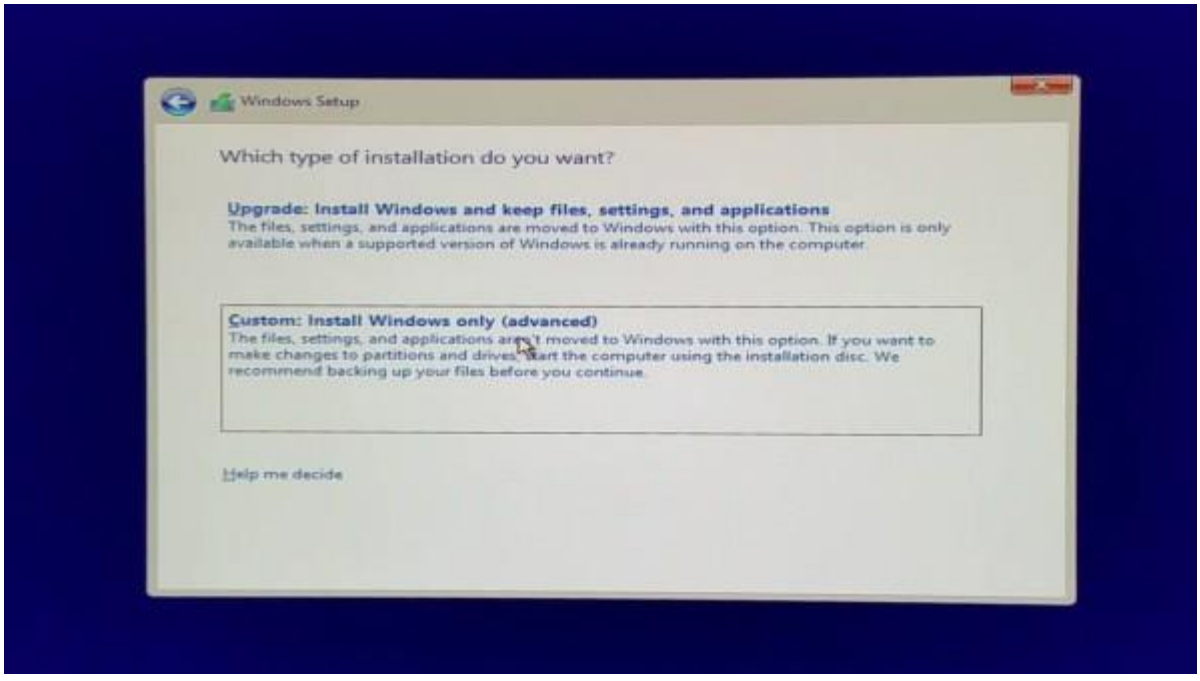


**Figure 2-17**

8. Select the drive where you want to install Windows 10 (Fig. 2-18).

   Note: Make sure the drive is formatted, if not you can format by selecting the format option provided.

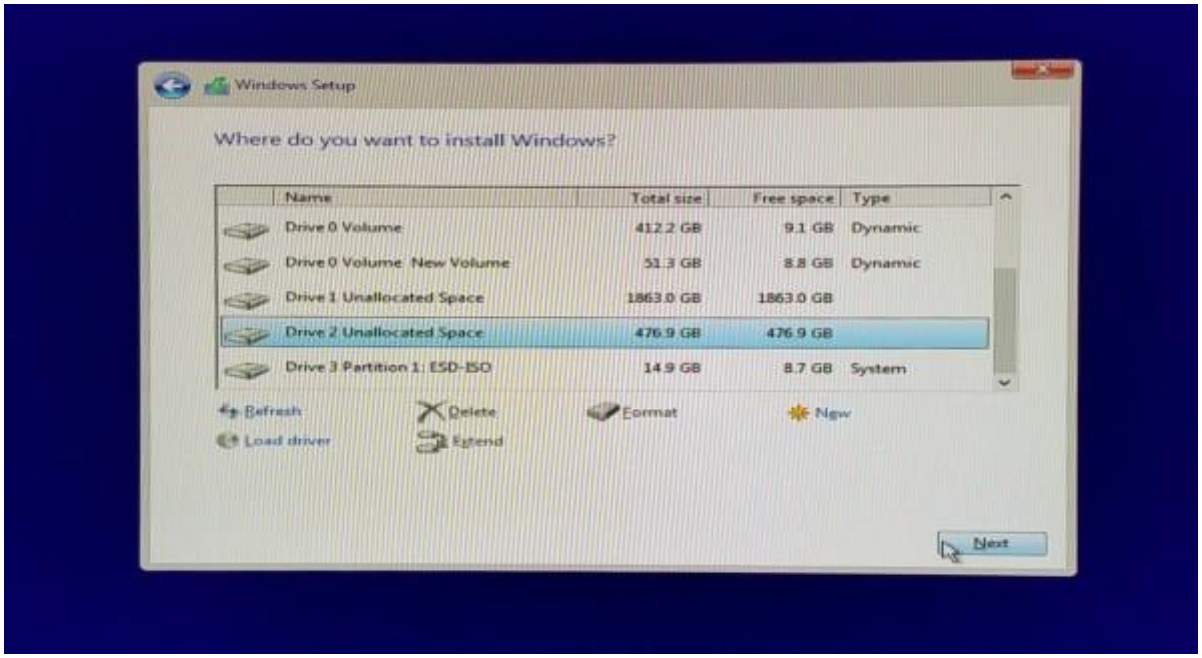


**Figure 2-18**

9. Wait for a sometime until Windows is being installed. This may take from a few minutes to an hour depending on the hardware of your personal computer. Once this process is complete, your PC will restart (Fig. 2-19).


**Figure 2-19**

10. Choose Windows 10 (Fig. 2-20).


**Figure 2-20**

11. Wait for some more time (Fig. 2-21).


**Figure 2-21**

12. Enter a serial key, otherwise click on Do this later to skip this option (Fig. 2-22).

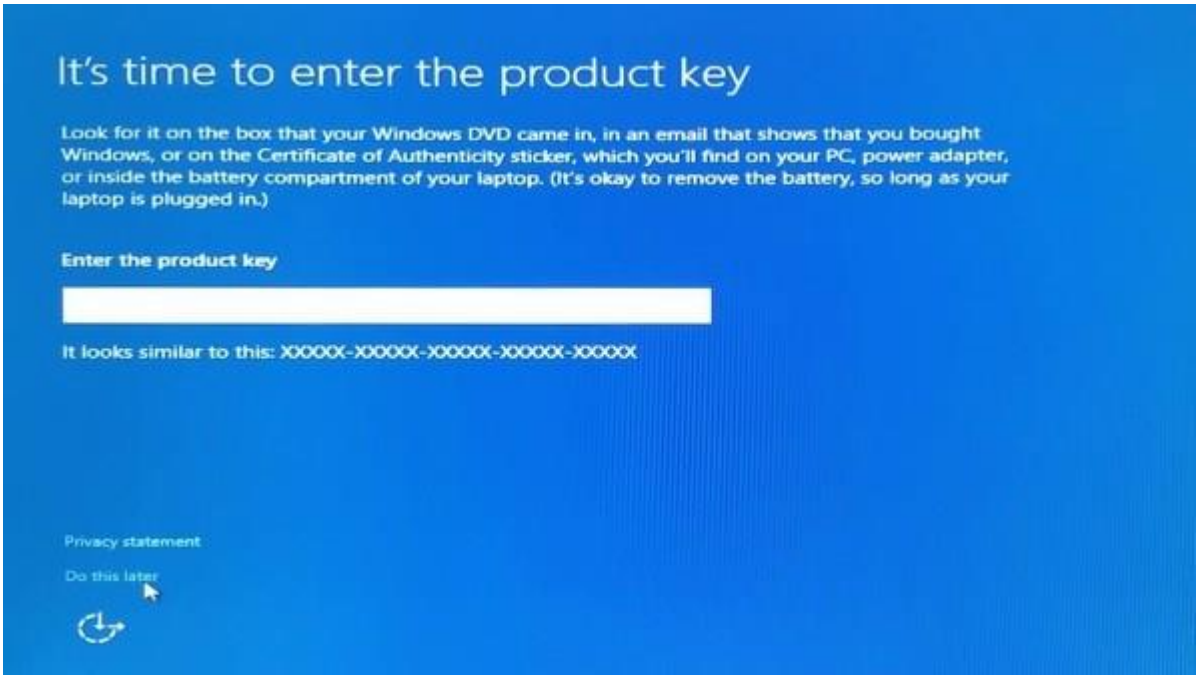


**Figure 2-22**

13. Click on Use express settings to use the recommended settings. Alternatively you can even click on Customize settings to customize the settings (Fig. 2-23).

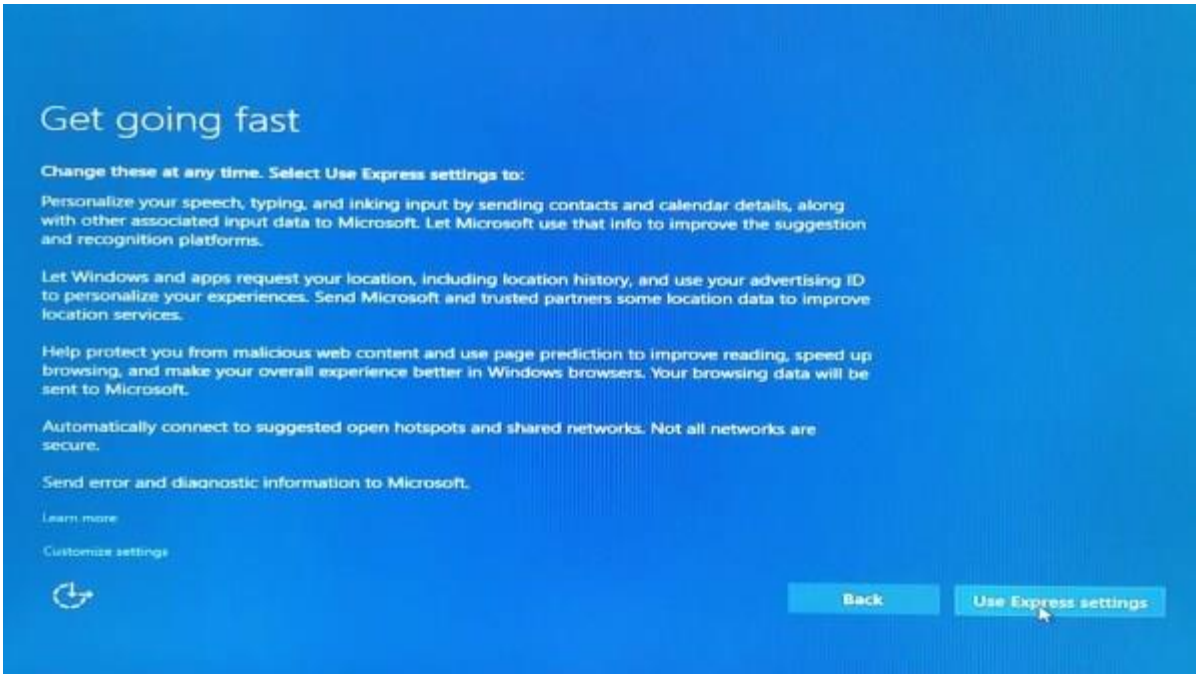


**Figure 2-23**

14. Wait for a few seconds more (Fig. 2-24).

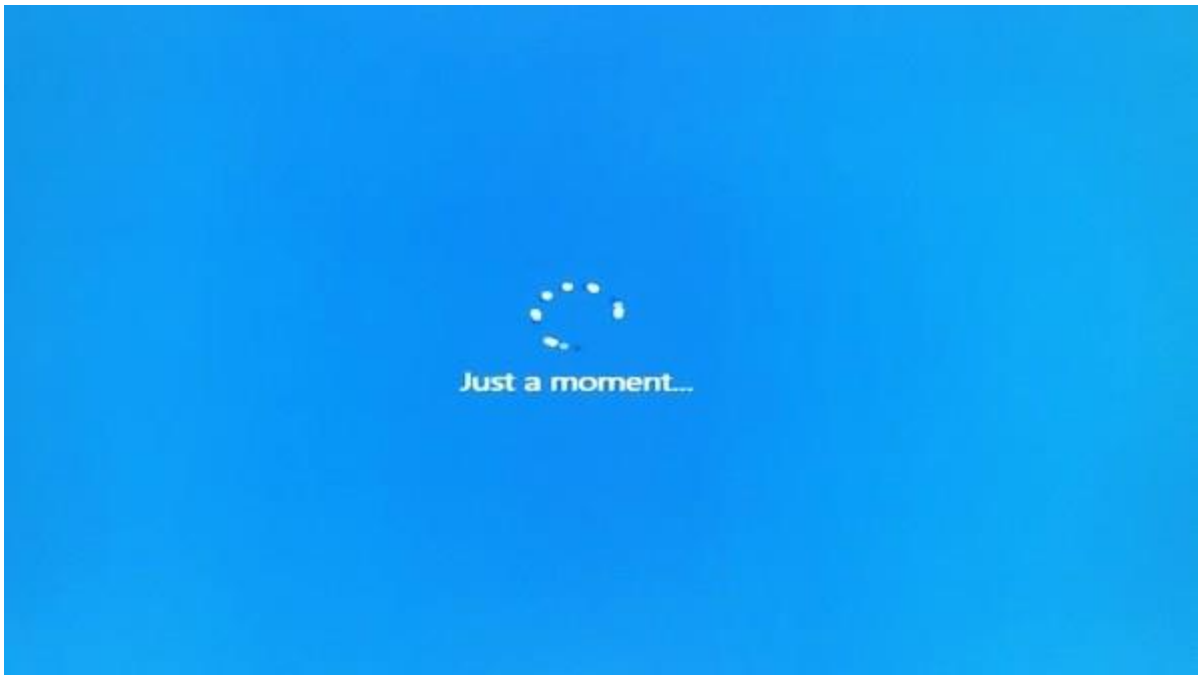


**Figure 2-24**

15. Enter a name and password to create your account (Fig. 2-25).

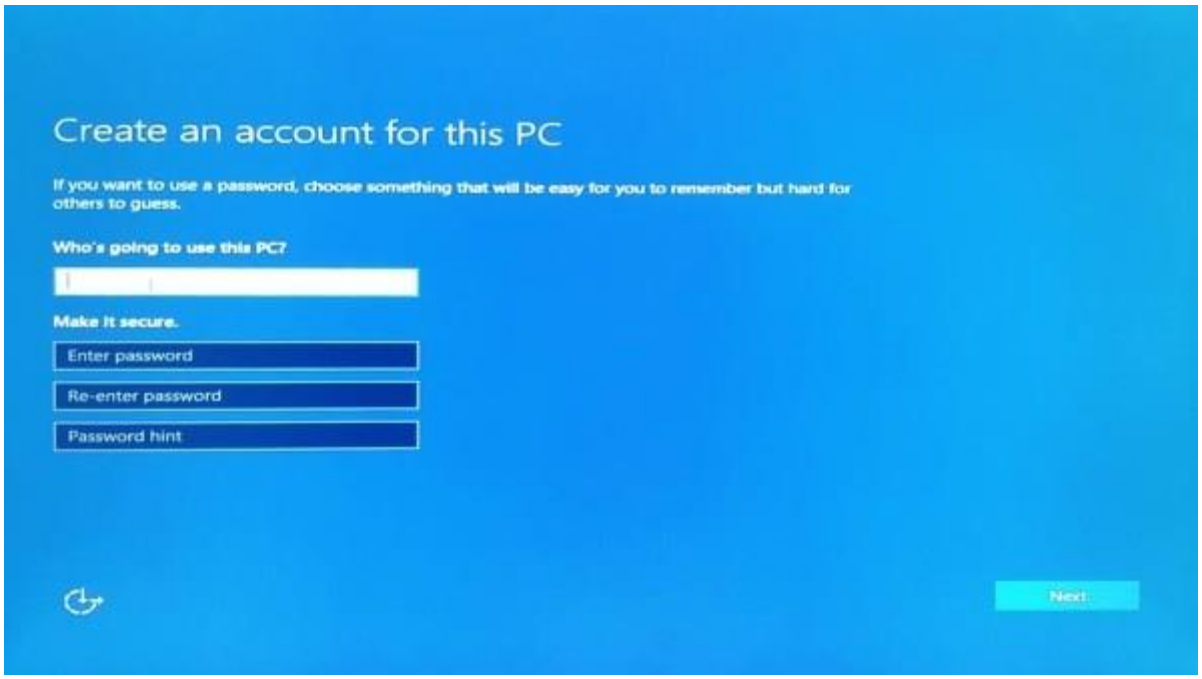


**Figure 2-25**

16. Wait for a few seconds more (Fig. 2-26).


**Figure 2-26 a**

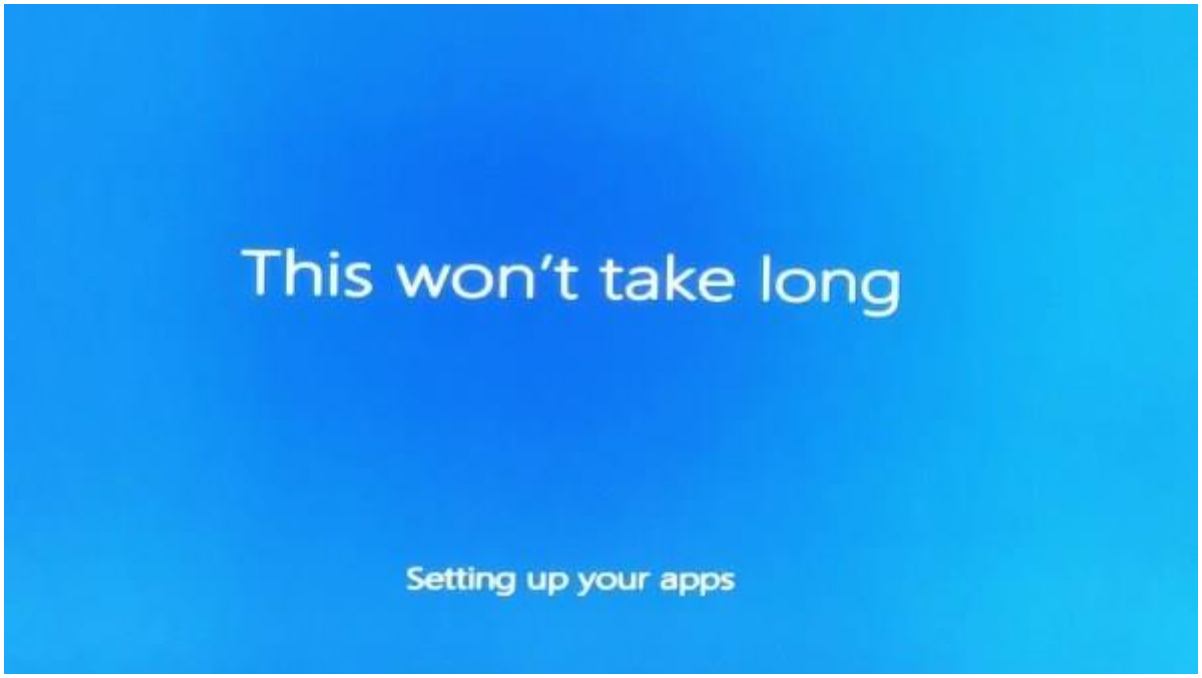


**Figure 2-26 b**

17. There you go, you are finally on Windows 10 (Fig. 2-27).


**Figure 2-27 a**


**Figure 2-27 b**

## 2.4.2 INSTALLATION OF ANITVIRUS SOFTWARE

The following are the steps for installation of AVG Antivirus software.

**DO YOU KNOW?**
The first antivirus software was developed by Bernd Fix in early 1987 to remove Vienna virus.


**Fig.2-28 Icon of AVG Antivirus program**

1. Download the AVG Antivirus Free Edition from Internet that runs on Microsoft Windows.
2. Double-click on the installation program shown in Fig.2-28.
3. Welcome screen will appear as shown in Fig.2-29. Click the Next button to proceed with the installation.

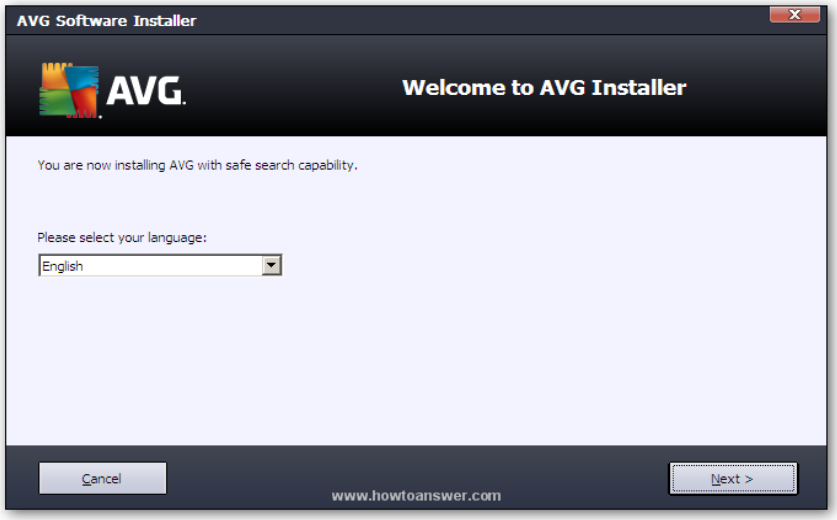


**Fig.2-29 Welcome screen of AVG Antivirus**

4. License Agreement screen will be displayed as shown in Fig.2-30. Click Accept to continue with the installation.

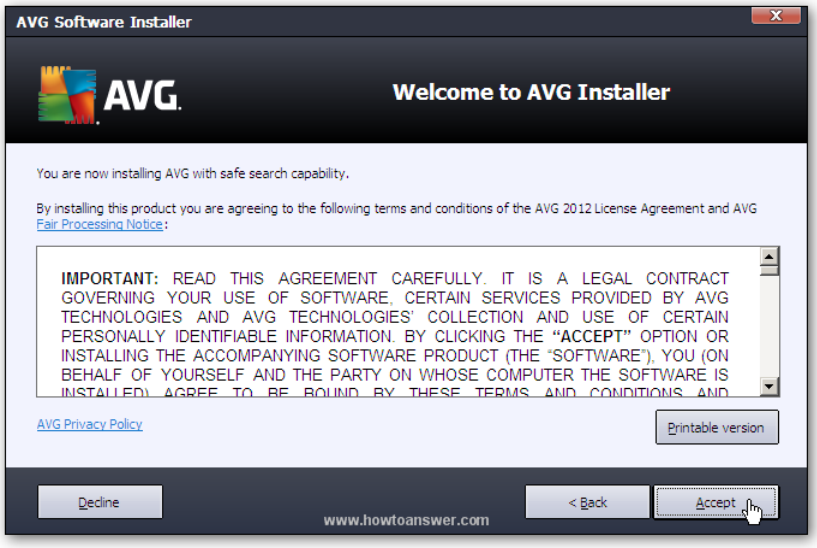


**Fig.2-30 License Agreement screen**

5. Select Express Install in the screen shown in Fig.2-31 and click Next.

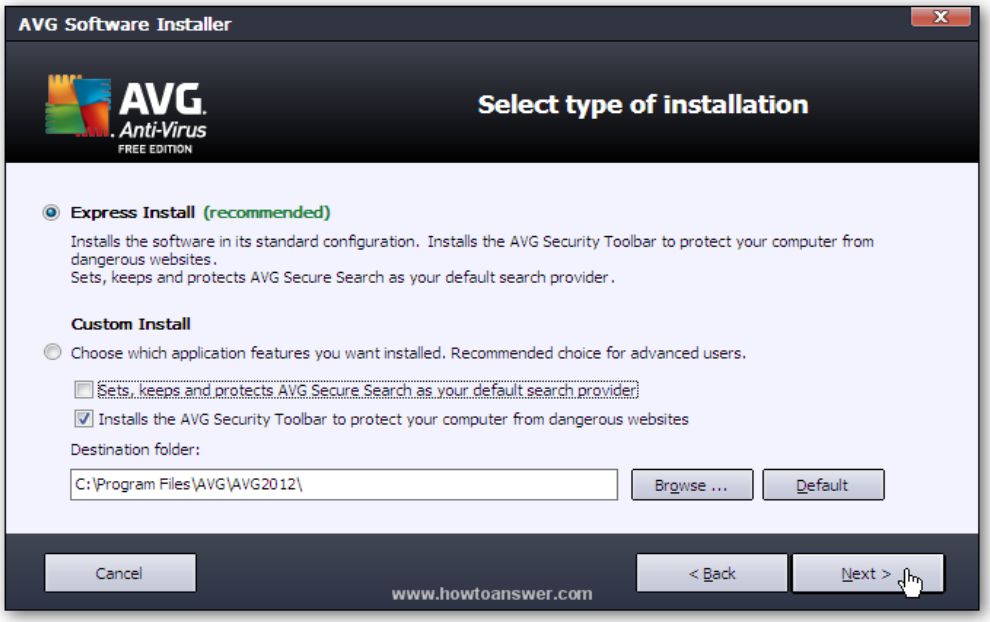


**Fig.2-31 Screen to select type of installation**

6. Click Next to accept the default Component Selection shown in the screen of Fig.2-32.

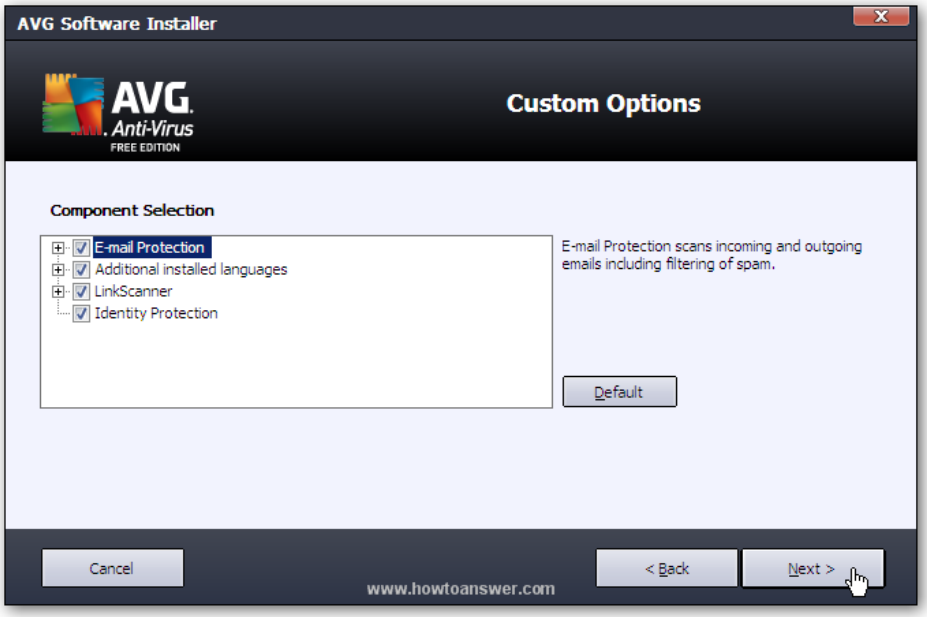


**Fig.2-32 Screen to select custom options**

7. Tick (✔) the option in the screen of Fig.2-33 if required and click Finish to complete the installation.


**Fig.2-33 Screen to finish the installation**

## 2.4.3 WINDOWS DEFENDER

Windows 10 comes with Windows Defender which is anti-virus software. Now, computer users do not have to buy anti-virus software. When Windows 10 is installed on a computer, Windows Defender is also installed as built-in anti-virus software. It runs in the background and checks for viruses. It automatically scans programs and files that user opens or downloads. If any type of malware is detected, it will display warning message and recommend what to do next to keep the computer safe.

### Key Points

- Operating System is a collection of system software that controls the working of computer system and acts as an interface between the computer user and computer.
- The main objectives of operating system are convenience and efficiency. It makes the computer more convenient to use.

- Memory Management is the process of allocating memory space for user programs in main memory and managing it.
- Input/Output Management is the process of controlling the operation of all the input/output devices attached to computer.
- File Management System is the part of operating system that organizes, stores and keeps track of computer files and folders.
- Resource Management refers to the automatic management of resources of a computer by the operating system when application programs are executed by computer user. Resources of a computer are CPU, memory, input/output devices, etc.
- User Management is an important feature of operating system for creating and managing user accounts for a secure computer system.
- Command Line Interface (CLI) is a type of computer interface that is based on textual input. In CLI, commands are given with a keyboard.
- Menu Driven Interface presents a menu on the screen and the user makes a choice and then the next menu appears. The user makes another choice and so on to operate the computer.
- GUI is a graphical interface for computer users to interact with computer. It uses windows, icons, menus and pointer. To perform a task, the user has to select icons or make choices in menus using a mouse.
- The operating system that is used by a single user at a time is known as Single.user Operating System. It is used in microcomputers.
- Multi-user Operating System allows many users to use a computer at the same time. These are used on large computers such as minicomputers and mainframes. They manage a large number of users.
- Batch Processing System groups jobs in batches and the computer executes them one.by.one.
- Time-sharing System is a feature of operating system in which multiple users can run different programs on a large-scale computer. It allows many users to have access to a computer at the same time and share the computer’s time.
- Real-time System must process information and produce a response within a specified time. It is developed for special applications.

- Recycle Bin is a temporary place (folder) for items that the user deletes form the hard disk. Deleted items can be restored if required.
- Computer icon allows the user to access the contents of computer drives and manage files and folders.
- Folder icon resembles a physical file folder and it is used to store files.
- In a GUI files are represented by file icons. A file can be easily recognized by looking at its icon. It opens by double-clicking on it.
- Program icons represent executable program files. They open when the user Double-clicks on them.
- Shortcut icons are created to access a program, file or folder quickly. They have an arrow at bottom left corner and the name below it.
- Managing Data means storing files in secondary storage devices such as hard disk or USB flash drive, in an organized way in folders so that they can be accessed easily and quickly when needed.

## Exercise

**Q1. Select the best answer for the following MCQs.**

i. Which interface is based on textual input?

A. GUI B. CLI

C. Menu-driven interface D. Windows

ii. Which of the following interface uses window, icon, menu and pointer to interact with computer?

A. GUI B. CLI

C. Menu-driven interface D. DOS

iii. Which of the following operating system was introduced in 1969?

A. Macintosh B Linux

C. Unix D. Windows

iv. Which of the following operating system must process information and produce a response within a specified time?

A. Batch Processing System B. Time-sharing System

C. Multiprogramming System D. Real-time System

v. Which of the following is open source operating system?

A. UNIX
B. Linux
C. DOS
D. Novell's Netware

vi. Which of the following user interface is the easiest one to learn and use?

A. CLI
B. GUI
C. Menu driven interface
D. DOS

vii. Which of the following operating system allows many users to use a computer at the same time?

A. Single-user operating system
B. Batch processing system
C. Real-time processing system
D. Multi-user operating system

viii. In which of the following operating system, CPU is switched rapidly between all the programs to simultaneously execute all of them?

A. Batch Processing System
B. Time-sharing System
B. Real-time System
D. DOS

ix. Which of the following Windows icon allows user to access a program, file or folder quickly?

A. Program icon
B. Computer icon
C. Shortcut icon
D. Recycle Bin icon

x. Which of the following Windows icon allows user to access the contents of computer drives and manage files and folders?

A. Program icon
B. Computer icon
B. Shortcut icon
D. Recycle Bin icon

**Q2. Write short answers of the following questions.**

i. Why operating system is important software for a computer? Give any five reasons.

ii. Give any three objectives of operating system?

iii. Mention few disadvantages of using DOS.

iv. Name two operating systems which are used in modern mobile phones.

v. What difficulties a student may face if he/she is not familiar with the operating system of a computer?

vi. Define UNIX and Windows operating system.

vii. Differentiate between single-user and multi-user operating systems.

viii. What is meant by managing data and why is it important?

ix. What is meant by resources of computer?

x. What types of problems may a student face if no antivirus is installed in his/her computer system.

**Q3. Write long answers of the following questions.**

i. Explain the main functions of operating system.

ii. Describe the following computer interfaces.

a) Command Line Interface

b) Graphical User Interface

c) Menu-driven Interface

iii. Describe the following types of operating systems.

a) Batch Processing System

b) Time-sharing System

c) Real-time System

iv. Write notes on Macintosh and Linux operating systems.

v. Describe the basic icons of Windows operating system.

## Lab Activities

**Activity 1:** The commonly used commands for using Windows operating system should be demonstrated. Students should be shown how to open and close a program. The commands for setting date and time, adjusting resolution, changing desktop background, color scheme, screen saver, etc. should be demonstrated.

**Activity 2:** The file management commands such as create folder, copy, move, delete, rename files and folders are to be demonstrated. Use of Recycle Bin should be demonstrated.

**Activity 3:** Installation and un-installation of a program and antivirus software should be demonstrated to students.