11.0	COMPUTERS

A computer is a general purpose device or machine that can be programmed to carry out a finite set of arithmetic or logical operations. Since a sequence of operations can be readily changed, the computer can solve more than one kind of problem.

Conventionally, a computer consists of at least one processing element, typically a central processing unit (CPU) and some form of memory. The processing element carries out arithmetic and logic operations, and a sequencing and control unit that can change the order of operations based on stored information. Peripheral devices allow information to be retrieved from an external source, and the result of operations saved and retrieved.

Conventionally, a computer consists of the following components:
- o Central Processing Unit (CPU)
- o Primary Memory
- o Secondary memory
- o Input Devices
- o Output Devices

Did you know….

Computers understand only Bits i.e. 0s and 1s. Eight such bits make one Byte e.g. 10110001 and 1024 Bytes make 1 Kilobyte

11.0.1   IMPORTANT TERMS

Sr	Term	Explanation
1	CPU	A **central processing unit** (CPU) is the hardware within a **computer** that carries out the **instructions** of a **computer program** by performing the basic arithmetical, logical, and **input/output** operations of the system.
2	Primary Memory	Primary memory, also known as main storage or memory, is the main area in a computer in which data is stored for quick access by the computer's processor. It is made of semi-conductor chips and is of two types: Read Only Memory (ROM) and Random Access Memory (RAM).
3	ROM	**Read Only Memory** (ROM) is a class Primary memory used in computers and other electronic devices. Data stored in ROM cannot be modified, or can be modified only slowly or with difficulty, so it is mainly used to distribute firmware (software that is very closely tied to specific , and unlikely to need frequent updates).
4	RAM	**Random Access Memory** (RAM) is a form of Primary memory which allows stored data to be accessed quickly in any random order.
5	Secondary Memory	Unlike primary memory, secondary memory is not accessed directly by the CPU. Instead, data accessed from secondary memory is first loaded into RAM and is then sent to the processor. While secondary memory is much slower than primary memory, it typically offers far greater storage capacity.

		Examples of Secondary Memory are Hard Disk Drive, CD ROM, Magnetic Tapes etc.
6	Input Devices	An input device is any peripheral (piece of computer hardware equipment) used to provide data and control signals to an information processing system such as a computer or other information appliance. Examples of Input Devices: keyboards, , scanners, digital cameras and joysticks.
7	Output Devices	An output device is any piece of computer hardware equipment used to communicate the results of data processing carried out by an information processing system (such as a computer) which converts the electronically generated information into human-readable form. Examples of Output Devices: Printers, Monitors.

Difference between Primary and Secondary Memory: i) Primary Memory is much faster than Secondary Memory, ii) Primary Memory is internal to a CPU, Secondary Memory is external, iii) Primary Memory is costlier than Secondary Memory, iv) Primary Memory is volatile whereas Secondary Memory is non-volatile in nature.

11.0.2   NETWORKING OF COMPUTERS

A computer network, or simply a network, is a collection of **computers** and other **hardware** interconnected by communication channels that allow sharing of resources and information. Where at least one process in one device is able to send/receive data to/from at least one process residing in a remote device, then the two devices are said to be in a network. A network is a group of devices connected to each other.

When networks first came into being, computers could typically communicate only with computers of the same manufacturer. In the late 1970s, the Open Systems Interconnection (OSI) reference model was created by International Organization for Standardization (ISO) to break this barrier.

The OSI model is the primary architectural model for networks. It describes how data and network information are communicated from an application on one computer through the network media to an application on another computer.

Did you know….

All machines connected to the network are provided with a unique 4 byte number known as IP address. Each of the bytes are separated by a (.) dot. - e.g. 192.168.2.10

The OSI reference model has 7 (Seven) layers, which along-with their functions are as follows:

Application	Provides user interface
Presentation	• Presents data • Handles Processing such as encryption
Session	• Keeps different application Data separate
Transport	• Provides reliable or Unreliable delivery • Performs error correction
Network	• Provides Logical Addressing
Data Link	• Combines packets into Frames • Provides access to media Using MAC Address • Provides error detection
Physical	• Moves bits between devices • Mention specification of Cables

The various Networking Topologies are as follows:

Bus Topology: This is the simplest of network topologies. In this type of topology, all the nodes (computers as well as servers) are connected to the single cable (called bus), by the help of interface connectors. This central cable is the backbone of the network and is known as Bus (thus the name). Every workstation communicates with the other device through this Bus.

Ring Topology: In Ring Topology, all the nodes are connected to each-other in such a way that they make a closed loop. Each workstation is connected to two other components on either side, and it communicates with these two adjacent neighbors. Data travels around the network, in one direction. Sending and receiving of data takes place by the help of TOKEN.

Star Topology: In Star topology, all the components of network are connected to the central device called "Hub" or "Switch". Unlike Bus topology (discussed earlier), where nodes were connected to central cable, here all the workstations are connected to central device with a point-to-point connection. So it can be said that every computer is indirectly connected to every other node by with help of "Hub" or "Switch". All the data on the star topology passes through the central device before reaching the intended destination.

Mesh Topology: In a mesh network topology, each of the network node, computer and other devices, are interconnected with one another. Every node not only sends its own signals but also relays data from other nodes. In fact a true mesh topology is the one where every node is connected to every other node in the network.

Different types of Networks are:

Local Area Network (LAN): A local area network (LAN) is a **computer network** that interconnects computers in a limited area such as a home, school, computer laboratory, or office building using network media. The defining characteristics of LANs, in contrast to **wide area networks** (WANs), include their usually higher **data-transfer rates**, smaller geographic area,

and lack of a need for **leased telecommunication lines**.

Wide Area Network (WAN): This is a network that covers a broad area (i.e., any **telecommunications network** that links across metropolitan, regional, or national boundaries) using private or network transports. In essence, this mode of telecommunication allows a business to effectively carry out its daily function regardless of location.

Metropolitan Area Network (MAN): This is a **computer network** that usually spans a city or a large campus. A MAN usually interconnects a number of **local area networks** (LANs) using a high-capacity backbone technology, such as fiber-optic links, and provides up-link services to **wide area networks** (or WAN) and the **Internet**.

Internet: The Internet is a global system of interconnected **computer networks** that use the standard **Internet protocol suite** (TCP/IP) to serve billions of users worldwide. It is a network of networks that consists of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by a broad array of electronic, wireless and optical networking technologies. The Internet carries an extensive range of information resources and services, such as the inter-linked **hypertext** documents of the **World Wide Web** (WWW) and the **infrastructure** to support email.

Various Devices used for Networking:

Switches: A network switch is a small hardware device that joins multiple computers together within one **local area network (LAN)** in Star Topology.

Gateways: A Gateway is a device that connects two different networks using different protocols.
Routers: A router is a device that forwards **data packets** between **computer networks**. It is connected to two or more data lines from different networks. When a data packet comes in one of the lines, the router reads the address information in the packet to determine its ultimate destination. Then, using information in its routing table or routing policy, it directs the packet to the next network on its journey. Routers perform the "traffic directing" functions on the Internet. A data packet is typically forwarded from one router to another through the networks that constitute the internetwork until it reaches its destination node.

Did you know….

Switches are Layer 2 Devices, i.e. they work in Data Link Layer of OSI Model.
Routers and Gateways are Layer-3 Devices, i.e. they work in Network Layer of OSI Model.

Different types of Cables used are:

Ethernet Cables: An Ethernet cable is one of the most popular forms of network cable used on wired networks. Ethernet cables connect devices on local area networks such as PCs, routers and switches. Most popular type of Ethernet cables available in the market are Category 5 and Category 6 Ethernet Unshielded Twisted Pair (UTP) Cables.

Fiber Optic Cables: An optical fiber cable contains one or more optical fibers. The optical fiber elements are typically individually coated with plastic layers and contained in a protective tube suitable for the environment where the cable will be deployed. This type of cable is used in very high speed networks.

IP   Addresses are of two types IPv4 and IPv6.

IPv4 addresses consists of 4 (Four) Octets, each one separated by a (.) dot. Ipv6 addresses consists of 6(Six) Octets, each one separated by a (.) dot. Ipv6 supports more numbers of networks and nodes   than IPv4

11.0.3   INFORMATION SECURITY

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Information security means protecting information and information systems from unauthorized access, use, disclosure, disruption, modification, perusal, inspection, recording or destruction. The terms information security, computer security and information assurance are frequently used interchangeably. These fields are interrelated often and share the common goals of protecting the confidentiality, integrity and availability (CIA Triad) of information.

11.0.4   METHODS OF BREACH

The most common methods by which breach of Information Security takes place are as follows:

Virus: A computer virus is an executable program. Depending on the nature of a virus, it may cause damage of your hard disk contents, and/or interfere with normal operation of your computer. A virus program is able to replicate itself. This replication is intentional; it is part of the virus program. In most cases, if a file that contains virus is executed or copied onto another computer, then that computer will also be "infected" by the same virus.

A virus can be introduced to a computer system along with any software program. For Internet users, this threat can come from downloading files through FTP (file transfer protocol), or referencing email attachments.

Malware: Malware, short for malicious (or malevolent) software, is software used or created by attackers to disrupt computer operation, gather sensitive information, or gain access to private computer systems. It can appear in the form of code, scripts, active content, and other software. Malware is a general term used to refer to a variety of forms of hostile or intrusive software.

Trojans: A Trojan horse, or Trojan, is a non-self-replicating type of malware which appears to perform a desirable function but instead facilitates unauthorized access to the user's computer system. Trojans do not attempt to inject themselves into other files like a computer virus. Trojan horses may steal information, or harm their host computer systems.

Phishing Attack: Phishing is a technique used to gain personal information for purposes of identity theft, using fraudulent e-mail messages that appear to come from legitimate businesses. These authentic-looking messages are designed to fool recipients into divulging personal data such as account numbers and passwords, credit card numbers and Social Security numbers.

Social Engineering: In the context of security, it is understood to mean the art of manipulating people into performing actions or divulging confidential information. This is a type of confidence trick for the purpose of information gathering, fraud, or computer system access.

11.0.5   METHODS OF PROTECTION

IT Security Policy: An Information Technology (IT) Security Policy identifies the rules and procedures for all individuals accessing and using an organization's IT assets and resources. Effective IT Security Policy is a model of the organization's culture, in which rules and procedures are driven from its employees' approach to their information and work.   The objectives of an IT security policy are the preservation of Confidentiality, Integrity, and Availability of systems and information used by an organization's members.

Confidentiality of Password: It is the duty of every user to safeguard their individual password in order to ensure that no sensitive information is stolen using their credentials.

Anti-Virus: Antivirus software are installed in computer systems to protect them from attacks by virus, malware, Trojans etc.

Firewalls: A **firewall** is used to help keep a network secure. Its primary objective is to control the incoming and outgoing network traffic by analyzing the data packets and determining whether it should be allowed through or not, based on a predetermined rule set. A network's firewall builds a bridge between the internal network or computer it protects, upon securing that the other network is secure and trusted, usually an external (inter)network, such as the Internet, that is not assumed to be secure and trusted.

The principle of information security is to protect the confidentiality, integrity and availability of information from harm. These principals together are known as the CIA Triad.

11.0.6   OFFICE AUTOMATION TOOLS

Office Automation tools are basically used to simplify, automate and fasten various day-to-day activities carried out in an office. There are various such tools available in the market most popular of which are MS-Word, MS-Excel, MS-Power Point, Mailing / Messaging System etc.

11.0.7   FEATURES OF MS-WORD

MS-Word is a Word Processing tool which is basically used for writing letters, notes, preparing reports etc. These documents may contain text, tables, graphs, pictures all together in the same document. Some of the features of MS-Word are as follows:

Creating Macro	A macro is a series of commands and instructions that can be grouped together as a single command to accomplish a task automatically.
Graphs and Charts	Various types of Graphs and Charts can be prepared in the Word documents based on figures provided in the same.
Mail Merge	Mail Merge is used in order to create a set of documents such as form letter that is sent to many customers/person. Each letter has the same kind of information, with the same Contents.
Collaboration	The document created can be directly mailed from within MS-Word only after completion of its preparation
Inserting Clip-Art	Based on the nature and type of documents, one can add various funny pictures, available either within the software or imported from any external source.
Protecting Documents	Provide security to documents, prevent changes or access to documents from un-authorized users.
Templates	Various pre-defined templates are available in the software which can be used for certain and specific purposes.
Creating Web Pages	Creating web pages from the prepared document directly from within MS-Word.
Tracking Changes	Tracking changes made in a document by various users while working on the same document.
Compare and Combine	Compare two versions of a document and combine revision from multiple authors into a single document

11.0.8   FEATURES OF MS-EXCEL

Ms-Excel is a very powerful tool which can be used to carry out various types of arithmetical and mathematical calculations and provide the same in a very presentable format. Some of the features of MS-Excel are as follows:

Creating Worksheet & Tables	Creating worksheets and Tables for the purpose of carrying out various arithmetical /Mathematical calculations.

Graphs and Charts	Various types of Graphs and Charts can be prepared in the Excel worksheets based on figures provided in the same. The graphs and charts will change automatically when the values in the worksheet changes.
Creating Macro	A macro is a series of commands and instructions that can be grouped together as a single command to accomplish a task automatically.
Using Functions and Formulas	Various types of functions and formulas can be used while carrying out calculations. Examples of some functions and formulas are: Arithmetical and Mathematical functions, Financial functions, Logical functions, Statistical functions etc.
Protecting worksheets	Provide security to documents, prevent changes or access to worksheets from un-authorized users.
Accessing data from other database	Sorting and Filtering data in a table in order to view various permutation and combination of data
Sorting and Filtering	Data can be accessed directly using Excel from databases such as Oracle, MS-SQL, MS-Access

Option of checking Spelling and Grammar is now available in Microsoft Excel

11.0.9   FEATURES OF MS-POWER POINT

Ms-Power Point is a very powerful tool used for the purpose of creating professional presentations. Some of its features are as follows:

Preparing Presentations	Presentations can be prepared in various forms with different backgrounds, different layouts etc.
Templates	Various pre-defined templates are available in the software which can be used for certain and specific purposes.
Inserting Clip-Art	Based on the nature and type of documents, one can add various funny pictures, available either within the software or imported from any external source.
Inserting Animation Effects	Various types of animation effects can be embedded in a slide in order to emphasis on certain points being presented.
Movie and Sound	Movie and Sound clippings can be inserted in the slide shows. Narrations can also be added in any presentation.
Writing on Slides	When delivering a presentation, one can circle, underline, draw arrows, or make other marks on the slides to emphasize a point or show connections.
Inserting Tables and Charts	Tables and charts can be either prepared in Ms-Power Point or directly imported from external sources such as Ms-Excel etc.
Embedding documents	Documents, worksheets can be embedded directly in slides which can be opened by clicking on the icon created in the slide itself.

Creating Macro	A macro is a series of commands and instructions that can be grouped together as a single command to accomplish a task automatically.

11.0.9   FEATURES OF MAILING/MESSAGING TOOL

A mailing/messaging system is a very powerful collaboration tool which can be used for quick offline communication between employees located anywhere within the Organization. Some important features of any mailing / messaging system normally has are as follows:

Sending, Receiving, Replying to and Forwarding Mails	Electronic mails can be send and received using a mailing/messaging system. In the same manner, one can reply back to any received mail or forward such mails to other persons.
Sending Attachments	Mails can be send with attachments also. Attachments can be any type of files such as an Ms-Word or Ms-Excel or Ms-Power Point file or a video or sound clipping or a normal text file etc.
Spell Check	When the spell check option is enabled, checking of spellings is carried out on any outgoing mail message
Creating Rules	Rules can be created in order to automate certain activity. For example, if one wants to organize mails from a certain sender or mails relating to a certain subject to be delivered to a certain folder only, the same can be attained by writing rules to that effect.
Out of Office Message	When not in office or unavailable and mails cannot be accessed, Out of Office Assistant can be configured to send automated messages to sender of mail stating the duration of unavailability and hence non response to received mails.
Directory Service	In case of a corporate mailing / messaging system, the entire corporate directory stating e-mail ids of all users having access to mail will be available
Creating Templates	Templates can be created for pre-defined mail response which needs to be delivered at a certain interval.

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Most prevalent corporate mailing/messaging systems available worldwide are Lotus Domino and Microsoft Exchange. Personal mailing systems in use are Gmail, Yahoo Mail etc.

11.0.11   APPLICATION AND DATABASE

Various types of Applications are currently available in the market. Some of them work on Standalone basis while others work in network environment. The two most widespread models of applications are Client Server based Application, Centralised Web based Application and COTS Applications.

11.0.12	BASIC PRINCIPLES - APPLICATION

Client Server based applications: This type of application can be divided into two components. First component is the Server i.e. the database and the second part is the data entry client which connects to the database in order to store and retrieve data. This is a traditional way of building applications.

Centralised Web based applications: This type of application is slowly replacing the traditional Client Server applications. It consists of various tiers of applications, which are as follows:

- Database tier,
- Application Server tier,
- Web Portal tier

Various software/ programming languages are used for development of such centralized web based applications.

The Web Portal tier consists of applications built using programming languages such as Java, PHP, C++ etc.

The Application Server tier consists of programs such as Websphere, Weblogic, Microsoft IIS, Apache Tomcat etc.

The Database tier consists of database applications such as Oracle, DB2, MS-SQL Server etc.

When any data is to be retrieved from the application, it first hits the Web Portal, which in turn passes the query to the Application server, which in turn then passes the same to the Database. The answer to the query passes from the Database tier to the Application tier and then to the Web portal where the same is displayed.

Did you know….

Web based centralized applications are accessible through Internet as well as Intranet i.e. within corporate network using web browsers

COTS Applications: COTS stands for Commercial Off The Self Applications. These are standard products that are available out of the box in the market. Examples of such applications are MS-Office Products, ERP products such as SAP and Oracle ERP etc.

11.0.13   BASIC PINCIPLES - DATABASE

Various types of databases are currently available in the market the most common of them being the Relational database type. Some of the common relational databases are Oracle, IBM DB2 etc.

A relational database is a collection of data items organized as a set of formally described tables from which data can be accessed easily. A relational database is created using the **relational model**. The software used in a relational database is called a **relational database management system** (RDBMS). A relational database is the predominant choice in storing data, over other models like the **hierarchical database model** or the **network model**. It consists of n number tables and each table has its own primary key which links various tables together in a database.

*The relational database was first defined in June 1970 by Edgar Codd, of IBM's San Jose Research Laboratory. Codd's view of what qualifies as an RDBMS is summarized in **Codd's 12 rules**.*

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