

ICDL Syllabus

Module One

Concepts of Information Technology

Module 1

Module 1 Concepts of Information Technology (IT)

Module 1 Concepts of Information Technology (IT) requires the candidate to have an understanding of some of the main concepts of IT at a general level. The candidate is required to understand the make-up of a personal computer in terms of hardware and software and to understand some of the concepts of Information Technology (IT) such as data storage and memory. The candidate shall also understand how information networks are used within computing and be aware of the uses of computer-based software applications in everyday life. The candidate shall appreciate health and safety issues as well as some environmental factors involved in using computers. The candidate shall be aware of some of the important security and legal issues associated with using computers. *(Taken from the ICDL Syllabus.)*

Introduction

In 1950 there were two computers in the world. Today there are millions. The introduction of the computer into general social use has had major effects for how work is organized, not only on the workers who are expected to use the computers, but also for workers who have no access to computers.

The introduction of computers, and especially computer communications, has promoted globalization (the interconnecting of economies around the world) and so all workers are affected - even if they do not use a computer. In order to influence and better understand globalization working people need to digitally develop their organizations. This is sometimes known as 'bridging the digital divide'.

To begin digitally developing our organizations, however, we need to develop a better understanding of computer technology. The following module covers the basics of Information Technology, including:

- General Concepts
- Hardware and Software
- Information Networks
- IT in Everyday Life
- The Electronic World
- Health and Safety
- The Environment
- Security Issues
- Copyright and the Law

1.1 General Concepts

1.1.1 Hardware, Software, Information Technology

Understand the terms hardware, software, information technology.

You can divide computer technology into two broad categories: hardware, which is anything you can touch (monitors, printers, etc.) and software, which are programs with the instructions for how the computer should operate. The IBM-PC is an example of computer hardware. Microsoft Word or Open Office Writer are examples of software.

Information technology is the use of computers to store and process facts and figures into a useful, organized, form. “Data” is the raw material: numbers and facts. “Information” is the raw material organized in a useful way. Numbers are data. A telephone book full of numbers is information. To emphasize the role of communications some people use the acronym ICT which stands for Information and Communication Technology.

1.1.2 Types of computers

Understand and distinguish between mainframe computer, network computer, personal computer, laptop, personal digital assistant (PDA) in terms of capacity, speed, cost, and typical users.

There are big, extremely complicated computers which can do many things very fast and there are smaller computers which do a few simple tasks. Here is the range:

- Supercomputers: powerful computers designed to handle billions of instructions very quickly. They are very expensive and are used for complex operations such as weather forecasting.
- Mainframe computers: large computers used by government departments and companies. The term refers to the fact that terminals (just monitors and keyboards) are attached to the “main” frame where all the computing power is found. A smaller version of the mainframe is the 'mini' computer. These computers are being increasingly used as the storage and processing units for complicated web sites such as Google.
- Networks: a network is a collection of computers which are connected so that they can communicate and transmit data to each other. Controlling the network is a central computer which is known as the file server. This server could be another personal computer or a mainframe. When a network is within a room or building it is known as a LAN - a Local Area Network. A computer on the network is known as a network computer.
- Personal computers: in 1981 IBM reacted to the introduction of smaller computers designed to be used by individuals by marketing a computer called the IBM-PC (Personal Computer). Today the term PC is used to refer to any computer which can be put on a desk for personal use, whether at home or in an office.
- Portable computers: a computer which is easily carried and powered by a battery. Laptops and notebooks are portable computers and can be used anywhere.
- PDA (personal digital assistant): these are designed to be easily carried and held in the hand while being used. Because the keyboards are so small a pen or stylus is used to select characters. An example of a PDA is the Palm Pilot.

1.1.3 Main Parts of a Personal Computer

Know the main parts of a personal computer such as: central processing unit (CPU), hard disk, common input and output devices, types of memory. Understand the term peripheral device.

Personal computers have four basic components: input devices, the central processor, output devices and storage. Inside the box (called the system unit or base unit) is the central processor, which is often referred to as the microprocessor or the central processing unit (CPU). A recent version of a CPU designed for PCs is the Pentium 4 produced by Intel, but there are other processors produced by other companies.

The system unit also includes the computer's memory. Memory can be divided into two basic types: RAM (Random Access Memory) and ROM (Read Only Memory). RAM memory is where you temporarily put your work such as words or numbers. You can read from it and write to it (use or create files). It is available only when the computer is turned on.

ROM is memory that is not accessible by you. It is used for things like storing the information for starting (booting up) a computer. Material in ROM stays even when the computer is turned off. The CPU and the ROM and RAM are on silicon (plastic-like) little black chips which plug into the main circuit board of the computer. This board is called the motherboard.

The disk drives are designed to store the information. They are either accessible from the front of the computer (via the slots into which you put diskettes or CD-ROMs) or they are hidden inside. A hard disk is inside the system unit and can hold many computer programs, documents, pictures, music, etc.

Common input and output devices include keyboards, monitors, microphones, scanners, bar-code readers, digital cameras and printers. All the devices which attach to the system unit are called peripherals. (*See Input/Output devices below.*)

1.1.4 Computer Performance

Know some of the factors that impact on a computer's performance such as: CPU speed, RAM size, the number of applications running.

A computer's performance is judged by factors such as: how quickly a program runs; how fast a file can be put into memory or saved on the hard disk; and the speed for re-writing (refreshing) material on the monitor's screen. When these factors are measured they are called benchmarks and can be used to compare different pieces of hardware or software. The computer's performance is affected by factors such as:

- The type of microprocessor – microprocessors "run" at different "clock" speeds which is usually expressed in megahertz (MHz). A 600 MHz processor will run much faster than a 166 MHz processor.
- The type of hard drive – hard drives are devices which "read" the information on a hard disk. Some read faster or slower than others. The "access" time for current drives is about 11 milliseconds.
- State of the hard drive – if a hard drive is almost full it can slow down significantly for two reasons: First, when a file is put on a hard disk it fills up empty spots in the disk. These

spots may be scattered all around the disk. The hard drive has to go all over the disk to put the file together so it can be displayed or used. Second, some operating systems such as Windows create a temporary file on the disk while it is running. This file is deleted when Windows is shut down. If there is not enough space on the disk to accept this temporary file Windows is forced to work with a smaller file and that makes things go slower.

- Multitasking – you can slow down a computer when you run more than one program at a time (which is called multitasking). The computer has to remember where it was in a particular program and what it was doing. The more programs to which it has to pay attention to at the same time, the more memory it uses. Adding more memory will help make a multitasking computer work faster.
- Graphics Card – inside your computer is a graphics card which determines how fast screen contents are displayed. Some programs which use complicated graphics, such as games or architecture-design programs, can be very slow depending on the graphics card. Adding a graphics card which has its own memory and processor will take the load off the computer's central processor and memory resulting in faster display times.

1.2 Hardware

1.2.1 Central Processing Unit

Understand some of the functions of the CPU in terms of calculations, logic control, and immediate access memory. Know that the speed of the CPU is measured in megahertz (MHz) or gigahertz (GHz).

A microcomputer consists of four major components. (You will have to know about each of them when purchasing a computer.)

- CPU – the Central Processing Unit – is the most important part of the computer. It acts as a 'brain', performing calculations and controlling the various components of the system. A computer works on three basic functions: input, processing and output. The CPU controls the processing of information.
- "Microprocessor" is another name for the Central Processing Unit of the computer, the CPU. When the microcomputer was first introduced the microprocessor was referred to by numbers such as : 286, 386, 486. Today they are given names such as Pentium and Athlon. A Pentium 4 microprocessor (which is produced by a company called Intel) is equivalent to the Athlon microprocessor (created by another company called AMD).
- Megahertz/Gigahertz – what makes the difference between current microprocessors is the speed at which they execute instructions. This speed is determined by an internal clock. How fast this clock pulsates/cycles (tick-tock, tick-tock) is measured in hertz. One hertz = one cycle. A megahertz (MHz) = one million cycles, and a gigahertz (GHz) = one billion cycles. When buying a computer, you get what you pay for: the faster the microprocessor the more you'll have to pay.

1.2.2 Memory

Understand different types of computer memory such as: RAM (random-access memory), ROM (read-only memory) and distinguish between them.

Memory is divided into two main types: RAM and ROM. They both involve pieces of hardware which are plugged into the computer's system unit.

RAM is Random Access Memory. It is the computer's main memory. The more of it you have, the faster your programs will run. That's because the computer uses its RAM to hold data, pieces of the operating system (such as Windows or Linux) and parts of the programs you are working with. If the RAM gets filled up, the computer runs more slowly. If you run many programs (multitasking), RAM quickly fills and things will start going very s_l_o_w_l_y. When people talk about the amount of memory a computer has they are referring to its RAM.

RAM is known as volatile memory. That means it is available only when the computer is turned on. If you have data in RAM, and you turn off the computer, that data will be lost, forever. So make sure you save the data as you go along.

One way of protecting a computer from electrical stoppages which cancels RAM is to plug the computer into a battery-like device called a UPS - an Uninterruptible Power Supply. The UPS holds enough power to give you a chance to save your files and safely shut down the computer.

ROM is Read Only Memory. It's the permanent memory which is not lost when the computer is turned off (non-volatile memory). It is used for storing essential operating information, such as starting ("booting up") the computer.

Know how computer memory is measured: bit, byte, KB, MB, GB, TB. Relate computer memory measurements to characters, files and directories/folders.

More memory in a computer is better than less memory. Which means it's important to measure the amount of RAM that is in, or can be put into, a computer.

It all starts with bits and bytes. A bit is a 0 or a 1. A place in the memory either has an electrical charge (1) or it doesn't (0). A byte is a collection of eight bits - for example : 10110010. Bytes are important because one byte represents one character. M, ?, 5, (including the commas) are all represented by one byte of memory. Here's what a capital "A" looks like to a computer: 01100101. Spaces also take up a byte of memory because they are treated like real characters. The measurement system used is metric. The basic units are:

kilo	one thousand	KB
mega	one million	MB
giga	one billion	GB

RAM is measured in megabytes (MBs). Most new computers have between 128 MB and 256 MB. You can put more memory into a computer by adding chips or cards inside the computer. Let's say you have a computer with the minimum 128 MB of RAM, you are using Windows 98, and you are running a number of programs. Here is the memory space the programs could take:

<u>Program</u>	<u>RAM Required</u>
Windows	32 MB

Microsoft Word or OpenOffice	40 MB
Internet Explorer or Firefox	20 MB

That leaves you only 36 MB for data or other programs. That's not much. The more memory that is being used, the slower your computer will operate. The solution is to add more memory (or buy more when you first purchase the computer). You should have at least 256 MB in a new computer.

1.2.3 Input devices

Identify some of the main devices for inputting data into a computer such as: mouse, keyboard, trackball, scanner, touchpad, lightpen, joystick, digital camera, microphone.

Input devices are pieces of hardware which are used to put data into a computer. They include keyboards, a mouse, microphones, digital cameras, bar code readers and scanners.

Mouse – a pointing device used to control the pointer or cursor on the screen, or to make selections in a program. It is hand shaped and operates on a flat surface.

Keyboard – similar to an electric typewriter, a keyboard consists of alpha-numeric keys, as well as extra 'function' keys that interact with various applications.

Trackball – similar to a mouse, but with a ball on the top of the device. The ball controls the movement of the pointer on the screen. It is commonly used with games and laptop computers.

Scanner – a piece of equipment which can be used to put text, pictures and graphics into the computer. Text that is scanned is a picture of text on the page. It can't be edited unless you use OCR (optical character recognition) software which lets you edit the text just as you would with a word processing file.

Bar Code Reader/Scanner – bar codes are thin black machine-readable lines, also called a UPC (Universal Product Code). They are used on a wide variety of consumer products, including food packaging labels, clothing labels, books, identification cards and other items. A bar code reader translates the marks into data and can be used for many purposes, such as product prices and inventory control. The bars and spaces are arranged in a specific way defined by international standards and the scanner translates the codes to letters, numbers and symbols.

Touchpad – an input device which is sensitive to the pressure or motion of the user's fingers. They are used to control the cursor/pointer, and are often found on laptop computers.

Touchscreen – similar to a touchpad, the touchscreen lets the user make selections by putting pressure on a selection on a computer screen.

Lightpen – a device which uses a light-sensitive detector to select objects on a screen. With a lightpen you select objects by pointing directly at them.

Joystick – like a mouse with a small arm attached to the top. These are commonly used as game controllers.

Digital camera – a camera which stores images digitally and does not require film. The images can be downloaded to the computer and used with a graphics program.

WebCam – a video camera which attaches to a computer and sends live images via the Internet.

Microphone – a device which converts sound waves (voices) to an electronic signal. It can be used for various purposes with a computer, including: dictating documents when a computer has voice recognition software and video conferencing. (While they can be used for dictation, many people prefer to type a document rather than using this feature, as they find it far easier than trying to remember where to put punctuation, etc., in the dictated text.)

1.2.4 Output devices

Identify common output devices for displaying the results of processing carried out by a computer, such as: monitors, screens, printers, plotters, speakers. Know where these devices are used.

Output devices are pieces of hardware such as monitors, printers, and speakers which convert computer data into a form which can be used productively. For example, data which can be read, printed or heard.

- Monitors – there are two types of monitors in use today: Cathode Ray Tubes (CRT) and Liquid Crystal Display (LCD). CRTs contain electronic guns which shoot electrons at phosphor dots painted on the back of the screen. The dots light up in different combinations (such as letters) when they are hit with the electrons. LCDs have liquids in them which reflect light differently when electric voltages are applied. Monitors are measured diagonally from the top left corner of the screen to the bottom right. Common sizes are 15", 17", 19" and 21".
- Screen – the part of the monitor that displays information.
- Printers – can be divided into two types: impact (which means "to hit") and non-impact. Impact printers have ribbons which have ink on them that is pressed to the paper by a device inside the printer. A dot matrix printer, for example, has a square of little pins which extend in different combinations to hit the ribbon and create characters or pictures. Non-impact printers include laser printers and ink-jet printers. Laser printers work like photocopiers: fine powder is attracted to paper in different combinations by electric charges. Ink-jet printers spray fast-drying ink on to the paper.
- Plotters – used primarily for engineering or architecture software applications such as CAD (computer assisted drawing) programs. It is a type of printer which produces line drawings using vector graphics files or commands.
- Speakers – a device which converts electronic signals from a computer sound card to speech or music. Headphones will also perform the same function. Most newer home computers have sound cards and many newer monitors have built-in speakers.

Understand some devices are both input/output devices such as: touchscreens.

Some devices can be used for both input and output, such as modems, webcams and touchscreens. A touchscreen is a screen which lets the user make a choice by putting pressure on a selection on the screen (input). The result is a new selection of information (output.) They are commonly used

for public information displays. Modems allow communications with other computers, which means that they can send information (input) or receive information for the user (output). Webcams take live video pictures (input) and send them over the Internet for viewing (output).

1.2.6 Storage Devices

Compare the main types of memory storage devices in terms of speed, cost and capacity such as: diskette, Zip disk, data cartridges, CD-ROM, internal, external hard disk.

Even though RAM is known as primary or main storage you can't keep data in RAM for long. Eventually the computer will shut down and everything in RAM will be lost. The data has to be put into more permanent storage such as diskettes or CDs. These are examples of secondary storage.

Floppy disks – at one time computers used to store data on big 8" squares of magnetic tape sandwiched between light cardboard. These disks were portable and they were so soft that they could flop around; so they were called "floppies". They were easily damaged, and fell out of use once the diskette was developed.

Diskettes – today the magnetic tape is encased in 3.5" squares of hard plastic. You can still see the tape if you move the metal door (which is what the computer does when it wants to read the data on the disk). They are called diskettes because they are smaller than the original floppy disks, although they are also commonly called floppy disks. Diskettes are still used a lot these days because they are portable and great for moving data from one computer to another. They hold about one and a half megabytes of data (1.44 MB).

Zip disk – this is similar to the floppy disk but slightly larger. It usually uses an external zip drive, and can hold from 100 to 250 MB.

Data cartridge – similar to a cassette cartridge. This is usually used for servers in network situations. It can hold up to 70 GB. Newer versions also use magnetic or optical disks or memory chips.

Compact Disks (CDs) – these are a type of high-density storage media and can hold far more data than a diskette. A typical CD can hold 700 MB - that almost 500 floppy disks! While it used to take several diskettes to hold a computer program such as OpenOffice.org, it can now be stored on one CD. It used to be that CDs were called CD-ROMS because, after data was recorded on them, they could not be used to add more data. They were Read Only. Today, there are CDs which can be written on to many times. They're called rewritable CDs. CDs are much faster than diskettes. The speed you see written on a CD refers to how fast they can be used for recording music.

USB Memory Stick – this is a small, portable data storage device that plugs into a computer's USB port. It can be used to store data, music, pictures, etc.

Internal Hard Disks – a hard disk, also called a hard drive, is the device on which most computer data is stored. It's called a hard disk because it is a hard non-removable disk-shaped piece of metal. They are usually built into the computer system unit. The computer takes part of programs from the hard disk and puts them into RAM so they can be used quickly. Hard disks are much slower to access (use) than RAM. Some programs, such as Windows, create temporary files on hard disks while the programs are running and delete them when the program is closed.

External Hard Disks – an external hard drive is a separate device which is attached to the computer by a cable. It has its own 'box' or casing, and is used to back up information from the main hard drive.

Digital Versatile Disks (DVDs) – DVDs are just CDs which can hold much more data. Some store as much as 17 GB of data. That's a lot of space; enough to hold a whole movie. You need a special hard drive to read a DVD because DVDs are read by two little lasers in the the computer. Ordinary CDs can be read with just one laser.

Disk Costs

The cheapest form of external / secondary storage is the diskette (floppy disk). They come in boxes of ten. CDs are more expensive than floppies, but store far more data. DVDs are a little more expensive than CDs, but require a special hard drive which adds to the cost of using them.

Hard disks are the most expensive form of storage, but they are becoming much less expensive because they are being designed to hold more data. They are priced according to how many gigabytes of space they can hold.

Understand the purpose of formatting a disk.

Today disks come already formatted, which means that the disk is ready for immediate use. Originally the user had to 'format' the floppy disk using a special procedure on the computer before it could be used. The formatting procedure established a series of blocks into which data could be written. The first track of blocks on a disk is like an index of the disk. This index is called the FAT (file allocation table). It tells the computer what blocks are free and can be used to store data. If the FAT is corrupted (broken) the disk cannot be used.

1.3 Software

1.3.1 Types of Software

Distinguish between operating systems software and applications software.

Computers are dumb. They have to be told what to do one step at a time: Do this, then do that. One. Two. Three. Four. What makes them effective is that they can perform these steps very, very quickly. Software is used to provide the instructions to perform these steps.

Software is any set of instructions or programs which can be operated on a computer. There are two categories of software: system software and application software. System software tells the computer how to operate its software and work with its equipment (the hardware). Application software is any program which tells the computer to do a particular task, such as manipulating text or calculating membership dues.

Understand the reasons for software versions.

You can tell a program's development stage by its version number. The beta version (with numbers below 1 such as .1) is a draft program that is still under initial development. When the program is released for use it is given the number 1.0 (or v1.0). After the release of version 1.0 the programmers may make minor improvements (sometimes called patches, because they patch up problems.) These minor improvements are numbered in increments: 1.1, 1.2, 1.3, etc. Many times these minor improvements are meant to fix bugs in the program. A bug is something in a program that is not working correctly.

If the programmers produce a version with major changes they will number the program 2.0 and start the minor numbering again: 2.1, 2.2, 2.3, etc. When OpenOffice.org was released to the public it was called 1.0. As the bugs and minor improvements were added the version number increased: 1.1, 1.2, 1.3 and so on. When a major development took place (adding a database capability amongst other things) version 2.0 was released. Usually when a new version of a program is released it can work with the data and documents which were produced by earlier versions. A program is 'backward compatible' if it works with the material created by its earlier versions.

1.3.2 Operating System Software

Describe the main functions of an operating system and name some common operating systems.

The most crucial type of system software is the operating system (OS). The OS tells the computer how to coordinate all its hardware and software. It is the interface between the user and the computer. You are using an operating system when you operate a microcomputer – probably one of the following:

- MS-DOS - developed in the early 1980s as a command line OS . The computer gave you a line to type on and you typed a command. MS-DOS is still around but rarely used.
- Windows 3.1 - the first popular version of the Windows operating system.
- Windows 95 - a major upgrade (improvement) to Windows 3.1.
- Windows 98 - still used in many computers, especially in the developing world.
- Windows 2000 - another upgrade.
- Windows XP - a major upgrade which comes in two versions: home and professional. The difference is that the professional version allows more sophisticated connections between computers (networking).
- Windows NT - used by organizations for their computer networks.
- Windows Vista – the latest Windows version, due to be released in early 2007.
- Unix - a complicated command-line OS much loved by computer techies.
- OS/2 - IBM's answer to Windows which unfortunately did not get popular acceptance.
- Linux - based partly on the Unix model this OS was created by thousands of volunteer programmers who continually work to improve its source code (its basic instructions). Because its source code is open to anybody to see and change it is known as open source.

- MacOS - the first OS to use a graphical user interface (GUI) - little pictures - to make the use of a computer easier. Adored especially by graphic artists.

One of the advantages of operating systems is that all of the programs which are written for them have to operate in common ways: for example, the PRINT command is always in the same place. The programs have the same look and feel about them, and because they do, users can move more easily to other programs which use the same OS. Users develop what is known as transferable skills.

The dominant operating system is Microsoft Windows. It has about 90 per cent of the market. MacOS has approximately nine percent, leaving Linux with about one per cent. However, because Linux is free of charge, and many companies and open source developers are now producing good GUIs (Graphical User Interface) for it, Linux may eventually replace Windows.

Drivers

An important part of the operating system consists of drivers which are little programs that tell pieces of hardware how to operate. You need individual drivers for particular printers or CD readers. The drivers are created for specific operating systems and are usually provided by the company that produced the equipment.

1.3.3 Applications Software

List some common software applications such as: word processing, spreadsheet, database, Web browsing, desktop publishing, accounting, together with their uses.

Any program which is applied to a certain task is known as application software. Examples include: databases of membership information, accounting programs for union dues, payroll systems and word processing programs. All of these work only if the operating system has been started.

Application software comes in two categories: general purpose or specialized. The general purpose programs include: wordprocessing, databases, drawing, presentation and spreadsheets. Specialized or custom software is written for specific applications, such as the payroll of a particular organization.

Common software applications:

- Word processing - used to create text documents. Especially useful because they allow text to be edited and formatted before it is printed. Examples: OpenOffice.org Writer; Microsoft Word, WordPerfect.
- Spreadsheets - used for calculations. They store, calculate and display numerical information. They are useful for seeing different possibilities, such as the effect of different wage offers on an organization's payroll. Examples: OpenOffice.org Calc, Microsoft Excel or WP Quattro Pro.
- Databases - store and retrieve data. Sometimes known as DBMS (Database Management Systems) they can be used to store information about an organization's members and produce various types of reports from this information. A record is one set of information such as the contact data on one member. Examples: OpenOffice.org Base, Microsoft Access or WP Paradox.

- Web browsers - a browser is a program which interprets files (pages) on the World Wide Web so users can see them on their monitors. People use them to browse or surf the web. Examples: Netscape, Firefox or Internet Explorer.
- Web Page Editors - programs which allow people to create web pages as if they were using a word processor. Examples: Dreamweaver or Nvu.
- Desktop Publishing (DTP) – these are programs that allow users to create pages of text, graphics and pictures for publication. They are very useful for creating newsletters and brochures. (Many wordprocessing programs now include sophisticated DTP features.) Example: PageMaker.
- Accounting Programs - specialized programs which allow organizations to do their accounting. Smaller organizations can often use programs which are designed for general use by many different type of organizations. Larger organization may need programmers to create custom programs - programs which have been written especially for the organization's operations.
- Presentation - used for creating computer presentations which can be projected onto a screen. They can use text, graphics, pictures and sound. Examples: OpenOffice.org Impress; Microsoft PowerPoint or WP Presentations.
- Integrated Packages - large programs which include multiple applications such as word processing, spreadsheets, databases and presentations. OpenOffice.org, Microsoft Office or Corel WordPerfect Office.
- Specialized - specialized application software is written especially for a particular task such as the payroll program of a company. Also known as custom software (or in Britain as bespoke software).

1.3.4 Graphical User Interface

Understand the term Graphical User Interface (GUI).

A GUI (pronounced gooey) is the graphical user interface which people use to communicate with the computer. An 'interface' is a link between two elements. The computer user 'interfaces' with the computer using the keyboard, mouse and monitor, for example. A graphical user interface consists of icons (little pictures) and menus (sets of commands). GUIs often, but not always, use a mouse to point to things and navigate through the OS. An example of a GUI which does not use a mouse is a touch screen display where you make choices by touching the screen with your finger.

1.3.5 Systems Development

Understand how computer-based systems are developed. Know about the process of analysis, design, programming and testing often used in developing computer-based systems.

Custom software is created either by a software company hoping to sell its product or by organizations which have particular needs that cannot be met by purchasing a general software program. The creation of this software has certain development stages known as the 'systems life cycle'.

First, a systems analyst (a person who understands how to design software) produces a system design. This design sets the basic structure and capabilities of the program. Eventual users (called end users) of the program should be involved at this stage.

If the system design is accepted the next step is for the systems analyst to produce a document called the specifications. This document describes in precise detail what the program should do and how it will perform its tasks. It provides the basis for signing the work contract with the programmers. Changes to the program suggested by the client (the person or organization asking for the program) are judged according to what is in the specifications document. If the requested feature is not in the specifications document the programmers may charge more to include it or say that it cannot be included at all.

Once the program has been written it goes through a series of release stages.

- Alpha - first testing of the program, usually by people associated with the programmers.
- Beta - first testing of program by people in the client organization.
- Version 1.0 - release of the program for use.

1.4 Information Networks

When you see somebody working on a computer they are using one of these three arrangements:

- Standalone – this is a computer that is not connected to anything else. It stands alone.
- Terminal – the monitor and keyboard are acting as a terminal to a big mainframe (or mini) computer somewhere which holds all the computing power.
- Networked – this is a computer that is connected to other computers either in the same building or around the world.

1.4.1 LAN, WAN

Understand the terms local area network (LAN), wide area network (WAN). Understand the term client/server.

Computer networks can be divided into two broad categories: LANs and WANs. A LAN is a Local Area Network. A WAN is a Wide Area Network. A LAN is a network of computers which are relatively close to each other: in an office or a building. Its various pieces are connected by cables. If it's a small LAN (under 50 users) it's called a workgroup. Larger ones (up to 200 or so) are called intermediate or departmental LANS.

A WAN is a network that is spread over a wide geographical area with its pieces connected by telecommunications systems such as telephone exchanges or satellites. In both versions data travels around the network in 'packets'. Each packet has units called 'fields' which do things like define the start and end of the packet plus the number of packets which have been sent. If the receiving

computer sees that it has not received all the packets it simply calls for the missing packet to be re-sent. A packet looks like this:

[START] [# of packets] [data] [data] [data] [END]

The main or remote computer in a network is the server, where the main applications are stored and which transmits files. For example, a computer which holds web site files is called a server because it transmits the files which make up the web site.

A client is a program that operates on the local computer and acts as a receiver for the server's files. Examples of clients are email programs such as Outlook or Thunderbird (which accept and manipulate email files) and web browsers such as Internet Explorer or Firefox (which receive and display web files.)

Another example of a client which is important for computer communication is a File Transfer Program (FTP). This program transfers files from one computer to another. It is essential for creating web sites because people create files on their computers and then use an FTP (such as Filezilla) to upload the files to the web server.

List some of the advantages associated with group working such as: sharing printers, applications, and files across a network.

Networks, such as the ones used in offices (Local Area Networks - LANS), are very useful and cost-effective because they:

- allow users to share computer equipment such as printers.
- give shared access to telecommunication equipment such as modems.
- provide central storage spaces which can be used by groups to organize and share files.
- let many people use a program such as a database at the same time.

1.4.2 Intranet, Extranet

Understand what an intranet is and understand the distinction between the Internet and an intranet.

Internet – a global electronic communications network. It includes networks from universities, government offices, research facilities and many organizations. (*For more information on the Internet see section 1.4.3 below.*)

Intranet – at first organizations simply attached their local area networks to the Internet so people could use its functions, such as accessing web sites. But then they started building private Internet spaces called intranets. An intranet is simply a part of the Internet which is protected by a password and that allows only the users of a particular business or organization to enter.

Once organizations connected their LANS to the Internet they began to worry about unauthorized people from outside getting into their computer systems and doing damage. So they installed firewalls. A firewall is a computer program which allows only certain people or types of communication systems to transmit messages into and out of the LAN.

Understand what an extranet is and understand the distinction between an intranet and an extranet.

Once the power of the Internet became obvious, organizations started building private Internet spaces called intranets, as explained above. An intranet is simply a part of the Internet which is protected by a password and that allows only the users of a particular business or organization to enter. An extranet is an organization's intranet which also allows outside users - clients and other businesses - to enter.

1.4.3 The Internet

Understand what the Internet is and know some of its main uses.

The Internet was designed in the United States to allow computers in universities and military establishments to communicate with each other. At first the computers passed on data as if they were in a line. But what if one of the computers in the line stopped working ("went down")? The solution was to send the data packets scattered throughout all the computers on the network. If one computer went down the packets would just go around the dead computer. This design opened the possibility of building a network based not just in the United States, but globally.

When we talk about the Internet we are actually talking about the physical equipment which is used to connect the computers. The formula (or "protocol") which determines if the messaging can be sent around correctly is named TCP/IP. As the Internet developed people decided there was a need to link all the documents which were available so the idea of hypertext was developed.

Hypertext is simply a word or phrase which includes an address for another document. That other document could be on the same computer or on a computer thousands of miles away. Eventually this capability was improved and given a graphical design (an "interface"). The result was the World Wide Web. The WWW is the software which allows users to see and use collections of computer files called websites. Today web sites hold more than just text files. They can also include files of music, graphics and video. Search engines such as Google have been created in order to sift through all the Web files on the Internet to find those related to the search term (the word or phrase being searched for) which the user has entered.

The other major applications of the Internet are electronic mail (email), file transfer (moving files from one computer to another) and computer conferencing (where groups can share the same collection of messages).

One of the major advantages of the Internet is that it involves a local instead of a long distance telephone call. If people want to see what is in a computer thousands of miles away they use their computer to call a local company called an ISP (an Internet Service Provider). The ISP passes their computer signals to the Internet (and vice versa). The costs for connecting to the Internet therefore are related to the cost of phoning the ISP and the company's charges. ISPs bill by the minute or through monthly flat rates (which provide certain amounts of hours).

Cybercafés are businesses which have permanent connections to an ISP and charge their clients for the use of their computers by the minute.

Understand what the World Wide Web (WWW) is and distinguish it from the Internet.

The Internet and the World Wide Web are related, but they are two different elements. The Internet is an international collection of networks in which any computer anywhere can connect to another computer if it is connected to the Internet. The World Wide Web (WWW/Web) is what allows users to access the information on the Internet. It uses HTTP protocol (*see above*) to transmit data and relies on browsers to access web pages. (*See Browsers above.*)

1.4.4 The Telephone Network in Computing

Understand the use of the telephone network in computing. Understand the terms Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN), Asymmetric Digital Subscriber Line (ADSL).

The primary connection to the Internet for an individual's computer or a LAN is the telephone line.

There are four basic telephone systems used for normal computer communications:

- PSTN – the public telephone system. A normal telephone line which can be used by a computer's modem.
- Leased lines which are telephone lines dedicated solely to computer communications. They provide permanent connections to the Internet.
- ISDN (Integrated Services Digital Network) lines. These are lines which are especially designed for the integrated transmission of text, graphics and video. They are completely digital and consequently fast and reliable.
- ADSL (Asymmetric Digital Subscriber Line). These are lines designed specifically for home and business users. They use the existing copper phone lines and are faster than regular telephone and ISDN lines. They are called asymmetric because the speeds at which they transmit data into and out of the home or business is not the same (it's asymmetrical). The speed at which users download (receive) data is faster than the speed at which they upload (send) data. Because most of the data during a web session is downloaded the user doesn't notice much of a difference. Another advantage of ADSL lines is that they allow people to use their computers for communicating to the Internet at the same time as they are on the phone.
- WAP (Wireless Application Protocol) is used to allow mobile (cell) phones to use basic Internet functions. However, not all web sites are compatible with WAP and normal web pages are difficult to see on a cell phone.

Understand the terms analogue, digital, modem, transfer rate, (measured in bps – bits per second).

There are two types of computer signals: analogue and digital. Computer digital signals are electronic situations which are either on (1) or off (0). Analogue signals are continuous. A telephone signal is analogue. A digital signal is 'non-continuous'. Think of digital as 'bit, bit, bit' and analogue as 'hummmmmmmmm'.

A piece of equipment called a modem translates the computer signals (which are digital) into telephone signals (which are analogue). In computer talk the modem Modulates and Demodulates, hence: modem. The speed of the computer doesn't really affect the speed at which people communicate to the Internet, but the modem's speed does. The speed of the modem is measured by its baud rate which is approximately the speed at which it can translate bits (1s and 0s) per second (bps). A modern dial-up modem (one which a user uses to dial up the Internet) works at 56 kilobits per second. ADSL lines are much faster.

The speed at which computer communication lines transmit data is called the transfer rate. Transfer rates are usually expressed in bits per second (bps), kilobits per second (Kbps), or megabits per second (Mbps). A modem speed of 56 kilobits per second is an example of a transfer rate. Your use of the Internet is affected by the speed at which you are connected to it. If you are using a dial-up modem big files can take a long time to download. Video, audio and graphic files are usually quite large. This is why if you go to a web site that has lots of pictures the web page may display itself very slowly. Increasing the speed of your Internet connection can save on telephone costs by reducing the time for files to download as well as making the experience more convenient.

1.5 The Use of IT in Everyday Life

1.5.1 Computers at Work

Identify some situations where a computer might be more appropriate than a person for carrying out a task and where not.

Computers can perform better than humans in a wide variety of situations. They can process data at increasingly high speed, handle complex equations, operate large scale systems, pilot trains, ships or airplanes and outperform humans at many menial repetitive tasks. They can work at any time of day or night and often require only basic maintenance. They store vast amounts of information that can be shared within an office, an organization or internationally.

Typical uses of computers in the workplace:

- workstations allow employees access to efficient wordprocessing, spreadsheet, database and presentation software, to name a few applications.
- email lets employees send information and communicate with employees/ clients throughout the world.
- newer technology, such as laptop computers and cell phones, allow people to work away from the office yet be in constant contact.
- business can be conducted at any time, day or night, with companies in other countries and time zones.
- computerized answering services can take messages and re-direct calls to the appropriate offices.
- material which was once sent out for mass copy can now be produced with high quality results in the workplace, thanks to large computerized photocopiers.

As newer and more efficient information technologies are developed, the members of an organization are free to develop new uses for these tools, as well as apply their power to current situations. At the source of every computerized action is a human to tell it what to do and when to do it. There are many situations where computers cannot replace people, and where their use would be inappropriate:

- Communication – a computer can transmit data, but it is the user who actually communicates. Creating correspondence, personal contact, intuition in recognizing needs and acting on them – these all require a real person.
- Decision-making – individuals apply experience, knowledge and skill to diagnose and solve workplace problems.
- Organization – someone needs to organize the needs and purpose of the workplace, as well as the technology used in the workplace
- Human resources
- Process and design
- Situations requiring art/graphics/editing
- Product control

In addition, technology, in many cases, is far more expensive than hiring people to do the same work.

Know some of the uses of large-scale computer applications in business such as: business administration systems, airline booking systems, insurance claims processing, online banking.

Large businesses such as car manufacturers, oil companies, airlines and insurance firms use computers to handle the huge amount of data they must work with. There is so much data in the computers of these companies that their managers need computer programs just to figure out what all the data means and how it can be used. Consequently there are computer applications designed to help with business administration:

- **Management information systems (MIS)** are computer systems designed to get information to company managers when they need it. They usually deal with things such as budgets and sales targets.
- **Decision support systems (DSS)** are aimed primarily at higher-level managers. They collect data from different sources and put it in a form which can help top-managers make decisions. They allow sophisticated "what if?" scenarios like: if wages increases are held to a certain percentage what effect would this have on overall profits?
- Most of the large IT systems in companies have a database at their core. A database is a collection of files related to each other by certain key pieces of information such as name or employee number. These systems can be quite complex because they have to allow multiple users to access the information at the same time. (What would happen for instance if two people worked on the same file at the same time and there was no organized way of saving the files?)

Examples of the use of large IT systems include:

- Insurance companies which have to track information on policies for cars, houses, etc. They need computers to track data on policies, claims and settlements. They also have to allow their brokers (the people who sell the insurance) to get into their data banks.

- Financial institutions have to manage millions of transactions every day: accounts, loans, payments, credit cards statements and more. Many banks in developed countries offer banking through the Internet. The advantages to online banking include 24 hour access to transfer money, pay bills and apply for loans. The disadvantages include job loss for many bank employees.
- Smaller businesses use only a few IT applications. These include word processing, spreadsheets, accounting programs, email and databases. A spreadsheet is a program such as OpenOffice Calc which allows users to enter numbers into an electronic accounting sheet and manipulate the numbers in many ways. An accounting program tracks revenue and expenses. A database program such as OpenOffice Base is used to store information such as client names and addresses. Unions can use many of the applications which have been developed for small businesses.

Know some of the uses of large-scale computer applications in government such as: public records systems (census, vehicle registration), revenue collection, electronic voting.

Governments have the same need as large companies to store, manipulate and report on large amounts of data. But they also have very specific needs, such as the provision of social services. Large government systems include:

- Car registration and drivers licenses
- Census figures on the population
- Storing and processing tax statements and payments, some of which are done online
- Pensions and other social services

One application which is becoming more of a possibility is electronic voting. Many countries are experimenting with voting which could take place via cell phones, computer communications, and computer terminals in government offices.

A serious problem is the possibility of government databases being merged so that huge amounts of coordinated information is available on individuals. This could have negative consequences. For example, what if all the information related to a person's income and taxes was put together with the health system? Would HIV/Aids sufferers who are in a certain income level be taxed differently because of their use of the health system? What if governments sold health records to insurance companies? Would the companies be able to find people who are HIV positive and deny them insurance?

Many countries have legislation specifically aimed at making sure government databases are not merged to the detriment of a person's privacy or social services.

Know some of the uses of large-scale computer applications in hospitals/ healthcare such as: patient records systems, ambulance control systems, diagnostic tools and instruments, specialist surgical equipment.

The primary application of IT systems in hospitals is to track patient records. Various hospital departments such as radiography (x-ray) and laboratories can quickly share information on patients. Monitoring systems tied to patient records can help doctors and nurses intervene early in a crisis or provide information for on-going health care.

IT systems can help doctors by allowing them to share information on complex procedures, access data banks on drugs or diseases and run appointment systems. The sharing of all this knowledge can

be helpful in the diagnosis of health problems. Symptoms can be described and the results of treatments can be tracked. Many hospitals in developed countries provide access to some of their information via terminals or computer communications so people can check on problems such as poisons or child illnesses before making an appointment with a doctor.

One potential advantage of health care IT systems for developing countries would be to allow health practitioners in remote areas to gain access to data banks via the Internet.

Know some of the uses of computer applications in education such as: student registration and timetabling systems, computer-based training (CBT), distance learning, homework using the Internet.

Computers are used in education for administrative and teaching purposes. Educational institutes use custom-built or off-the-shelf programs to track student attendance, academic records and timetabling.

Computers are also used as teaching instruments in what is referred to as computer-based learning or computer-based training (CBT). Learners interact with computer programs which guide them through a set of lessons. CBT is used for training activities such as air traffic control and teaching computer programs such as word-processing or spreadsheets. Most CBT programs have built in revisions and tests. They can also make use of multimedia such as music, graphics and video. But while they have the advantage of offering students learning opportunities just by turning on the computer, they force people to work alone with the material as presented. This can lead to narrowly focused training as students get only one viewpoint.

One method of encouraging the development of more diverse educational activity is to involve groups through the use of computer communications for distance education. Traditionally, distance education meant the use of the post office to mail learning material to students who would have to study it on their own. Depending on the organization of the program they might have access to tutors by telephone, but still they were expected to pursue their studies individually. Today, with the use of the Internet and web groups it is much easier to participate in education online. Members of the group can access the Internet 24 hours a day at their convenience. They do not have to be on the computer system at the same time as the other members of the group. And by working in a group they are introduced to more diverse viewpoints. Working in a group can help increase the motivation of a person who is no longer expected to study the educational material alone.

Understand the term teleworking. List some of the advantages of teleworking such as: reduced or no commuting time, greater ability to focus on one task, flexible schedules, reduced company space requirements. List some disadvantages of teleworking such as: lack of human contact, less emphasis on teamwork.

With the widespread introduction of computer communications in developed countries the division between work and home life is decreasing. Teleworking, or telecommuting, allows people who have computers in their homes to work as if they were in their offices.

Some people find this an ideal situation. They do not have to commute to the office and they can organize their work schedules to suit their life situations. Others find that teleworking increases the time they spend on work so they have less time for their families. Some also find that they are isolated from their co-workers.

Teleworking can also contribute to the individualization of work forces so it becomes more difficult for employees to work together for better wages or benefits. Unions are much more difficult to organize when people work at home instead of a central office or factory. As well, teleworking may encourage the intensification of piece-work as employees are paid for only the number of files or documents they have worked on.

At the same time, teleworking has opened opportunities for people in developing countries to find work. For example, India in the past few years has built a thriving software industry because of the capabilities of computer communications. Programmers in India, for example, can work on projects for companies in the developed world without leaving their countries.

1.5.2 Electronic World

Understand the term electronic mail (e-mail) and know its main uses.

Email is the use of computers to send messages. Although it is primarily an individual-to-individual medium it can be used to send messages to thousands of recipients. Today email can be accessed by people using their personal computers, visiting cybercafés or using cell phones. Email receivers are even being built into products such as cars or refrigerators. Some 33 billion email messages are sent every day. What's more, its usage is growing at a tremendous rate. It is estimated that, by the end of 2006, some 60 billion messages will be sent daily.

You can think of an email message as an electronic envelope which is sent from computer to computer. The outside of the envelope (called the “header”) contains information about the sender and receiver. The inside of the envelope contains the text of the message. These days the “text” can also be the instructions for producing graphics, sounds and alphabetical characters not found in English.

When you send an email it is placed in the computer you are communicating with (called the server”) and then sent to another computer server on the great collection of computers called the Internet. Each server holds the message for awhile, decides where to send it next and then passes the message to another server. This continues until the message reaches the computer on which the recipient has an account. In the electronic world the holding of the messages may take a split second. In the developing world it may take hours.

Email accounts (such as member@unionmail.net) can be purchased from the company that provides the user with Internet access or by using free services such as Microsoft's Hotmail. These free commercial services can survive economically because they sell advertising opportunities. Unionists have access to a free email service called SoliComm (www.solicomm.net) which does not have advertising.

Understand the term e-Commerce. Understand the concept of purchasing goods and services online, including giving personal details before a transaction can be carried out, payment methods, consumer’s basic right to return unsatisfactory goods.

E-commerce (EC) is the buying and selling of goods and services on the Internet. Millions of people in the developed countries are using the Web to purchase books, buy software, book hotels, purchase airline tickets and perform other commercial activities.

Normally these transactions demand that the users pay with a credit card. Usually the user sets up an account, provides personal details related to the sale, and gives their credit card information. Another form of payment becoming popular is to use “Pay Pal”. This is a web-based service which allows anyone with an account to send money to anyone who has an email address. The recipient must also have a Pay Pal account. Pay Pal also processes payments for e-commerce sites, auction sites and large corporations. A newer payment method being introduced is to bill your telephone account. Instead of using a credit card you would use a pre-authorized account with your telephone service.

As e-commerce grows developed countries are reacting by passing legislation to protect online consumers, legalizing activities such as the online signing of contracts and policing illegal activities. Most reputable companies offer a return policy, and many will pay the return postage if you are not satisfied with the product (*see below*).

One aspect of e-commerce which is growing very quickly is business-to-business (B2B) transactions. Businesses can buy and sell by opening their computer systems to their suppliers or clients.

List some of the advantages of purchasing goods and services online, such as: services available 24 hours a day, opportunity to view a wide range of products. List some of the disadvantages of purchasing goods and services online such as: choosing from a virtual store, no human contact, risk of insecure payment methods.

The advantage to online shopping is that the web sites which offer the goods or services are open 24 hours a day. Many sites have most or all of their stock catalogued online, allowing the user to view a wide selection of products and compare prices from different sites without leaving home. Also, customers can track the status of their orders online.

The disadvantage is that people cannot talk to a person about the purchase or see the product which is being bought. And e-commerce is not possible in much of the developing world. Key issues:

- Credit card safety – make sure you order from a legitimate, secure website to avoid credit-card fraud. This fraud occurs when someone uses your credit card information to make unauthorized purchases, and this can happen as easily offline as online. Newer versions of browsers handle SSL- Secure Socket Layer, an encryption method used to safely send your personal information over the Internet and commonly used by e-commerce sites. When you are using a secure page, there is an 's' after the http part of the URL in the address box. For example, a secure page would have the address: <https://amazon.com>. Note: only pages requiring extra security will show the extra s in the address.
- Returns and product quality – most reputable companies offer a return policy, and many will pay the return postage if you are not satisfied with the product. All information regarding returns should be posted on the web site and you should read this information carefully. In addition, once you place an order you should always write down or print out the order number. This will allow you to track the order in case it does not arrive. Legitimate companies should also provide contact information, either by email or telephone, in case you need to contact them about problems with your online order.
- Lost orders – make sure that you complete the required information carefully. Check the order form to make sure the address, etc., is correct before submitting the form. If your information is correct, and an order is lost, most companies will replace the order or you can ask for a refund.

- Economic Divisions – the developing world is at a disadvantage in all of this because the use of credit cards by individuals or companies is minimal, legislation to regulate e-commerce is non-existent and the technological infrastructure to allow for fast computer communications is not developed. The danger is that the economic gap between the developed and the underdeveloped countries may increase even more as the richer countries increase their use of e-commerce.

1.6 Health and Safety, Environment

1.6.1 Ergonomics

Understand what elements and practices can help create a good working environment such as: appropriate positioning of monitors, keyboards and adjustable chairs, use of a mouse mat, use of a monitor filter, provision of adequate lighting and ventilation, frequent breaks away from the computer.

Ergonomics is the study of the interaction of people with tasks, jobs, products, systems and work environments, in order to optimize human well-being. Numerous studies have indicated that an appropriate workstation layout can improve the work environment and reduce health problems. Many countries have health and safety regulations which apply to the workplace. For example, some of the following information was adapted from the Canadian Standards Association.

Monitors should be placed at a height where the neck can be kept straight, usually when the top of the screen is at the user's eye level. The viewing range should be about 40 – 75 cm (16" - 30"), depending on the size of the monitor. If the screen is too low/high it can cause vision problems, neck problems, fatigue and discomfort. If the user views the monitor a lot, the screen should be directly in front, not to the side. Monitors have controls to adjust the position, screen brightness, etc., and the user should know how to change the settings to make the screen more comfortable to view. Note: for those who wear bifocals/trifocals, monitor height needs to be adjusted for the user's vision requirements. Also, those who wear glasses or view the screen continuously should have their eyes checked regularly. Those who wear contacts should remember to look away from the screen regularly and to blink more often to avoid dry eyes.

Keyboards should be placed so that the arms hang naturally when the elbows are bent at a 90 degree angle. When the arms are bent they should hang naturally at the sides. Hands should be positioned so that the wrists are straight, not bending up, down or to the side. Work surfaces that are too high/low put extra strain on the arms, shoulders and wrists and back. Many keyboards have 'feet' which allow the user to position it higher or lower on the workstation. Newer keyboards are designed to be more ergonomically correct for the user. Keyboard rest pads support the wrists and palms, which helps prevent wrist strain. Serious finger/wrist problems can occur when keyboards are not positioned at the correct level.

Chairs should be stable and fully adjustable, with good lumbar (back) support. They should allow the user's feet to touch the floor comfortably, or a footrest should be used. Inappropriate seating or chair height can contribute to serious back and neck problems.

Mouse – this should be placed as close to the user's side as possible, to let the user hold it in a relaxed position. The arm should hang normally with the wrist in a comfortable and relaxed position. Mouse settings should be adjusted for clicking and speed, as well as changes for left-handed users. Use a mouse pad to decrease resistance while 'mousing'. Constant mouse use with poor positioning and/or without a mouse pad can contribute to serious hand/wrist problems.

Monitor filters – glare from the monitor can cause eye strain and vision problems, especially when light is reflected from windows or bright overhead lighting. These problems can be reduced by the use of screen filters which reduce the glare and improve visual perception.

Lighting – bright light from either overhead lights or windows can cause glare on the workscreen, making it difficult to see screen contents. This can cause headaches and eye strain for the user. The screen should be at right angles to windows, and drapes or blinds can be used to control the light. As well, matte or anti-reflective colours should be used on the walls to absorb light rather than reflect it. Overhead lighting should be parallel to the user's line of vision. Where possible, indirect or shielded lights (with lampshades) should be used.

Ventilation should be adequate for both the comfort of the user and to offset problems from chemicals released into the air from computer hardware. Computers should not be placed too close to heating or cooling systems, which can cause discomfort for the user and possible damage to the equipment. There should be sufficient fresh air so that the area is not too dry, causing fatigue and eye strain.

Breaks – during prolonged computer use a worker should take frequent breaks away from the computer, at least five minutes every hour. Sitting in one position for a prolonged period of time can cause back and muscle strain, and constantly staring at the screen can cause eye strain.

Desks – these should have two levels to allow the keyboard and monitor to be positioned at different levels. There should be a large enough work surface for the required hardware and sufficient leg room as well.

Telephones – for those required to use a telephone while working on a computer, headsets are recommended to prevent neck problems.

Document holders/Slantboards – these should be placed upright and close to the monitor in a position which is comfortable for the reader and where it does not cause too much eye and neck movement.

List some common health problems which can be associated with using a computer such as: injuries to wrists caused by prolonged typing, eye strain caused by screen glare, back problems associated with poor seating or bad posture.

There are several health related issues associated with computer use, especially when using a poorly designed workstation.

- Repetitive Strain Injury (RSI) is a common problem related to constant use of a mouse or keyboard. It affects muscles tendons and nerves in the wrist, arms and upper back. It occurs

when muscles are kept tense for long periods of time, due to repetitive motions and / or poor posture. Carpal Tunnel Syndrome is one of the most common types of RSI and affects the hands and wrists, causing severe pain.

- Eye strain – Computer Vision Syndrome (CVS) is the term for vision related problems which can be caused by: working in front of a monitor for more than two hours daily; working where there is extensive glare; or working in front of a monitor that is not positioned properly. Symptoms of eye strain can include: watery eyes, dry eyes, blurred or double vision, difficulty focusing, a heavy feeling of the eyelids or forehead, after-images, temporary near-sightedness, headaches, neck and back aches.
- Back and neck problems have been linked to prolonged computer use, especially when poor posture and /or poor workstation design is involved. In addition, using a computer for a long period without a break forces the body to overuse one group of muscles, which leads to repetitive strain injury of the back. Low back pain can also be caused by using the wrong type of chair, leaning forward or sitting with your legs crossed while using the computer.

List some safety precautions when using a computer such as: ensuring power cables are safely secured, power points are not overloaded.

A computer uses electricity, and if not set up properly this can lead to the danger of fire or electrical shock. Cables should be properly connected and kept where they can't be tripped on. The proper type of power supply should always be used. In addition, cables and electrical cords should be kept away from water and heat sources. Never use a damaged cable or cord, and never overload the power bar or surge bar. This can cause overheating and quickly lead to a fire, or you can trip the circuit breaker or fuse box, causing damage to the computer equipment.

Be aware that recycling printed outputs, recycling printer toner cartridges, using a monitor that consumes less power while the computer is inactive can help the environment.

Electronic waste (e-waste) is a growing problem. As newer technology is introduced, older technology is abandoned. Moreover, the products associated with computer use are also discarded, such as cables, modems, cartridges, used CDs, etc. Recycling has become a key issue for the world of technology:

- Printer cartridges – these can be recycled and many charitable organizations collect them to use as fund raisers. In addition, many companies buy used toner cartridges to re-manufacture them. They are taken apart, cleaned and filled to be used again. Recycled cartridges save the environment and less non-biodegradable waste is created.
- Printed output – paper – is commonly recycled and used to make boxes, newspaper and a wide variety of other paper products which do not require high quality. The more paper which is recycled, the fewer trees that are required to produce more paper.
- Monitors that require less power, or using a power management system, reduces the amount of electricity required for use and contributes to the environment by saving valuable resources. Low power management means that a system goes into a low power mode when it is not active, but remains on standby for immediate use. When your monitor 'goes to sleep' it is in power management mode.
- Computer equipment – many charitable organizations accept used computer equipment which they recycle by sending it to areas where it is needed.

Understand that using electronic documents can help reduce the need for printed materials.

Electronically based documents can be shared by a large number of users, without relying on a printed product. In addition, letters or newsletters sent electronically also save paper and reduce waste. Increasingly, information from an organization, catalogues or products are available online, reducing the need for printed materials, saving time, money and our natural resources, thus helping the environment.

1.7 Security

1.7.1 Information Security

Understand the term information security and the benefits to an organisation of being proactive in dealing with security risks such as: adopting an information security policy with respect to handling sensitive data, having procedures for reporting security incidents, making staff members aware of their responsibilities with respect to information security.

Information security (IS) is the practice of safeguarding all information / data from unauthorized access or disclosure. This applies to all types of data, not just that related to computerized systems. Every organization should have a policy for safeguarding sensitive data or personal employee or member information. If there are no security policies, members of organizations could be subject to identity theft, which could cause financial and personal problems. Organizational data could be misused, corrupted, changed or stolen. Recommendations for ensuring information security include the following:

- Organizations should adopt an information security policy which clearly defines the responsibilities of the employees and members when accessing sensitive data. Material stored on a computer should be encrypted and secure passwords used. Most computer operating systems come with built in options for securing sensitive information. Electronic data should be stored on a secure server where possible.
- Procedures should be implemented to ensure that any security breaches or problems are reported immediately. Staff should receive training to recognize signs of problems and should know the steps to take when this occurs.
- Staff should receive training on all procedures required to prevent security problems, and only staff with appropriate clearance should have access to sensitive data. They should be aware of the need to protect devices which can easily be stolen, such as laptops. Staff members should also be aware of security procedures for protecting printed material, such as keeping it in locked cabinets and shredding sensitive printed material that is no longer needed.
- The use of a firewall will contribute to network security in an organization. A firewall is a hardware/software system which is used to prevent unauthorized users. It can also filter data entering a system to prevent the appearance of viruses or inappropriate material. Firewalls are used on many LANs and WANs.

Know about privacy issues associated with computers, such as adopting good password policies. Understand what is meant by user ID and differentiate between user ID and password. Understand the term access rights and know why access rights are important.

Once personal data has been entered into a computer, the issue of protecting the privacy of the individual(s) becomes significant. Information regarding health insurance, taxes, employment, education and social security exists on a computer somewhere for most individuals in developed countries.

Computerized record keeping is practical and efficient, but it is necessary to protect the data from misuse or unauthorized users. When resources are password protected, it is easier to protect sensitive data because only those with authorization can access restricted programs. Passwords are used by many people on a daily basis, from using a computer to an automated bank machine or retrieving voice mail. They are private and kept secret and should be created so that it is difficult for another individual or computer to guess.

A password policy is a set of rules established by an organization to promote computer security. It establishes the rules for designing secure passwords, such as requiring a combination of letters and numbers, a minimum length, etc. The policy will also establish the level of security for users, such as entry into low level security data for all employees, but restricted use for higher security levels. Suggestions are made for safe password storage for users requiring more than one password. For example, high level passwords could be kept in a safe, if it is necessary to write them down.

While a password is a private code used by the individual to gain access to an account or program, user ID is a different type of security which is often required with the password. Your user ID is usually a name you have chosen when setting up an account. It could be your real name or an alias. For example, when using Hotmail to send an email, you would login with your user ID and a password:

User name (ID):	simonsays@hotmail.com
Password:	*****

Access rights (access privileges) grant permission for the user to enter specific programs or view secure files. Also, access rights determine whether a user is allowed to perform various functions related to the files, such as: read, write, create or delete shared files. Access rights are an important means of controlling and maintaining the security of data where there are multiple users. These rights are usually determined by the system administrator.

A newer form of security which will one day replace passwords is biometrics. This security feature identifies the user by scanning a fingerprint or retinal pattern. At present the equipment is extremely expensive and impractical for most organizations.

Know about the purpose and value of backing up data, software to a removable storage device.

To backup a file means to make a separate copy on a removable storage device. Backups are a way of securing computer data and are important for several reasons. If computer problems occur, the operating system fails, files are accidentally deleted, or equipment is stolen, the data still exists in another location. Also, in case of fire or natural disaster, such as a hurricane, data is protected by backups. Typically, backup files are kept on CDs, tapes or DVDs. They can be stored in a secure location, either onsite or offsite, such as in a company vault or a bank safety deposit box. Another

method is to backup files over the Internet using a file hosting service.

Be aware of possible implications of theft of a laptop computer, PDA, mobile phone such as: possible misuse of confidential files, loss of files, loss of important contact details if not available on a separate source, possible misuse of telephone numbers.

Laptops, cell phones and PDAs make it easier for employees to work offsite and still remain connected. The main problem is that because they are small, they are easily stolen. Everyone needs to be alert to the possibility of theft and consider the consequences which might occur if a laptop, cell phone or PDA is stolen. All devices should be password protected, where possible. Users should be aware of security issues as follows:

- Users should restrict the number of confidential files to the absolute minimum when using laptop computers. Consider the information available to a thief when creating or saving files on a laptop. Use passwords and encrypt sensitive files.
- Use external storage devices for backups to prevent total loss of data. (*See section on backups above.*) It can take months to create data files and only minutes to have them stolen.
- If a cell phone is stolen, not only does the thief have access to all of your personal numbers, but depending on the type of service you have, the thief can also run up large amounts on your cell phone bill. Again, make sure your cell is password protected and keep a separate contact list as a backup.

Additional Security

- Engrave the outside of the laptop with the name of your organization, or write it on with an indelible marker.
- Most laptops have a security slot which lets you attach a cable or alarm to them. When you aren't using it, keep it locked up. Also keep in mind that statistics show that laptops are frequently stolen from the office, not just while you are travelling.
- Know your cell phone's serial number, and if the phone is stolen call your service provider to report it. The phone can be deactivated, preventing anyone else from using it. (This only works for service providers who use the GSM Standard.) To find your phone's ID number, dial * # 0 6 # and the number will be displayed. Note: once you report this number and the phone is disabled, it is permanent. If you find the phone you cannot reactivate it.

Understand the term virus when used in computing and understand that there are different types of virus. Be aware when and how viruses can enter a computer system.

A virus is a program usually designed to cause damage to a computer. It is self-replicating, which means that it copies itself and spreads. Viruses imitate a human virus, which spreads when the infected person comes into contact with a healthy person. When a computer has a virus it is 'infected', just as a human is infected with a virus.

The way the virus infects other computers is that it attaches itself to another program (it 'piggybacks'). For example, email viruses attach themselves to an email message. When the message is opened, the virus will mail itself to the people in the user's address book. Viruses can cause small problems or major damage, depending on the type, and can spread quickly. They are spread by using infected disks, files or software.

Worms are a type of virus that reproduce themselves using computer networks. In January 2004 the Mydoom worm infected over ¼ million computers in one day. A Trojan horse is a program that appears to perform one operation while actually doing something else in the background and

causing damage to the computer. Unlike viruses, Trojan horses don't copy themselves.

There are different types of viruses:

- Boot Viruses infects the boot sector of the storage disk
- Program Viruses infect programs
- Stealth Virus is able to hide itself in the system
- Multipartite Viruses infects boot sectors and files
- Polymorphic Viruses mutate, changing their structure to avoid detection
- Macro Viruses are spread by sharing document files from MS-Word (version 6.0 and above) or MS-Excel (version 5.0 and above). They are a common cause of virus infections, and can infect either PCs or Macintosh computers.

Viruses are classified by the way that they attack the system. They can be found on any type of computer, but most viruses are written for PCs. While there are many ways for a virus to enter a computer, most viruses attack through email messages and attachments. The second major source of viruses is visiting an unreliable Web site, and using infected diskettes ranks third.

Spyware, also called Malware, is a program that secretly monitors the activity of a computer user or organization. It is generally attached to shareware or freeware, or can install itself from some websites. It runs without the user's knowledge or consent and gathers data which is forwarded to a third party via the Internet. It can change system settings or even deliver unsolicited advertising. Some Spyware can even install keystroke loggers which copy passwords, while other types collect and report the user's personal information. It can be very difficult to remove and requires special anti-spyware software. Reliable programs are readily available as a free download via the Internet. Note: anti-spyware software is not the same as anti-virus software and it does not run automatically.

Know about anti-virus measures and what to do when a virus infects a computer. Be aware of the limitations of anti-virus software. Understand what 'disinfecting' files means.

If your computer becomes infected with a virus, don't panic. Not all viruses cause major damage. Run your anti-virus software immediately. If this doesn't work, reboot from a clean system diskette and run the anti-virus software. If you don't know what to do, turn off the computer and ask someone for assistance.

To protect a computer from a virus, use a high quality anti-virus program and update it frequently, at least once a week. New viruses are being created constantly, and updates are released as they are discovered. Anti-virus software usually runs in the background, checking all files as they are used. Good quality software automatically updates itself when you connect to the Internet.

When an anti-virus program detects a virus, it will immediately notify the user. You can then try to 'disinfect' the file. This means that the software tries to isolate and remove the virus without damaging the file. If it is not possible to remove the virus, you should probably delete the file.

While anti-virus software is an essential tool in protecting your computer, don't rely on it entirely. The user must constantly update the program to avoid viruses. When the software is not kept up-to-date, newer viruses can easily infect a computer. Moreover, new viruses are released almost on a daily basis, and it takes time for the anti-virus software producers to create an update to treat the problem.

Note: anti-virus software should be run in combination with anti-spyware software for additional

protection for your computer. Anti-spyware does not run automatically, you need to start it.

Understand good practice when downloading files, accessing file attachments, such as: use of virus scanning software, not opening unrecognised e-mail messages, not opening attachments contained within unrecognised e-mail messages.

While anti-virus software is an essential tool, good computer practices are also necessary to ensure computer health:

- Scan files, disks, software before using it on your computer for the first time.
- Scan your disks after using them on another computer and scan all downloaded files from the Internet.
- Don't open unsolicited email or attachments as they could contain viruses.

1.8 Copyright and the Law

1.8.1 Copyright

Understand the concept of copyright when applied to software, and also to files such as: graphics, text, audio, video. Understand copyright issues involved in downloading information from the Internet.

Copyright law allows a person who creates something to control who can use or make copies of the original creation. Most countries have copyright laws and there are international agreements which also protect copyrights. Copyright law protects the right of the creator to control the use of a product, as well as guaranteeing his/her right to financial benefits from the product. The Berne Convention for the Protection of Literary and Artistic Works (revised in 1971), signed by most developed countries, guarantees the copyright of a tangible creative work until 70 years after the creator's death, even if a copyright was not applied for. (Facts and ideas cannot be copyrighted.) Copyrights can be sold or given away, but the creator has sole rights to it otherwise.

Software copyrights are designed to protect the developer from software piracy, which is when illegal copies of a program are produced and sold. It also makes it illegal to make copies and give them to others. Both of these are major problems in many countries. Developers also try to protect themselves with licenses controlling the use and distribution of the product.

Graphics, text, audio and video files are also the copyright of the author, unless otherwise stated. None of these should be reproduced without permission. Most of the material available on the Internet is also subject to copyright, which means that while you can view it, you cannot copy or reproduce it.

As well as being illegal, copyright infringement is unethical. You should never use material created by someone else without their permission. Downloading files, whether they are graphic, text, music or video should only be done with the permission of the author.

Note: most copyright law includes special provisions for schools and libraries, which are allowed to make backup copies in case of theft, loss or damage to the material. Also, schools are allowed to

use certain material for resource and educational purposes.

Understand copyright issues associated with using and distributing materials stored on removable media such as CD's, Zip disks, diskettes.

Copyrighted material should not be copied or distributed without the consent of the author.

It is illegal in most countries to:

- make unauthorized copies of CDs or DVDs
- use someone else's original work and not give credit to the author
- distribute unauthorized copies of books, videos, movies, CDs, software, DVDs and games
- sell unauthorized material
- distribute unauthorized material via the Internet

Some countries treat copyright infringement as a criminal offence punished by heavy fines and/or jail terms. To get a legal copy of software, music, etc., contact the author or purchase a legal copy.

Know how to check the Product ID number for a software product. Understand the terms shareware, freeware, end-user license agreement.

In order to prevent software piracy, many new programs require you to activate the program with a product ID number (product key). These numbers are included with the installation materials. To determine the product's version and background information, open the Help menu in any program and usually the last option is 'About...'. Click on this to get product information. Keep this information in case you ever need to reinstall the software!

Some products do not require product registration. These are programs like freeware and shareware. Freeware is software which can be downloaded free for personal use, but the author retains the copyright. Shareware is usually free for a trial period only. If the user decides to continue using the program, payment is commonly required. Shareware is also subject to copyright laws.

End User Licence Agreement (EULA) is a type of licence used for most software. It is also known as a software licence or user licence. It lists the restrictions for using the software or website and is a contract between the company and the end-user (the organization/person using the software).

Know about data protection legislation or conventions in your country. Understand the implications of data protection legislation for data subjects and data holders. Describe some of the uses of personal data.

Data protection legislation has been adopted in many countries to protect the way personal information can be used and how it can be stored, in order to protect the rights of the individual. While most countries have laws regarding data protection, they are not necessarily the same everywhere. Most data protection legislation can be found on the Internet or by contacting the appropriate government office. Data holders have a responsibility to make sure that the rights of the individual are not violated through misuse of the data.

Some of the laws include directions for information and security, including guidelines similar to those listed below:

- data should be accurate and limited to the amount realistically required by the user
- data should be stored in a secure manner
- data should only be used for the purpose it was acquired for

- data should not be shared with unauthorized users
- data should be destroyed when no longer necessary

There are many legitimate reasons for an organization to hold personal data, such as:

- tax or census information
- health records
- banking information (accounts/mortgages/loans/investments)
- employee records
- life insurance files
- social security benefits

When organizations do not protect the privacy of their members, identity theft is possible. This occurs when personal data is stolen from unprotected computers, or confidential files are not properly destroyed. It can also occur when mail is stolen or from material thrown in the garbage.

Some of the common misuses of personal data are:

- credit card fraud, which is the most common type of identity theft
- creation of illegal ID cards (driver's licence, passport, etc.)
- blackmail
- illegal immigration
- terrorism

This concludes Module One.