Course: Basics of ICT (5403)
Semester: Spring, 2021
ASSIGNMENT No. 1

Q. 1 (a) Define the term ICT. Describe it with the help of proper examples.

Information and Communication Technology or "IT," includes products that store, process, transmit, convert, duplicate, or receive electronic information. Examples are: software applications and operating systems; web-based information and applications such as distance learning; telephones and other telecommunications products; video equipment and multimedia products that may be distributed on videotapes, CDs, DVDs, email, or the World Wide Web; office products such as photocopiers and fax machines; calculators; and computer hardware. Electronic textbooks, instructional software, email, chat, and distance learning programs are also examples of IT.

Assistive technology, as it relates to information and communication technology, includes special tools or software to help people use computers, software, the Internet, telephones, or other technology used in education. Examples are: special keyboards; software to magnify a computer screen or audibly read the text on a computer screen; text telephones (TTYs) to help people who are deaf communicate using the telephone.

Information and communication technology may be inaccessible to people if it provides only one way to access the information. For example, those with visual impairments cannot read documents presented only in a visual format; people who are deaf cannot understand content that is only presented orally; people who have limited use of their hands or arms may not use a computer mouse; and people who use wheelchairs may not be able to operate a fax machine if the controls are impossible to reach.

Many of these barriers can be reduced or eliminated when the principles of "universal design" are used to design and develop the information technology. The decision to plan ahead for accessibility can reduce the need for special accommodations.

Most people will tell you that IT is a shortening for "**information and communications technology**" – option number one above. Let's unpack that phrase. So it is "information technology" or "communications technology". It is not "information" or "communication" standing on its own. "Information" or "communication" has to go with technology – they cannot exist independently. You could shorten information and communications technology to just technology.

In my view, it should be "**Information and technology**" – option number two above. Each aspect of the acronym can stand on its own. So it includes "information" or "communication". It also includes technology or "information and communications technology". This interpretation is wider. Another way of looking at it is that IT stands for:

1. Information – (or data) in paper or electronic format
2. Communication – in person or electronically (electronic communications), in writing or voice, telecommunications, and broadcasting
3. Information technology (IT) – including software, hardware and electronics
4. Communications technology – including protocols, software and hardware

There are various relevant sections in the black economic empowerment charter for the IT sector, which I have quoted below for ease of reference. The IT BEE Charter is unfortunately poorly drafted and contradITs itself. Have a look at the sections below. For example, the drafters have defined IT in different ways. Initially, IT is a shortening for "Information and Technology", but then in the definition of IT it is defined as "Information and Communication Technology". As illustrated above, there is a difference in meaning between these two and therefore the IT BEE Charter contradITs itself. In my view, they got it right initially. An example of poor drafting is the definition of "Information Technologies Sector". It is not clear what it means – I'm not even going to try to interpret.

"Recognizing the cross cutting nature of Information and Technology (IT), and its role in the social and economic development of our country.

"**IT**" means Information and Communication Technology and refers to the combination of manufacturing and services industries that capture, transmit and display data and information electronically (OECD 2002: 18; SAITIS 2000: 3)"

The "**Information Technologies Sector**" shall without in any way limiting the ordinary meaning of the terms, mean the sector in which employers and employees are associated for the carrying on of any one or more of the following activities:

marketing, manufacturing, assembling, servicing, installing, maintaining and/or repairing systems, software, equipment, machines, devices and apparatus, whether utilizing manual, photographic, optical mechanical, electrical, electrostatic or electronic principles or any combination of such principles, that are primarily intended for the recording and/or processing and/or monitoring and/or transmission of voice and /or data and/or image and/or text or any combination thereof for use in any one or more of the following activities:

accounting, calculating, data processing, data transmission, duplicating, text processing, document reproduction, document transmission, record keeping and record retrieval, broadcasting or transmission for entertainment or information purposes of voice and/or image and/or text or any combination thereof and/or; the provision of services relating to the above.

(b) Write down the advantages and disadvantages of "Information and Communication Technology".

Information and communication technology, generally known as ICT, is a vast field encompassing virtually all technologies that can store, receive or transmit signals electronically. Even your thermostat and your vehicle fleet can be part of the ICT universe if they are tied into a wireless communication network. With electronic devices so tightly wound into the fabric of modern society, the advantages and disadvantages of ICT use may not be immediately apparent. Taking a fresh look at the pros and cons helps to give perspective on the ways ICT affects you and your business.

New Communication Methods

ICT has opened up a wide range of new communication methods, allowing you to contact others more or less instantaneously, and for less money and over greater distances than ever before. Technologies such as texting, instant messaging and video conferencing allow users to communicate in real time with people across the world for a nominal fee, a concept which may have seemed ludicrous before the advent of computers. In addition, text-based computer communication can give those with speech or social problems a level playing field to communicate with their peers.

The ease of these communication methods comes with a downside, as anyone who has had to review a thousand new email messages before morning coffee is well aware. Some ICT components, such as intelligent chat bots, are finding service to help respond automatically to at least some forms of incoming communications.

Creation of New Industries

As well as providing a boost to existing industries such as manufacturing and shipping, heavy adoption of ICT has spawned new industries all of its own. Programmers, systems analysts and Web designers all owe their jobs to ICT, as do the people involved in secondary industries such as technology training and recruitment.

However, the increased efficiency and automation brought about by ICT can also cause job losses, especially in manual roles and the manufacturing sector. New forms of communication also put old business models at risk. Newspapers and print magazines are pressured by online news sources. Peer-to-peer communications have made possible businesses like Uber and Airbnb that are disrupting traditional services like taxis and hotels.

Body Language and Non-Verbal Cues

Communication through voice chat or instant messaging does not take body language into account. Non-verbal cues are a vital part of the way humans communicate, with researcher Albert Mehrabian calculating that 55 percent of the message pertaining to feelings and attitudes portrayed by people is in facial expression alone. As such, there is an increased chance that your message will be misunderstood if you are not engaged in face-to-face dialog with the person you are talking to.

Security Issues and Risks

ICT provides a range of ways for fraudsters to gain access to your personal details, which could result in you or your business losing money and reputation. Technologies such as online banking mean that with the right security information a third party could impersonate you and gain access to your finances remotely. This is in stark contrast to the pre-ICT era, when frauds would have needed to convince another person (for example, a bank teller or phone operator) that they were you in order to access your money.

Advantages of ICT in education

1 – Interaction without geographical barriers

The users of these technologies are almost all the time interacting with each other through forums or social networks. If it is a course coordinated by a teacher, it is not necessary that they are all together in a room to be

able to interact, since the **Internet allows the creation of discussion forums and in this way all the members participate even if they are not physically close** .

2- Diversity of information

By accessing the Internet **anyone can be informed about the latest news on virtually any subject** . This is a great advantage because it does not limit knowledge to a textbook or a teacher in the classroom, in addition to which you can offset sources and opinions and reach different points of view on an issue.

3 – Self-paced learning

With alternatives such as online courses or moocs each user can **study at their own pace** and at the time that suits them, saving time and money since they do not have to travel to an academy and the moocs are free.

4 – Skill development

Among them, the ability to search for reliable information on the network. Internet is a sea of information to navigate, but a large amount of content is not reliable, so using this tool the student acquires discernment skills to know **when he is facing valuable information and when he is receiving disposable information** . In addition, you also learn to use the machines, which is very useful for anyone.

5 – Strengthening the initiative

In online education **each student is responsible for their learning process** , so it can be a good way to reinforce the initiative of each one to continue studying and learning; since although the good courses involve the guidance and guidance of the teacher, none will be on the student to complete the task.

6 – Immediate correction

Learning through the Internet also provides an **immediate feedback system** when the user makes a mistake, allowing the student to know that he is wrong when he is making the mistake.

Disadvantages of ICT in education

1 – Distractions

The Internet, as well as an inexhaustible source of knowledge, is as much a distraction. It is very easy that **with this tool there are losses of time every time**, so **each person must self-censor** on these issues and leave the distractions of the internet for leisure time, avoiding them when working or studying.

2 – Surface learning

As we mentioned above on the web you will find information in abundance, but **often it is not of quality** . This can lead to incomplete learning or even worse to erroneous learning.

3 – Little human educational process

The learning process, being through a machine, can become impersonal and cold because you will **not be in contact with classmates and teachers** .

(c) Internet is a well-known example of ICT. How it enables people to communicate easily through different communication mediums?

The internet is a collection of connected computer networks, linking tens of billions of devices across the globe. These include servers, personal computers, mobile telephones and video game consoles. Increasingly, other devices are also being connected to the internet, such as cars and domestic appliances. Devices connected to the internet are connected to each other through network links. These links can be either physical cables or wireless connections. Physical cables come in an array of shapes and sizes, ranging from small cables used to directly link two computers together, to large undersea cables connecting continents. Wireless connections, though not visible, work on similar scales, from Wi-Fi networks in the home to links to satellites in space. Communications on the internet may traverse any combination of these network links, and they have become a hotly contested topic in international relations.

Though often used synonymously, the internet is not the same as the 'world wide web' (www). The web is just one of many services operating on the internet, accessed through a web browser to display documents containing text, images and other media. Examples of other services on the internet include email, voice and video communications and online gaming. The distinction between the internet and the web is important as conflating technological concepts can have severe repercussions in the area of laws and regulations where precise wording is paramount. Throughout this chapter, the internet should be envisaged as the whole gamut of connected digital devices and services. When individual devices or services are discussed in detail, it will be made explicitly clear which device or service is being talked about.

At least as old as the idea of commerce is the idea of communicating with other humans across geographical divides. A primary means for doing so is through the written word. The most direct of these means is the letter, because it is sent from one individual to another individual carrying a specific message. As such, letters represent a key connection between humans. In the digital age, email and instant messaging have usurped letters as the primary means of written communication, with hundreds of billions of digital messages sent from one person to another each day. The process of mailing a letter resembles the protracted commercial chain described in the section above. There is a sender who authors the letter and drops it in a post box. A postal worker then collects the letter and brings it to a sorting centre where a machine (though previously a human) directs the letter towards the right address. The letter is then transported by land, sea and/or air to a distribution centre where more sorting happens. Finally, a delivery person deposits it at the stipulated address, where the receiver accepts and reads the letter. Through a convoluted series of middlemen, the sender and receiver can thereby communicate with each other. With email and instant messaging, the human middlemen are completely removed from the process. The only step between sender and receiver is some technological wrangling that ensures the email or message arrives intact at the correct destination. In this way, sender and receiver can communicate directly and, importantly, with near instantaneousness. A written letter can take anything from a day to a week, or more, to arrive at its destination. By comparison, an email usually takes a matter of seconds, regardless of how much of the planet it has to traverse. Even emails to the International Space Station take only a few seconds to transmit.

You may take the speed at which you can message others for granted. But it is worth putting this in perspective with a historical comparison. According to legend, when Martin Luther set in motion the Protestant Reformation in 1517, he did so by nailing a polemical document to a church door in Wittenberg. This act began a process of violent upheaval that culminated in 1648 with the end of the cataclysmic Thirty Years' War. The full effects of Luther's public posting thus took some 130 years to come to fruition. The modern equivalent of his document would be a social media post. Given that digital communications travel with almost no delay, messages can be quickly delivered to millions of people to spread ideas and organise movements. Perhaps the best example of this is the Arab Spring, also called the Twitter Revolution due to the widespread use of social media to propagate ideas and organise a response. While the Thirty Years' War took over a hundred years to materialise and play out, the revolution in Tunisia took just a few weeks. It is clear that digital communications have played some role in speeding up such events.

Q. 2 (a) Explain the first four generations of computer with proper examples.

First Generation Of Computers

Computers developed between 1946 – 1959, are the first generation of computers. They were large and limited to basic calculations. They consisted of large devices like the vacuum tubes. The input method of these computers was a machine language known as the 1GL or the first generation language. The physical methods of using punch cards, paper tape, and magnetic tape were used to enter data into these computers.

Examples of the first generation computers include ENIAC, EDVAC, UNIVAC, IBM-701, and IBM-650. These computers were large and very unreliable. They would heat up and frequently shut down and could only be used for very basic computations.

Second Generation Of Computers

Computers developed between 1959-1965 the second generation computers. These computers were more reliable and in place of vacuum tubes, used transistors. This made them far more compact than the first generation computers. The input for these computers were higher level languages like COBOL, FORTRAN etc. In these computers, primary memory was stored on the magnetic cores and magnetic tape and they used magnetic disks as secondary storage devices.

Examples of the second generation computers include IBM 1620, IBM 7094, CDC 1604, CDC 3600, UNIVAC 1108. As a result, they worked on AC and therefore were faster than their predecessors.

Third Generation Of Computers

Computers developed during the period of 1965 – 1971, the third generation of computers. These computers differed from the first and the second generations simply by the fact that a new circuit element like IC's (Integrated Circuits) was used. An integrated circuit is a small device that can contain thousands and thousands of devices like transistors, resistances and other circuit elements that make up a computer. Jack Kilby is credited with the invention of the Integrated Circuit or the IC chips. With the invention of IC's, it became possible to fit

thousands of circuit elements into a small region and hence the size of the computers eventually became smaller and smaller.

Another salient feature of these computers was that they were much more reliable and consumed far less power. The input languages for such computers were COBOL, FORTRAN-II up to FORTRAN-IV, PASCAL, ALGOL-68, BASIC, etc. These languages were much better and could represent more information. Consequently more and more complex calculations are possible

Examples of the third generation computers include IBM-360 series, Honeywell-6000 series, PDP (Personal Data Processor), and IBM-370/168.

Fourth Generation Of Computers

Fourth Generation of computers was between 1971 – 1980. These computers used the VLSI technology or the Very Large Scale Integrated (VLSI) circuits technology. Therefore they were also known as the microprocessors. Intel was the first company to develop a microprocessor. The first "personal computer" or PC developed by IBM, belonged to this generation. VLSI circuits had almost about 5000 transistors on a very small chip and were capable of performing many high-level tasks and computations. These computers were thus very compact and thereby required a small amount of electricity to run.

Examples are STAR 1000, CRAY-X-MP(Super Computer), DEC 10, PDP 11, CRAY-1. This generation of computers had the first "supercomputers" that could perform many calculations accurately. They were also used in networking and also used higher and more complicated languages as their inputs. The computer languages like languages like C, C+, C++, DBASE etc. were the input for these computers.

(b) List the hardware components of a computer. Explain at least five of them in detail.

A computer is any machine that can be programmed to carry out a set of algorithms and arithmetic instructions. Of course, the computers we think of today are so much more than that—and I'm talking beyond just being machines used to play games and watch videos of cats on the internet!

5 parts of a computer

Whether it's a gaming system or a home PC, the five main components that make up a typical, present-day computer include:

- A motherboard
- A Central Processing Unit (CPU)
- A Graphics Processing Unit (GPU), also known as a video card
- Random Access Memory (RAM), also known as volatile memory
- Storage: Solid State Drive (SSD) or Hard Disk Drive (HDD)

In terms of construction, each of these main components are attached to the motherboard and then put into a protective case—resembling the clean, polished look most of us are accustomed to seeing.

Sure, most computers have their own distinct design - and different brands of hardware installed - but the components listed above are standard across all computers.

Important: A quick note before we dive into the details—I'm listing and talking about the different components of a computer. This is by no means intended to be an invitation to disassemble your computer, nor is it a set of instructions to do so. Without the proper knowledge, you can severely damage your computer, and importantly, doing so is unsafe.

1. The motherboard

What it is: All components of a computer communicate through a circuit board called the motherboard, as was mentioned above.

What it does: Think of the motherboard as the glue that holds everything else together.

(The Raspberry Pi, like the one featured in our summer course for kids, Build and Code Your Own Take-Home Laptop, is a motherboard.)

The motherboard's video card and Central Processing Unit are contained in an integrated (built-in) chipset, shown in the picture below:

This is where input/output devices such as a keyboard, mouse, and speakers get plugged in.

2. The Central Processing Unit (CPU)

What it is: The CPU is often called the "brain" of a computer, thanks to its direct plug connection to the motherboard, and communication with all of the computer's other components.

3. The Graphics Processing Unit (GPU)

What it is: It's not uncommon to hear gamers obsess over the next new graphics card, as these graphic cards make it possible for computers to generate high-end visuals like those found in the many different types of video games.

In addition to video games, though, good graphics cards also come in handy for those who rely on images in order to execute their craft, like 3D modelers using resource-intensive software.

What it does: Graphics cards often communicate directly with the display monitor, meaning a $1,000 graphics card won't be of much use if there isn't a high-end monitor connected to it.

4. Random Access Memory (RAM)

What it is: RAM, also known as volatile memory, stores data regarding frequently accessed programs and processes. (It's called volatile memory because it gets erased every time the computer restarts.)

What it does: RAM helps programs and games start up and close quickly.

5. Storage

What it is: All computers need somewhere to store their data. Modern computers either use a Hard Disk Drive (HDD) or Solid State Drive (SSD).

What it does: HDDs are made of an actual disk onto which data is stored. The disk is read by a mechanical arm. (HDDs are cheaper than SSDs, but are slowly becoming more and more obsolete.)

SSDs (think SIM cards) have no moving parts and are faster than a hard drive, because no time is spent waiting for a mechanical arm to find data on a physical location on the disk.

Q. 3 (a) Discuss the purpose of speech recognition device?

Speech recognition, the ability of devices to respond to spoken commands. Speech recognition enables hands-free control of various devices and equipment (a particular boon to many disabled persons), provides input to automatic translation, and creates print-ready dictation. Among the earliest applications for speech recognition were automated telephone systems and medical dictation software. It is frequently used for dictation, for querying databases, and for giving commands to computer-based systems, especially in professions that rely on specialized vocabularies. It also enables personal assistants in vehicles and smartphones, such as Apple's Siri.

Before any machine can interpret speech, a microphone must translate the vibrations of a person's voice into a wavelike electrical signal. This signal in turn is converted by the system's hardware—for instance, a computer's sound card—into a digital signal. It is the digital signal that a speech recognition program analyzes in order to recognize separate phonemes, the basic building blocks of speech. The phonemes are then recombined into words. However, many words sound alike, and, in order to select the appropriate word, the program must rely on the context. Many programs establish context through trigram analysis, a method based on a database of frequent three-word clusters in which probabilities are assigned that any two words will be followed by a given third word. For example, if a speaker says "who am," the next word will be recognized as the pronoun "I" rather than the similar-sounding but less likely "eye." Nevertheless, human intervention is sometimes needed to correct errors.

Programs for recognizing a few isolated words, such as telephone voice navigation systems, work for almost every user. On the other hand, continuous speech programs, such as dictation programs, must be trained to recognize an individual's speech patterns; training involves the user reading aloud samples of text. Today, with the growing power of personal computers and mobile devices, the accuracy of speech recognition has improved markedly. Error rates have been reduced to about 5 percent in vocabularies containing tens of thousands of words. Even greater accuracy is reached in limited vocabularies for specialized applications such as dictation of radiological diagnoses.

(b) Clarify the difference between OCR and OMR

OMR (Optical Mark Recognition) and OCR (Optical Character Recognition) are two methods of getting information from paper into a digital format. Although both seem to work in similar ways, there is a major difference between OMR and OCR. The responsibility of OMR is only to tell whether a mark is present or not in a predetermined area. OCR also detects the presence of marks but its task doesn't stop there. OCR also needs to determine what that mark is. It is usually limited to a single language to limit the possible characters and enhance the accuracy.

The primary purpose of OCR is to eliminate the need to re-encode a document that has already been printed. OCR takes an image of a printed document, attempts to recognize all the characters on a page, then string the characters together into an editable document that can then be edited in a word processor and mostly resembles

the original document. Although not 100% accurate, it significantly reduces the effort needed to recreate the document. In comparison, the main use of OMR is in tabulating or evaluating data from a large number of documents. The biggest example of this is in grading simple multiple choice exams. OMR is also used to tabulate data from census or surveys using the same method. OMR is much faster compared to doing it by hand since the machine can process a sheet in an instant.

When it comes to hardware, OMR is far simpler compared to OCR. In OMR, a light is shone into the predetermined spaces. If a mark is present, the paper would have less reflected light than if there was none. With OCR, it is not that simple. The image of the page is usually scanned into an image. The individual marks on the page are then evaluated separately and compared to the known character shapes. This is not very easy to achieve and is quite costly to be implemented in hardware. That is why most OCR systems use computers with the appropriate software. OMR systems are relatively easy to implement in hardware, and they are quite prevalent; like those machines used in lotteries.

Q. 4 (a) Differentiate between Dot Matrix Printer and Inkjet Printer. Explain it with the help of suitable examples.

Before the 1980s, laser printers were expensive, high-volume units. At that time, dot matrix printers commanded the early PC desktop market for homes and businesses. Compact laser printers, introduced in the late 1980s, turned the trend around with high-quality output and quiet operation. Although computer equipment makers still produce dot matrix printers for a few customers, laser technology has become more widely used, particularly in the business world.

Print Quality

A typical laser printer has a resolution of 1,200 dots per inch, or dpi. It achieves this level of detail through the use of microscopic toner powder, high-performance electronics and precision optics. Many laser printers have color capability at the same high resolution. Some dot matrix printers achieve 240 dpi by making repeated passes over the same printed area, though documents produced this way take at least twice as long to print as those printed at normal quality. As a dot matrix printer's output color depends on the ribbon, virtually none offer choices beyond black and red.

Speed

A typical desktop laser printer turns out about four full-color pages per minute; for black-and-white text, this rises to 25 pages per minute. Dot matrix printers are typically rated at between 200 and 600 characters per second, or about 50 pages per minute in draft mode. Some high-output dot matrix printers achieve 1,100 characters per second, or 100 pages per minute, although the print quality is low-resolution text.

Noise

Dot matrix technology prints by striking an inked ribbon with a column of metal pins. At the speeds required for printing, the pins move very rapidly, producing a loud buzz. Sound-deadening equipment covers reduce the

noise to tolerable levels for office use. Laser printers are quiet by comparison. The paper-feed mechanism produces light clicking sounds, but no sound deadening is necessary for a laser printer.

Costs

Laser and dot matrix printers have roughly comparable initial purchase prices: as of October 2012, dot matrix models run between $250 to $600, and you can find low-end laser printers for under $100, though most range between $150 to $600. The per-page cost for dot matrix printers is lower, at .15 to .2 cents per page; laser printers cost from 1 to 9 cents per page. Dot matrix printers use inexpensive ribbons and have little other maintenance; however, the toner cartridges used for laser printing figure heavily into operating costs.

(b) Explain the function of TM machine.

A Turing Machine (TM) is a mathematical model which consists of an infinite length tape divided into cells on which input is given. It consists of a head which reads the input tape. A state register stores the state of the Turing machine. After reading an input symbol, it is replaced with another symbol, its internal state is changed, and it moves from one cell to the right or left. If the TM reaches the final state, the input string is accepted, otherwise rejected.

A TM can be formally described as a 7-tuple $(Q, X, \sum, \delta, q_0, B, F)$ where −

- **Q** is a finite set of states
- **X** is the tape alphabet
- $\sum$ is the input alphabet
- **δ** is a transition function; $\delta : Q \times X \rightarrow Q \times X \times \{Left\_shift, Right\_shift\}$.
- $\mathbf{q_0}$ is the initial state
- **B** is the blank symbol
- **F** is the set of final states

Comparison with the previous automaton

The following table shows a comparison of how a Turing machine differs from Finite Automaton and Pushdown Automaton.

Machine	Stack Data Structure	Deterministic?
Finite Automaton	N.A	Yes
Pushdown Automaton	Last In First Out(LIFO)	No
Turing Machine	Infinite tape	Yes

Example of Turing machine

Turing machine $M = (Q, X, \sum, \delta, q_0, B, F)$ with

- $Q = \{q_0, q_1, q_2, q_f\}$

- X = {a, b}
- ∑ = {1}
- q_0 = {q_0}
- B = blank symbol
- F = {q_f }

δ is given by −

Tape alphabet symbol	Present State 'q_0'	Present State 'q_1'	Present State 'q_2'
a	$1Rq_1$	$1Lq_0$	$1Lq_f$
b	$1Lq_2$	$1Rq_1$	$1Rq_f$

Here the transition $1Rq_1$ implies that the write symbol is 1, the tape moves right, and the next state is q_1. Similarly, the transition $1Lq_2$ implies that the write symbol is 1, the tape moves left, and the next state is q_2.

Q. 5 Write short notes on the following topics:

- **Secondary Storage Devices**

Secondary storage is non-volatile, long-term storage. Without secondary storage all programs and data would be lost the moment the computer is switched off.

There are three main types of secondary storage in a computer system:

- solid state storage devices, such as USB memory sticks
- optical storage devices, such as CD, DVD and Blu-ray discs
- magnetic storage devices, such as hard disk drives

However, not all computers require secondary storage. Embedded computers, such as those found in a washing machine or central heating system, do not need to store data when the power is turned off. The instructions needed to run them are stored in read-only memory (ROM) and any user data is held in RAM.

Solid state

Solid state storage is a special type of storage made from silicon microchips. It can be written to and overwritten like RAM. However, unlike RAM, it is non-volatile, which means that when the computer's power is switched off, solid state storage will retain its contents.

Solid state is also used as external secondary storage, for example in USB memory sticks and solid state drives.

One of the major benefits of solid state storage is that is has no moving parts. Because of this, it is more portable, and produces less heat compared to traditional magnetic storage devices. Less heat means that components last longer.

Solid state storage has no moving parts making it more portable and durable.

Solid state storage is also faster than traditional hard disk drives because the data is stored electrically in silicon chips called cells. Within the cells, the binary data is stored by holding an electrical current in a transistor with

an on / off mode. Unlike RAM which uses a similar technique, solid state storage retains this even when the power is switched off by using a technology known as flash memory.

Solid state is an ideal storage medium for many modern devices such as tablets, smartphones and digital cameras.

Magnetic devices

Magnetic devices such as hard disk drives use magnetic fields to magnetise tiny individual sections of a metal spinning disk. Each tiny section represents one bit. A magnetised section represents a binary '1' and a demagnetised section represents a binary '0'. These sections are so tiny that disks can contain terabytes (TB) of data.

As the disk is spinning, a read/write head moves across its surface. To write data, the head magnetises or demagnetises a section of the disk that is spinning under it. To read data, the head makes a note of whether the section is magnetised or not.

Magnetic devices are fairly cheap, high in capacity and durable. However, they are susceptible to damage if dropped. They are also vulnerable to magnetic fields - a strong magnet might possibly erase the data the device holds.

Optical devices

Optical devices use a laser to scan the surface of a spinning disc made from metal and plastic. The disc surface is divided into tracks, with each track containing many flat areas and hollows. The flat areas are known as lands and the hollows as pits.

When the laser shines on the disc surface, lands reflect the light back, whereas pits scatter the laser beam. A sensor looks for the reflected light. Reflected light - land - represents a binary '1', and no reflection - pits - represents a binary '0'.

There are different types of optical media:

- ROM media have data pre-written on them. The data cannot be overwritten. Music, films, software and games are often distributed this way.
- Read (R) media are blank. An optical device writes data to them by shining a laser onto the disc. The laser burns pits to represent '0's. The media can only be written to once, but read many times. Copies of data are often made using these media.
- Read/write RW works in a similar way to R, except that the disc can be written to more than once.

- **Multimedia Projector**

In the world of projection technology, there are four main types including; DLP, LCD and LCOS. DLP stands for Digital Light Processing, LCD stands for Liquid Crystal Display while LCOS means Liquid Crystal on Silicon. Also, there are laser projectors that rely on solid-state laser instead of lamp for its light source. Different types of projectors serve different types of areas of application and have a varied range in terms of price. Thus when choosing a projector, one has to be aware about their requirements and the budget they have in their mind.

DLP projector consists of a chip that is made up of millions of microscopic mirrors, each of which is capable of independent adjustment. They can move towards or away from the light source to create a light or dark pixel. To create coloured images, the colour wheel rotates in order to create coloured pixels on the screen. Thus, the colours are displayed sequentially at a high rate than an observer sees a full coloured image. Most of the systems operate at up to 10x the frame rate.

DLP Projectors Uses

DLP Projectors are used for the following purposes in our home, school, and offices.

1. Used a business projector for conducting conferences and delivering presentations.
2. Used in home theatres for displaying movies, TV programs, playing video games, etc.
3. Used in command and control centers by telecommunications and utility companies.
4. In classrooms and hotels for lectures and launch events.

LCD Projectors use three liquid crystal displays, in which an image is created through multiple steps. A light source emits a beam of white light which is passed to three mirrors which are specially shaped to reflect only particular wavelengths of light. Each coloured light beam is sent to an LCD panel, which receives an electrical signal. The signal commands the panel on how to arrange the pixels in the display to create the image. The same image is produced on the three LCD panels, but in different colours due to the source light falling on them. These different coloured images are then combined in a prism resulting in a single coloured image. Finally, the image goes through a lens before reflecting on the projection screen.

LCD Projectors are highly used in the following areas:

1. Schools
2. Corporate Presentations
3. Exhibitions and Tradeshows
4. Home Theatres

Globus' line-up of Multimedia Projectors includes DLP Projectors of Ultra Short Throw, Short Throw, Long Throw, and Portable Projector type. It speaks of high resolution, contrast ratio, brightness, lamp life, and long operational life. Globus Multimedia Projectors are an essential component of the Digital Teaching System that includes an Interactive Board with multi-touch support.

- **Speech Synthesizer**

A speech synthesizer is a computerized device that accepts input, interprets data, and produces audible language. It is capable of translating any text, predefined input, or controlled nonverbal body movement into audible speech. Such inputs may include text from a computer document, coordinated action such as keystrokes on a computer keyboard, simple action such as directional interpretation of a joystick, or basic functions such as eye, head, or foot movement. According to a study by the American Speech and Hearing Association, approximately 1.5 million people in the United States are unable to communicate through vocal language; this

number does not include hearing impaired. A speech synthesizer can provide an electronic means of verbal communication for individuals who are unable to speak or have visual impairments. Since spoken language is the primary means of communication in most societies, it is often essential for people who are unable to speak on their own to capture that ability. Individuals with motor neuron disease (MND) often lose their ability to speak due to weakened vocal cords. MND is a classification for disorders that cause muscle weakness and wasting such as **amyotrophic lateral sclerosis** (ALS), progressive bulbar palsy (PBP), **primary lateral sclerosis** (PLS), and progressive muscular atrophy (PMA). In patients with **cerebral palsy** , the area of the brain controlling vocal muscles is damaged resulting in speech loss. Speech synthesizers can also be useful for people who are visually impaired. Although they may be able to produce oral speech, they are unable to read or produce written text in a non-Braille format. In the example of a student who is visually impaired, the ability to take notes during a lecture and to then review those notes later is not possible. However, with a speech synthesizer, the student can type lecture notes into a laptop and have a text-to-speech software program read them back for review and revision. Without this technology, the more time-consuming method of transcribing audio-recorded lectures into Braille is used.

- **Electronic Card Reader**

A card reader is a device that can decode the information contained in a credit or debit card's magnetic strip or microchip. In finance, the term "card reader" refers to the technologies used to detect the account number, cardholder information, and authorization code contained on a credit card. This information is contained either in the magnetic strip of the card, or in the microchip embedded in chip-enabled cards. Although historically card reading technologies relied on physical copies being made and stored by the vendor, today's card readers are able to scan and process this information electronically at nearly instantaneous speeds.

- Card readers are the devices used to read the cardholder and account information contained on a credit or debit card.
- Today's card readers are Internet-connected and are able to complete transactions electronically within seconds.
- Older models of card readers required customers or merchants to physically copy the information from their card, slowing down the transaction process.