Biyani's Think Tank

A concept based exclusive material

Fundamentals of Information Technology

M.Sc. I.T.

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Preface

I am glad to present this book, especially designed to serve the needs of the students. The book has been written keeping in mind the general weakness in understanding the fundamental concepts of the topics. The book is self-explanatory and adopts the “Teach Yourself” style. It is based on question-answer pattern. The language of book is quite easy and understandable based on scientific approach.

This book covers basic concepts related to the microbial understandings about diversity, structure, economic aspects, bacterial and viral reproduction etc.

Any further improvement in the contents of the book by making corrections, omission and inclusion is keen to be achieved based on suggestions from the readers for which the author shall be obliged.

I acknowledge special thanks to Mr. Rajeev Biyani, *Chairman* & Dr. Sanjay Biyani, *Director* (*Acad.*) Biyani Group of Colleges, who are the backbones and main concept provider and also have been constant source of motivation throughout this Endeavour. They played an active role in coordinating the various stages of this Endeavour and spearheaded the publishing work.

I look forward to receiving valuable suggestions from professors of various educational institutions, other faculty members and students for improvement of the quality of the book. The reader may feel free to send in their comments and suggestions to the under mentioned address.

Author

Syllabus

M.Sc.-IT (Sem.-I)

112 : FUNDAMENTALS OF INFORMATION TECHNOLOGY

[This course is of introductory nature, and therefore, emphasis will be on basic concepts and direct applications of mathematical expressions without rigorous analysis.]

Part A (Weightage 10%)

What is IT, Information Systems, Data and Information, IT in Business and Industry, IT in Home and Play, IT in Education and Training, IT in Entertainment and the Arts, IT in Science, Engg. and Maths, Personal, Social and Ethical Issues in IT.

Part B (Weightage 25%)

Fundamentals of Electricity, DC Circuits, AC Circuits, Electrical Machines, Measuring Instruments, Electrical Wiring and Distribution of Electrical Power, Resistors, Capacitors, Inductors, Transducers.

Semiconductor Devices, P-N Junction Diode, Bipolar Junction Transistor FET, Tyristors, Opto-Electronic Devices, Display Devices, Rectifiers.

Part C (Weightage 65%)

Overview of the Digital Computer System (Processor, Memory, Input and Output Devices, Operating Systems, Application Software, Types of Computers).

Representation of Data : Digital versus Analog, Digital Number System (Binary, Octal, Decimal and Hexadecimal Numbers), Conversion from one form to another, Fractional Numbers and Signed Numbers, Complements, Fixed Point and Floating Point.

Representations, Boolean Algebra (Addition, Subtraction, Multiplication and Division), Logical Gates (NOT, AND, NAND, NOR, XOR, XNOR), Codes (ASCII, EBCDIC, Unicode), Encoding and Decoding, Integrated Circuits, Digital ICS, Flip-Flops, Shift Registers, Counters.

Anatomy of a Computer (Introductory Level : Emphasis shall be on basic concepts, features available in the component, characteristics and behavior of components, comparison, merits and limitations. Complete technical know how is expected), Mother

Board (Special reference to Intel 810 Chipset Motherboard), CISC Micro Processors (Special reference to Pentium, AMD, Cyrix), RISC Processors (Motorola, Power PC and 680 x O Series), Types of RAM, Flash, Cache, SDRAM, Type of Memory Modules (SIMM, DIMM), System Clock, Bus (Data, Address, Control), Bus Architecture (ISA, MCA, EISA, PCI, AGP), Expansion Slots and Cards (RS 232, BIN), Input Devices (Keyboard, Mouse, Trackball, Trackpad, Pen, Touch Screen, Bar Code Reade, Scanner, OMR, OCR, Voice Input, Video Input, Digital Camera), Output Devices [Monitors (Refresh Rate, Resolutions, Standards – CGA, VGA, SVGA, XGA, SXGA; LCD Monitors, Video Controllers and VRAM), Printers (Dot-Matrix, Line, Label, Inkjet, Laser, Color Laser, Thermal Wax, Dye Sublimation, Fiely, IRIS), Plotters (Pen, Inkjet, Electrostatic), Voice Output), Storage Devices, Storage Types (Magnetic, Optical, Magneto-Optical, Solid State), Random versus Sequential Access, Formatting, Tracks and Sectors, Speed, Storage, Capacity, Floppy Disk (5.25 inch, 3.5 inch; 2 HD zip, Superdisk, HiFD), Hard Disk (Tracks, Cylinders, Sectors; Hard Drive Interfaces (IDE, EIDE, Fast SCSI, Fast/Wide SCSI, Uitra SCSI; Hard Disk Cartridges, RAID), Optical Disks [Pits and Lands, CD (ROM, R, RW), DVD (ROM, R, RAM)] Magnetic Tape (Reels, Streamers, DAT, DLT, Stripe, Smart Card), Modem (Fax/Data/Voice).

Content

M.Sc.(I.T.)
2922 **P-112**

M.Sc. (First Semester) (INFORMATION TECHNOLOGY) EXAMINATION, 2007

(New Scheme)

PAPER 112
FUNDAMENTALS OF INFORMATION TECHNOLOGY

TIME ALLOWED : THREE HOURS
Maximum Marks – 80

Attempt any FIVE questions out of nine.
All questions carry equal marks

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1 (a) Distinguish between Data and Information. Discuss the role of IT in the field of Education, Arts, Entertainment and Sports.

(b) Describe two users for each of the following Resistors, Capacitor and Inductor. Write SI units for measuring resistance, capacitance and inductance distinguish between A.C. Current and D.C. Current.

8 + 8

2 (a) Draw Characteristic Curve for a P-N Junction diode in Forward Bias and Reverse Bias. Explain how a Diode can be used as Rectifier?

(b) What do you mean by Operating Systems in a Computer? Explain and give examples of Operating System. What is Application Software, give three examples?

8 + 8

3 (a) Draw Truth for NOT, NAND and XNOR Logic Gates. Provide their Symbols also.

(b) Explain, with one example, the Floating Point Representation of Numbers for Computers.

(c) Prove the following in Boolean Algebra :

(i) $A\bar{B} + AB = A$ (ii) $\bar{A}\bar{B}CD + \bar{A}BCD = \bar{A}CD$

6 + 5 + 5

4 (a) Explain how Data is Stored and Retrieved from a CD.

(b) What is a Flash Memory and Cache Memory?

Distinguish between RAM and ROM in Computers.

8 + 8

5 Write short notes on any four :

(a) Type Codes

(b) IC

(c) Optical Disks

(d) Storage Devices

(e) Motherboard

(f) Computer Printers

4 x 4 = 16

6 (a) What are Flip-Flop Circuits? What is a Shift Register? With the help of Timing Diagram explain different types of Flip-Flops used in Digital Circuits.

(b) What is an L.E.D.? Explain in brief working of an L.E.D. with the various uses of L.E.D.

10 + 6

7 (a) Convert the following :

(i) $(126)_{16}$ = ( )$_2$

(ii) $(C5E2)_{16}$ = ( )$_2$

(iii) $(10001100)_2$ = ( )$_8$

(iv) $(35.375)_{10}$ = ( )$_2$

(v) $(112.6)_8$ = ( )$_{16}$

(vi) $(3287)_{10}$ = ( )$_8$

(b) Perform the following Binary Arithmetic Operations :

(i) 1101 + 1111

(ii) 1010 + 1101

(iii) 1011 - 110

(iv) 10000010 + 1010

(c) Find Complements as asked :

(i) One's Complement of $(11011010)_2$

(ii) Two's Complement of $(0101)_2$

(i) Nine's Complement of $(153)_{10}$

6 + 4 + 6

8 Explain the following in brief :

(i) Electric Measuring Instruments

(ii) Various Important Parts of a Computer

(iii) Magnetic Storage Devices

(iv) Various Computer Display Monitors

4 x 4 = 16

9 (a) Differentiate RISC and CISC Types of Microprocessors.

(b) Explain Motherboard and its various components.

(c) Briefly explain Bus Architecture of a PC.

5 + 6 + 5

□ □ □

M.Sc. (FIRST SEMESTER) (INFORMATION TECHNOLOGY) EXAMINATION, 2006

(Held in February, 2007)

PAPER 112
FUNDAMENTALS OF INFORMATION TECHNOLOGY

TIME ALLOWED : THREE HOURS
Maximum Marks – 80

Attempt any FIVE questions out of nine.
All questions carry equal marks
Draw diagrams wherever appropriate

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1 (a) Briefly discuss the functions and fields of applications of various Input Devices used with a Computer System.

(b) Why is operating system known as Resource Manager? Justify your answer with suitable examples.

8 + 8

2 (a) What is Information Systems? Discuss the role of IT in the fields of Industry, Education, Science and Business.

(b) With circuit diagram, explain the principle of operation of Registers and Inductors.

8 + 8

3 (a) Why are Floating Point Representation used to represent the numbers in the Computer System?

(b) What is Virtual Memory? Why is it so called? How is it useful? Explain.

(c) Explain why NAND and NOR Gates are called the Universal Gates.

5 + 6 + 5

4 (a) What is Hard Disk? Explain how data are stored and organized on a Hard Disk.

(b) What is a Scanner? Explain the working mechanism of Laser Printers.

8 + 8

5 Write short notes on any four :

(a) Optical Disks

(b) Buses used in Computer Systems

(c) Addition and Subtraction of Signed-Magnitude Binary Numbers

(d) Logic Gates

(e) Plotters

(f) Bus Architecture

4 x 4 = 16

6 (a) Draw the complete Logic Diagram of an Edge Triggered J-K Flip-Flop. With the help of Timing Diagram, explain its principle of operation. How is it supported to R-S Flip-Flop?

(b) What is the difference between ASCII and EBCDIC Codes? Explain with examples.

10 + 6

7 (a) Convert the following :

(i) $(A2B.D4)_{16}$ = ( )$_{10}$

(ii) $(126)_6$ = ( )$_4$

(iii) $(FAB)_{16}$ = ( )$_2$

(iv) $(1101101.1011)_2$ = ( )$_{10}$

(v) $(82.375)_{10}$ = ( )$_2$

(b) Perform the following binary arithmetic operations :

(i) 100111 + 11011

(ii) 10101 + 01110

(iii) 101111 x 111

(iv) 100001 + 110

(c) Discuss a method for loading and shifting the date in parallel in a Shift Register.

5 + 4 + 7

8 Briefly explain the following :-

(i) Semiconductor Devices

(ii) Flash Memory

(iii) Network Adapter Cards

(iv) Random and Sequential Access

(v) LCD Monitors

4 + 3 + 3 + 3 + 3

9 (a) What is meant by Softwares? How are Softwares classified? Explain with suitable examples.

(b) Give a hierarchy of different memories used in a Computer System. How is Cache Memory different from a Primary Memory.

(c) Writ short notes on RISC and CISC Microprocessors.

4 + 8 + 4

□ □ □

CHAPTER-1

Information System

Q.1 What is Information Technology? Explain difference between Data and Information.

Ans.: Information technology is the study, design, development, implementation, support or management of computer based information systems, particularly software applications and computer hardware. It is the capability to electronically input, process, store, output, transmit and receive data and information, including text, graphics, sound and video as well as the ability to control machines of all kinds electronically. It is comprised of computers, networks, satellite communications, robotics, e-mail, electronic games and automated office equipment. The information industry consists of all computers, communications and electronics related organizations, including hardware, software and services.

Information is the summarization of data. Data are raw facts and figures that are processed into information, such as summaries and totals. Information is the result of processing, manipulating and organizing data in a way that adds to the knowledge of the receiver. Even though information and data are often used interchangeably, they are actually very different. Data is a set of unrelated information and as such is of no use until it is properly evaluated. Upon evaluation, once there is some significant relation between data, it is converted into information. Now this data can be used for different purposes. Till data conveys some information, they are not useful.

Q.2 What is the role of IT in various sectors like Business, Medicine, Education, Science, etc.?

Ans.: **Education :** Getting the right kind of information is a major challenge as is getting information to make sense. College students spend an average of 5-6 hours a week on the internet. Research shows that computers can significantly enhance performance in learning. Students exposed to the internet say they think the web has helped them improve the quality of their academic research and of their written work. One revolution in education is the advent of distance learning. This offers a variety of internet and video-based online courses.

Health and Medicine : Computer technology is radically changing the tools of medicine. All medical information can now be digitized. Software is now able to computer the risk of a disease. Mental health researchers are using computers to screen troubled teenagers in need of psychotherapy. A patient paralyzed by a stroke has received an implant that allows communication between his brain and a computer; as a result, he can move a cursor across a screen by brainpower and convey simple messages.

Science : Scientists have long been users of it. A new adventure among scientists is the idea of a "collaboratory", an internet based collaborative laboratory, in which researchers all over the world can work easily together even at a distance. An example is space physics where space physicists are allowed to band together to measure the earth's ionosphere from instruments on four parts of the world.

Business : Business clearly see the interest as a way to enhance productivity and competitiveness. Some areas of business that are undergoing rapid changes are sales and marketing, retailing, banking, stock trading, etc. Sales representatives not only need to be better educated and more knowledgeable about their customer's businesses, but also must be comfortable with computer technology. The internet has become a popular marketing tool. The world of cybercash has come to banking – not only smart cards but internet banking, electronic deposit, bill paying, online stock and bond trading, etc.

Q.3 What are the Personal, Social and Ethical Issues in IT?

Ans.: Personal Issues : An increase in work load and / or responsibilities can trigger job stress. Many employees feel information anxiety because other people are better than they in using computers, because they are slow in learning new technology and because of the need to continuously learn new things. Exposure to terminals can cause radiation exposure which is associated with cancer and other health related problems. It can also affect eyesight. Other hazards are backaches and muscle tension in the wrist and fingers.

Social Issues : They are mainly positive issues. There is now flexibility in jobs that can greatly improve the quality of leisure time. There are also great opportunities for people with disabilities. Those who cannot type are able to use voice-operated typewriters or work from home. It has brought about major improvement in health care delivery, ranging from better diagnosis to research of new drugs, to more accurate monitoring of critically ill patients.

Ethical Issues : Many companies and professional organizations develop their own code of ethics. A code of ethics is a collection of principles intended as a guide for the members of a company or an organization. There are four kinds of ethical issues - privacy, accuracy, property and accessibility. Information privacy is the right to determine when and to what extent information about oneself can

be communicated to others. The issues to be considered here are electronic surveillance and personal information in databases. Millions of computer users are being monitored without their knowledge. Information about individuals is being kept in many databases. Intellectual property is the intangible property created by individuals which is protected by trade secrets, patent and copyright laws.

Refer : *Information to Information Technology – Wiley Student Edition – Turban, Rainer, Potter.*

Q.4 What are the types of Information Systems?

Ans.: Transaction Processing System (TPS) : Organizations perform routine, repetitive tasks. For example employees are paid at regular intervals, customers place purchase orders and are billed and expenses are monitored and compared to budgets. The information system that supports such tasks is called 'Transaction Processing System'. A TPS supports the monitoring, collection, storage and processing of the organization's basic transactions. It also provides the input data for many other applications.

Management Information System (MIS) : These systems access, organize, summarize and display information for supporting routine decision making in the functional areas. A MIS provides reports about topics like operational efficiency, effectiveness and productivity. It prepares these reports by extracting information from the corporate database and processing it according to the needs of the user. MISs' are used for monitoring, planning and control. They also enable managers to detect possible problems in their early stages.

Support Systems : Support systems for office employees began to emerge in the late 1960s. Airline reservation systems are the best example of this development. Electronic communication is only one aspect of what is now known as an Office Automation System (O.A.S.). Decision support system is used to provide computerized support for complex, non-routine decisions.

Intelligent Systems : By the mid 1980s, managerial application of the so called artificial intelligence began, creating intelligent systems that seem to be able to replicate the thought process of humans. Expert systems are advisory systems that provide the stored knowledge of experts to non-experts, so that the latter can solve difficult problems.

□ □ □

CHAPTER-2

Electricity

Q.1 What is a P-N Junction Diode? Explain its working in Forward and Reverse Bias.

Ans.: A **P-N Junction** is formed by combining P-type and N-type semiconductors together in very close contact. Creating a semiconductor from two separate pieces of material introduces a grain boundary between them which would severely inhibit its utility by scattering the electrons and holes. The term junction refers to the region where the two regions of the semiconductors meet. In a p-n junction, without an external applied voltage, an equilibrium condition is reached in which a potential difference is formed across the junction. This potential difference is called built-in potential V_{bi}.

Forward-Bias occurs when the P-type semiconductor material is connected to the positive terminal of a battery and the N-type semiconductor material is connected to the negative terminal. With a battery connected this way, the holes in the P-type region and the electrons in the N-type region are pushed towards the junction. This reduces the width of the depletion zone. The positive charge applied to the P-type material repels the holes, while the negative charge applied to the N-type material repels the electrons. As electrons and holes are pushed towards the junction, the distance between them decreases. This lowers the barrier in potential. Connecting the P-type region to the negative terminal of the battery and the N-type region to the positive terminal, produces the **Reverse-Bias** effect. Because the P-type material is now connected to the negative terminal of the power supply, the 'holes' in the P-type material are pulled away from the junction, causing the width of the depletion zone to increase. Similarly, because the N-type region is connected to the positive terminal, the electrons will also be pulled away from the junction. Therefore, the depletion region widens, and does so increasingly with increasing reverse-bias voltage. This increases the voltage barrier causing a high resistance to the flow of charge carriers thus allowing minimal electric current to cross the p-n junction.

Q.2 Explain FET, BJT.

Ans.: The **Field-Effect Transistor (FET)** is a type of transistor that relies on an electric field to control the shape and hence the conductivity of a 'channel' in a semiconductor material. All FETs except J-FETs have four terminals, which are known as the gate, drain, source and body / base / bulk / substrate. Compare these to the terms used for BJTs - base, collector and emitter. BJTs and J-FETs have no body terminal. The FET controls the flow of electrons (or electron holes) from the source to drain by affecting the size and shape of a "conductive channel" created and influenced by voltage (or lack of voltage) applied across the gate and source terminals. Consider an **n-channel "enhancement-mode"** device. A positive gate-to-source voltage is necessary to create a conductive channel. Since one does not exist naturally within the transistor. The positive voltage attracts free-floating electrons within the body towards the gate, forming a conductive channel. But first, enough electrons must be attracted near the gate to counter the dopant ions added to the body of the FET; this forms a region free of mobile carriers called a depletion region, and the phenomenon is referred to as the threshold voltage of the FET.

A **Bipolar Junction Transistor (BJT)** is a type of transistor. It is a three-terminal device constructed of doped semiconductor material and may be used in amplifying or switching applications. Bipolar transistor is so named because its operation involves both electrons and holes. Although a small part of the transistor current is due to the flow of majority carriers, most of the transistor current is due to the flow of minority carriers and so BJTs are classified as 'minority-carrier' devices. A BJT consists of three differently doped semiconductor regions, the emitter region, the base region and the collector region. These regions are, respectively, p type, n type and p type in a PNP, and n type, p type and n type in a NPN transistor. Each semiconductor region is connected to a terminal, appropriately labeled: emitter (E), base (B) and collector (C). The base is physically located between the emitter and the collector and is made from lightly doped, high resistive material. The collector surrounds the emitter region, making it almost impossible for the electrons injected into the base region to escape being collected, thus making the resulting value very close to utility, and so, giving the transistor a large β. A cross section view of a BJT indicates that the collector – base junction has a much larger area than the emitter – base junction.

Q.3 Explain Semiconductor Devices.

Ans.: Semiconductor devices are electronic components that exploit the electronic properties of semiconductor materials, principally silicon, germanium and gallium arsenide. Semiconductor devices have replaced thermionic devices (vacuum tubes) in most applications. They use electronic conduction in the solid state as opposed to the gaseous state or thermionic emission in a high vacuum. Semiconductor devices are manufactured both as single discrete devices and as integrated circuits (ICs), which consist of a number – from a few to millions – of devices manufactured and interconnected on a single semiconductor substrate. Semiconductor conductivity can be controlled by introduction of an electric field, by exposure to light, and even pressure and heat; thus, semiconductors can make excellent sensors. Current conduction in a semiconductor occurs via mobile or "free" electrons and holes, collectively known as charge carriers. Doping a semiconductor such as silicon with a small amount of impurity atoms, such as phosphorus or boron, greatly increase the number of free electrons or holes within the semiconductor. When a doped semiconductor contains excess holes it is called "p-type", and when it contains excess free electrons it is known as "n-type", where p (positive for holes) or n (negative for electrons) is the sign of the charge of the majority mobile charge carriers. The semiconductor material used in devices is doped under highly controlled conditions in a fabrication facility, or fab, to precisely control the location and connection of p- and n-type dopants. The junctions which form where n-type and p-type semiconductors join together are called p-n junctions.

Q.4 What are Rectifiers?

Ans.: A rectifier is an electrical device that converts alternating current to direct current, a process known as rectification. Rectifiers are used as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid state diodes, vacuum tube diodes, mercury valves, and other components. A circuit which performs the opposite function (converting DC to AC) is known as an inverter. When only one diode is used to rectify AC (by blocking the negative or positive portion of the waveform), the difference between the term diode and the term rectifier is merely one of usage, i.e., the term rectifier describes a diode that is being used to convert AC to DC. Almost all rectifiers comprise a number of diodes in a specific arrangement for more efficiently converting AC to DC than is possible with only one diode. Before the development of silicon semiconductor rectifiers, vacuum tube diodes and copper (I) oxide or selenium rectifier stacks were used. Early radio receivers, called crystal radios, used a "cat's whisker" of fine wire pressing on a crystal of galena (lead sulfide) to serve

as a point-contact rectifier or "crystal detector". In gas heating systems flame rectification can be used to detect a flame. Two metal electrodes in the outer layer of the flame provide a current path and rectification of an applied alternating voltage, but only while the flame is present.

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CHAPTER-3

Computer System Fundamentals

Q.1 Explain ASCII, Unicode and Gray Code.

Ans.: **ASCII** : ASCII codes represent text in computers, communications equipment, and other devices that work with text. ASCII, pronounced "ask-ee" is the acronym for American Standard Code for Information Interchange. It's a set of characters which, unlike the characters in word processing documents, allow no special formatting like different fonts, bold, underlined or italic text. An "ASCII file" is a data or text file that contains only characters coded from the standard ASCII character set. Characters 0 through 127 comprise the Standard ASCII Set and characters 128 to 255 are considered to be in the Extended ASCII Set. These codes, however, may not be the same in all computers and files containing these characters may not display or convert properly by another ASCII program. ASCII characters are the ones used to send and receive email.

The reflected binary code, also known as **Gray Code** after Frank Gray, is a binary numeral system where two successive values differ in only one digit.The reflected binary code was originally designed to prevent spurious output from electromechanical switches. Today, Gray codes are widely used to facilitate error correction in digital communications such as digital terrestrial television and some cable TV systems. This is a variable weighted code and is cyclic. This means that it is arranged so that every transition from one value to the next value involves only one bit change. The gray code is sometimes referred to as reflected binary, because the first eight values compare with those of the last 8 values, but in reverse order. The gray code is often used in mechanical applications such as shaft encoders.

Unicode is an industry standard allowing computers to represent & manipulate text expressed in any of the world's writing systems. It consists of about 10000 characters, a set of code charts for visual reference, an encoding methodology and a set of character encodings, rules, etc. It allows for combining characters as it contains precomposed versions of most letter combinations in normal use. This makes conversion to and from encodings simpler. It covers almost all scripts like Arabic, Bengali, Greek, Hebrew, Latin, Gujrati, etc. It is used in operating systems, email, web, fonts, etc.

Q.2 Convert the following numbers.

Ans.: (a) $\mathbf{(11011.11)_2 = (?)_{10}}$

$(11011.11)_2 =$

$1 * 2^4 + 1 * 2^3 + 0 * 2^2 + 1 * 2^1 + 1 * 2^0 + 1 * 2^{-1} + 1 * 2^{-2} =$

$16 + 8 + 0 + 2 + 1 + 0.5 + 0.25 =$

$(27.75)_{10}$

(b) $\mathbf{(D3FB)_{16} = (?)_{10}}$

$(D3FB)_{16} =$

$13 * 16^3 + 3 * 16^2 + 15 * 16^1 + 11 * 16^0 =$

$53248 + 768 + 240 + 11 =$

$(54267)_{10}$

Q.3 Write a detailed note on Classification of Computers.

Ans.: Computers differ based on their data processing abilities. They are classified according to purpose, data handling and functionality.

According to purpose, computers are either general purpose or specific purpose. General purpose computers are designed to perform a range of tasks. They have the ability to store numerous programs, but lack in speed and efficiency. Specific purpose computers are designed to handle a specific problem or to perform a specific task. A set of instructions is built into the machine.

According to data handling, computers are analog, digital or hybrid. Analog computers work on the principle of measuring, in which the measurements obtained are translated into data. Modern analog computers usually employ electrical parameters, such as voltages, resistances or currents, to represent the quantities being manipulated. Such computers do not deal directly with the numbers. They measure continuous physical magnitudes. Digital computers are those that operate with information, numerical or otherwise, represented in a

digital form. Such computers process data into a digital value (in 0s and 1s). They give the results with more accuracy and at a faster rate. Hybrid computers incorporate the measuring feature of an analog computer and counting feature of a digital computer. For computational purposes, these computers use analog components and for storage, digital memories are used.

According to functionality, computers are classified as :

- Microcomputers
- Minicomputers
- Mainframe computers
- Supercomputers

Q.4 Perform the following Binary Arithmetic Operations.

Ans.:

a) 100111+11011

```
  11111
  100111
+  11011
--------
 1000010
```

b) 101111*111

```
    101111
  *   111
  --------
    101111
   101111
  101111
 ---------
  101001001
```

c) 10101-01110

```
    10101
-   01110
  --------
    0111
```

Q.5 Prove the following using Boolean Algebra.

Ans.: (a) (A+B).(A+C) = A+B.C

$(A+B).(A+C) = A.A + A.C + B.A + B.C$

$= A + A.C + B.A + B.C$ (Identity Law)

$= A + B.A + B.C$ (Redundance Law)

$= A + B.C$ (Redundance Law)

(b) $A+\overline{A}.B = A+B$

$(A + \overline{A}B) = A.(1 +B) + \overline{A}.B$ $(1 + A = 1)$

$= A + A.B + \overline{A}.B$

$= A + B(A + \overline{A})$

$= A + B$ $(A + \overline{A} = 1)$

Q.6 What are Logic Gates? State De-Morgan's Law of Boolean Algebra.

Ans.: A logic gate is an elementary building block of a digital circuit. Most logic gates have two inputs and one output. At any given moment, every terminal is in one of the two binary conditions *low* (0) or *high* (1), represented by different voltage levels. The logic state of a terminal can, and generally does, change often, as the circuit processes data. In most logic gates, the low state is approximately zero volts (0 V), while the high state is approximately five volts positive (+5 V).

There are seven basic logic gates : AND, OR, XOR, NOT, NAND, NOR, and XNOR.

The ***AND gate*** is so named because, if 0 is called "false" and 1 is called "true," the gate acts in the same way as the logical "and" operator. The output is "true" when both inputs are "true." Otherwise, the output is "false."

The ***OR gate*** gets its name from the fact that it behaves after the fashion of the logical inclusive "or." The output is "true" if either or both of the inputs are "true." If both inputs are "false," then the output is "false." The ***XOR*** (***exclusive-OR***) ***gate*** acts in the same way as the logical "either/or." The output is "true" if either, but not both, of the inputs are "true." The output is "false" if both inputs are "false" or if both inputs are "true." Another way of looking at this circuit is to observe that the output is 1 if the inputs are different, but 0 if the inputs are the same. A logical ***inverter***, sometimes called a ***NOT gate*** to differentiate it from other types

of electronic inverter devices, has only one input. It reverses the logic state. The ***NAND gate*** operates as an AND gate followed by a NOT gate. It acts in the manner of the logical operation "and" followed by negation. The output is "false" if both inputs are "true." Otherwise, the output is "true." The ***NOR gate*** is a combination OR gate followed by an inverter. Its output is "true" if both inputs are "false." Otherwise, the output is "false." The ***XNOR (exclusive-NOR) gate*** is a combination XOR gate followed by an inverter. Its output is "true" if the inputs are the same, and "false" if the inputs are different.

Q.7 What is a Race-Around Condition? Explain JK Flip-Flop.

Ans.: A flip-flop is a bistable device, i.e. it has two states. Its output remains either high or low. The high state is 1 called SET and the low state is 0 called RESET. The JK flip flop is the most versatile flip-flop, and the most commonly used flip flop when discrete devices are used to implement arbitrary state machines. Like the RS flip-flop, it has two data inputs, J and K, and a clock input. It has no undefined states or race condition, however. It is always edge triggered; normally on the falling edge. The JK flip-flop has the following characteristics:

i) If one input (J or K) is at logic 0, and the other is at logic 1, then the output is set or reset (by J and K respectively), just like the RS flip-flop, but on the (falling) clock edge.

ii) If both inputs are 0, then it remains in the same state as it was before the clock pulse occurred; again like the RS flip flop.

iii) If both inputs are high, however the flip-flop changes state whenever the (falling) edge of a clock pulse occurs; i.e., the clock pulse toggles the flip-flop.

There are two basic types of JK flip-flops. The first type is basically an RS flip-flop with its outputs $\overline{Q}$ and Q ANDed together with J and K respectively. This type of JK flip-flop has no special name. Note that the connection between the outputs and the inputs to the AND gates determines the input conditions to R and S when J = K = 1. This connection is what causes the toggling, and eliminates the invalid condition which occurs in the RS flip flop. The second type of JK flip-flop is called a master-slave flip flop. This consists of two RS flip flops arranged so that when the clock pulse enables the first, or master latch, it disables the second, or slave latch. When the clock changes state again (i.e., on its falling edge) the output of the master latch is transferred to the slave latch. Again, toggling is accomplished by the connection of the output with the input AND gates.

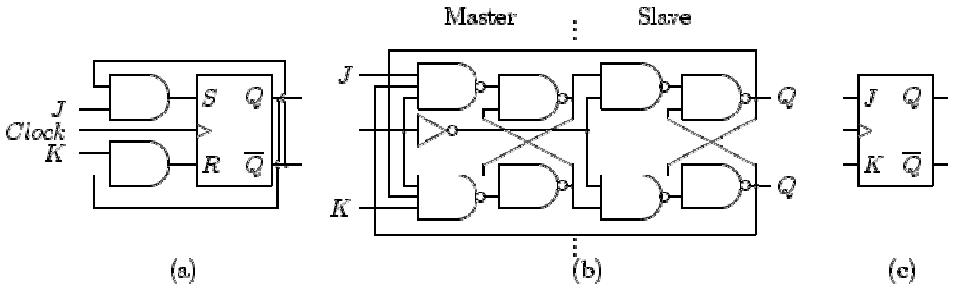

Figure 2.9: JK flip flop

The JK flip-flop is a very versatile device, and is probably the most commonly used form of flip-flop in digital electronic and control circuits. The fact that it has two inputs often means that it is simpler to design the control logic required to ensure that it changes state properly in a circuit.

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CHAPTER-4

Anatomy of Computer

Q.1 Explain Motherboards and Form Factor in detail.

Ans.: A **Motherboard** is the central or primary circuit board making up a complex electronic system, such as a modern computer. It is also known as a **main board, base board, system board** or **mobo.** A motherboard allows all the parts of your computer to receive power and communicate with one another. Most motherboards include, at a minimum;

- Sockets in which one or more microprocessors (CPUs) are installed.
- Slots into which the system's main memory is installed.
- A chipset which forms an interface between the CPU's front-side bus, main memory, and peripheral buses.
- Non-volatile memory chips containing the system's BIOS.

- A clock generator which produces the system clock signal to synchronize the various components.
- Slots for expansion cards.
- Power connectors and circuits, which receive electrical power from the computer power supply and distribute it to the CPU, chipset, main memory and expansion cards.

Form Factor : A motherboard by itself is useless, but a computer needs one to operate. The motherboard's main job is to hold the computer's microprocessor chip and let everything else connect to it. Everything that runs the computer or improves its performance is either part of the motherboard or plugs into it via a slot or port. The shape and layout of a motherboard is called the **Form Factor.** The form factor affects where individual components go and the shape of the computer's case. There are several specific form factors that most PC motherboards use so that they can all fit in standard cases.

The most popular motherboard form factor today is ATX, which evolved from it's predecessor, the Baby AT, a smaller version of the AT (Advanced Technology) form factor.

Some of the more popular motherboard form factors are :

- **PC / XT** : Created by IBM for the IBM PC, its first home computer.
- **AT (Advanced Technology) :** Created by IBM for its PC/XT successor, the AT.
- **ATX :** Created by Intel in 1995. As of 2007, it is the most popular form factor for commodity motherboards. Typical size is of 9.6x12" although some companies extend that to 10x12".

Q.2 Explain Chipsets.

Ans.: We know that a Motherboard sends information between vital computer components : it is the chipset specifically which performs this operation. A chipset is part of the motherboard, and cannot be upgraded without upgrading the whole board, The chipset is the "glue" that connects the microprocessors to the rest of the motherboard and therefore to the rest of the computer. On a PC, it consists of two basic parts – the **north-bridge** and **the south-bridge.** All of the various components of the computer communicate with the CPU through the chipset. The north-bridge connects directly to the processor via the front side bus

(FSB). A memory controller is located on the north-bridge, which gives the CPU fast access to the memory. The north-bridge also connects to the AGP or PCI Express bus and to the memory itself. The south-bridge is slower than the north-bridge, and information from the CPU has to go through the north-bridge before reaching the south-bridge. Other busses connect the south-bridge to the PCI bus, the USB ports and the IDE or SATA hard disk connections.

Q.3 What is CISC and RISC? Explain RISC in detail.

Ans.: CISC (Complex Instruction Set Computer) : A Complex Instruction Set Computer (CISC) supplies a large number of complex instructions at the assembly language level. During the early years, memory was slow and expensive and the programming was done in assembly language. Since memory was slow and instructions could by retrieved up to 10 times faster from a local ROM than from main memory, programmers tried to put as many instructions as possible in a microcode.

RISC (Reduced Instruction Set Computer) : RISC is a type of microprocessor that has a relatively limited number of instructions. It is designed to perform a smaller number of types of computer instructions so that it can operate at a higher speed (perform more million instructions per second, or millions of instructions per second). Earlier, computers used only 20% of the instructions. Making the other 80% unnecessary. One advantage of reduced instruction set computers is that they can execute their instructions very fast because the instructions are so simple. RISC chips require fewer transistors, which makes them cheaper to design and produce. In a RISC machine, the instruction set contains simple, basic instructions, from which more complex instructions can be composed. Each instruction is of the same length, so that it may be fetched in a single operation. Most instructions complete in one machine cycle, which allows the processor to handle several instructions at the same time. This pipelining is a key technique used to speed up RISC machines.

Advantages :

i) **Speed :** Since a simplified instruction set allows for a pipelined, superscalar design RISC processors often achieve 2 to 4 times the performance of CISC processor using comparable semiconductor technology and the same clock rates.

ii) **Simpler Hardware :** Because the instruction set of a RISC processor is so simple, it uses up much less chip space; extra functions, such as memory management units or floating point arithmetic units, can also be placed on the same chip. Smaller chips allow a semiconductor manufacturer to place more parts on a single silicon wafer, which can lower the per-chip cost dramatically.

iii) **Shorter Design Cycle :** Since RISC processors are simpler than corresponding CISC processors, they can be designed more quickly, and can take advantage of other technological developments sooner than corresponding CISC designs, leading to greater leaps in performance between generations.

Q.4 Explain Flash Memory.

Ans.: Flash Memory (sometimes called "flash RAM") is a type of constantly-powered nonvolatile memory that can be erased and reprogrammed in units of memory called blocks. It is a variation of electrically erasable programmable read-only memory (EEPROM) which, unlike flash memory, is erased and rewritten at the byte level, which is slower than flash memory updating. Flash memory is often used to hold control code such as the basic input/output system (BIOS) in a personal computer. When BIOS needs to be changed (rewritten), the flash memory can be written to in block (rather than byte) sizes, making it easy to update. On the other hand, flash memory is not useful as random access memory (RAM) because RAM needs to be addressable at the byte (not the block) level.

Flash Memory gets its name because the microchip is so organized that a section of memory cells are erased in a single action or "flash." The erasure is caused by tunneling in which electrons pierce through a thin dielectric material to remove an electronic charge from a floating gate associated with each memory cell. Intel offers a form of flash memory that holds two bits (rather than one) in each memory cell, thus doubling the capacity of memory without a corresponding increase in price. Flash memory is used in digital cellular phones, digital cameras, LAN switches, PC Cards for notebook computers, digital set-up boxes, embedded controllers, and other devices.

Q.5 What are the different types of RAM? Explain in detail.

Ans.: **Random Access Memory (RAM)** is the best known form of computer memory. RAM is considered "random access" because you can access any memory cell directly if you know the row and column that intersect at that cell. RAM is made in electronic chips made of so called semiconductor material, just like processors and many other types of chips. In RAM, transistors make up the individual storage cells which can each "remember" an amount of data, for example, 1 or 4 bits – as long as the PC is switched on. Physically, RAM consists of small electronic chips which are mounted in modules (small printed circuit boards). The modules are installed in the PC's motherboard using sockets – there are typically 2, 3 or 4 of these.

Dynamic RAM : Similar to a microprocessor chip is an **Integrated Circuit** (IC) made of millions of transistors and capacitors. In the most common form of computer memory, **Dynamic Memory Cell**, represents a single bit of data. The capacitor holds the bit of information – a 0 or a 1. The transistor acts as a switch that lets the control circuitry on the memory chip read the capacitor or change its state. A capacitor is like a small bucket that is able to store electrons. To store a 1 in the memory cell, the bucket is filled with electrons. To store a 0, it is emptied. The problem with the capacitor's bucket is that it has a leak. In a matter of a few milliseconds a full bucket becomes empty. Therefore, for dynamic memory to work, either the CPU or the **Memory Controller** has to come along and recharge all of the capacitors holding it before they discharge. To do this, the memory controller reads the memory and then writes it right back. This refresh operation happens automatically thousands of times per second.

This **refresh operation** is where dynamic RAM gets its name. Dynamic RAM has to be dynamically refreshed all of the time or it forgets what it is holding. The downside of all of this refreshing is that it takes time and slows down the memory.

Static RAM uses a completely different technology. In static RAM, a form of flip-flop holds each bit of memory. A flip-flop for a memory cell takes four or six transistors along with some wiring, but never has to be refreshed. This makes static RAM significantly faster than dynamic RAM. However, because it has more parts, a static memory cell takes up a lot more space on a chip than a dynamic memory cell. Therefore, you get less memory per chip, and that makes static RAM a lot more expensive. Static RAM is fast and expensive, and dynamic

RAM is less expensive and slower. Static RAM is used to create the CPU's speed-sensitive cache, while dynamic RAM forms the larger system RAM space.

Q.6 Explain Memory Modules including SIMM and DIMM.

Ans.: Single Inline Memory Modules (SIMMs) : The single inline memory module or SIMM is still the most common memory module format in use in the PC world, largely due to the enormous installed base of PCs that use them. SIMMs are available in two types : 30 pin and 72 pin. 30-pin SIMMs are the older standard and were popular on third and fourth generation motherboards. 72-pin SIMMs are used on fourth, fifth and sixth generation PCs. SIMMs are placed into special sockets on the motherboard created to hold them. The 30 pin SIMMs are generally available in sizes from 1 to 16 MB. Each one has 30 pins and provides one byte of data (8 bits) plus 1 additional bit for parity with parity versions. 72-pin SIMMs provide four bytes of data at a time (32 bits) plus 4 bits for parity/ECC in parity / ECC versions. SIMMs are available in two styles : single-sided or double-sided. This refers to whether or not DRAM chips are found on both sides of the SIMM or only on one side. 30-pin SIMMs are all single-sided. 72-pin SIMMs are either single-sided or double-sided. Some double-sided SIMMs are constructed as composite SIMMs. Internally, they are wired as if they were actually two single-sided SIMMs back to back. 72-pin SIMMs that are 1 MB and 16 MB in size are normally single-sided, while those of 2 MB, 8 MB and 32 MB in size are generally double-sided.

Dual Inline Memory Modules (DIMMs) : The dual inline memory module or DIMM is a newer memory module, intended for use in fifth and sixth generation computer systems. DIMMs are 168 pins in size, and provide memory 64 bits in width. They are a newer form factor and are becoming the de facto standard for new PCs; they are not used on older motherboards. They are also not generally available in smaller sizes such as 1 MB or 4 MB for the simple reason that newer machines are rarely configured with such small amounts of system RAM. DIMMs however have different connections on each side of the circuit board, so a 168-pin DIMM has 84 pads on each side and they are not redundant. This allows the packaging to be made smaller, but makes DIMMs a bit more sensitive to correct insertion and good electrical contact. DIMMs are inserted into special sockets on the motherboard, similar to those used for SIMMs. They are generally available in 8 MB, 16MB, 32 MB and 64 MB sizes, with larger DIMMs also available at a higher cost per megabyte. DIMMs are the memory format of choice

for the newest memory technology, SDRAM. A smaller version of the DIMM is also sometimes seen; called the small outline DIMM or SODIMM. These packages are used primarily in laptop computers where miniaturization is key.

Q.7 Explain Read Only Memory. What are the types of ROM?

Ans.: Read Only Memory (ROM), also known as firmware, is an integrated circuit programmed with specific data when it is manufactured. ROM chips are used not only in computers, but in most other electronic items as well. Because data is fully incorporated at the ROM chip's manufacture, data stored can neither be erased nor replaced. This means permanent and secure data storage. However, if a mistake is made in manufacture, a ROM chip becomes unusable. The most expensive stage of ROM manufacture, therefore, is creating the template. If a template is readily available, duplicating the ROM chip is very easy and affordable. A ROM chip is also non volatile so data stored in it is not lost when power is turned off.

ROM Types :

- **PROM :** Short for programmable read-only memory, a memory chip on which data can be written only once. Once a program has been written onto a PROM, it remains there forever. Unlike RAM, PROMs retain their contents when the computer is turned off. The difference between a PROM and a ROM (read-only memory) is that a PROM is manufactured as blank memory, whereas a ROM is programmed during the manufacturing process. To write data onto a PROM chip, you need a special device called a PROM programmer or PROM burner. The process of programming a PROM is sometimes called burning the PROM.
- **EPROM :** Acronym for erasable programmable read-only memory, and pronounced ee-prom, EPROM is a special type of memory that retains its contents until it is exposed to ultraviolet light. The ultraviolet light clears its contents, making it possible to reprogram the memory. To write to and erase an EPROM, you need a special device called a PROM programmer or PROM burner.
- **EEPROM :** Short form of electrically erasable programmable read-only memory. EEPROM is a special type of PROM that can be erased by exposing it to an electrical charge. Like other types of PROM, EEPROM retains its contents even when the power is turned off. Also like other types of ROM, EEPROM is not as fast as RAM.

Q.8 Explain ISA and PCI / Discuss various Ports available in the Computer System.

Ans.: Industry Standard Architecture (ISA) Bus : Earlier in every PC, a standard bus was used for I/O tasks. That was the ISA (Industry Standard Architecture) bus. It has 24 address lines and 16 data lines. It is designed to connect peripheral cards to the motherboard. The main characteristics of the ISA bus are its width and speed. The original ISA bus on the IBM PC was 8 bits wide and ran at 4.77 MHz. In 1984, the IBM AT was introduced using the Intel 80286; at this time the bus was doubled to 16 bits and increased to 8 MHz. The advantage of an ISA bus is its low cost and availability of many peripheral boards for it. One of the reasons the ISA bus was slow was that it only had 16 data channels. When the 80486 processor was introduced it needed 32 bits for each clock pulse. When it sent data to the ISA bus, these 32-bit packets had to be split into two 16-bit packets, which were sent one at a time, and this slowed down the flow of data. Another point is that when an ISA bus cannot send the data needed by the CPU, it will send a wait signal to the CPU. This again slows the PC.

Peripheral Component Interconnect (PCI) Local Bus : PCI stands for Peripheral Component Interconnect. The bus is an Intel product which is used in all PC's today, and also in other computers, as the PCI bus is processor independent. It can be used with all 32-biy and 64-bit processors, and is therefore found in many different computer architectures. It is able to support 10 devices. The PCI bus has a buffer which operates between the CPU and the peripheral devices (a kind of cache RAM). This allows the CPU to deliver its data to the buffer and then perform other tasks. Alternatively, PCI adapters can also deliver data to the buffer, whether or not the CPU has time to process it. The data just stands in a queue and waits until there is room on the system bus, which then relays it to the CPU. As a result of all this, the peripheral PCI devices operate asynchronously – at their own pace – in relation to the CPU. Most PCI systems support 3 to 4 PCI slots. The most commonly found cards are video cards and high-speed networking cards. Bus mastering is the capability of devices on the PCI bus to take control of the bus and perform transfers directly. PCI supports full device bus mastering and provides bus arbitration facilities which ensures that no device on the bus (including the processor) locks out any other device. At the same time, it allows any given device to use the full bus throughput if no other device needs to transfer anything.

Q.7 What is RS 232?

Ans.: RS or Recommended Standard-232, also known as EIA 232 standard, is a standard for computer data communications between a Data Terminal Equipment (DTE) and a Data Circuit-terminating Equipment (DCE) developed by EIA (Electronic Industries Association). A DTE is a PC, workstation or terminal and a DCE is usually a modem. The DTE device has a male DB25 connector and utilizes 22 of the 25 available pins for signals or ground. The DCE device has a female DG25 connector and utilizes the same 22 available pins for signals and ground. The cable linking DTE and DCE devices is a parallel cable. The maximum cable length is 50 feet. The cable length mentioned in the standard allows maximum communication speed to occur. There are four types of line defined in the RS232 specification. They are Data, Control, Timing and Ground. There are two data lines, one for data traveling in each direction. Transmit data is carried on pin 2 and the Receive data is carried on line 3. The most basic of the control circuits is Data Carrier Detected (DCD). This shows when the modem has detected a carrier on the telephone line and a connection appears to have been made. It produces a high, which is maintained until the connection is lost. Data Terminal Ready (DTR) and Data Set Ready (DSR) are the main control circuits. They convey the main information between the terminal and modem. When the terminal is ready to start handling data it sends this information on the DTR line. If the modem is also ready then it returns its signal on the DSR line. A further two circuits, Request to Send (RTS) and Clear to Send (CTS) are also used. This pair of circuits is used together. The terminal equipment will flag that it has data to send. The modem will then return the CTS signal to give the all clear after a short delay.

Q.8 Explain Hard Drive Interfaces like IDE, EIDE and SCSI.

Ans.: **IDE (Integrated Drive Electronics)** is a standard electronic interface used between a computer motherboard's bus and the computer's disk storage devices. Essentially, an IDE interface is a standard way for a storage device to connect to a computer. IDE was created as a way to standardize the use of hard drives in computers. The basic concept behind IDE is that the hard drive and the controller should be combined. The IDE interface was capable of transmitting information 16 bits at a time, compared to 8 bits on the original ISA bus. A ribbon cable from the drive/controller combination ran to an ISA card to connect to the computer, giving birth to the AT Attachment (ATA) interface.

A single IDE interface can support two devices. Most motherboards come with dual IDE interfaces (primary and secondary) for up to four IDE devices. To allow for two drives on the same cable, IDE uses a special configuration called master and slave. This configuration allows one drive's controller to tell the other drive when it can transfer data to or from the computer. The IDE interface consisted of 40-pin connectors which generally attached drives to a ribbon cable. Each cable has two or three connectors, one of which plugs into an adapter that interfaces with the rest of the computer system. The remaining one or two connectors plug into drives.

Enhanced IDE (EIDE) allows four devices, including a mixture of disks, tapes, and CD-ROM, and the hard disks can be larger. An EIDE interface chip can support four devices, but it has two interface cables each connecting two devices. The EIDE chip looks and acts like two IDE chips. An old IDE disk can be connected to a new EIDE connector. A new large EIDE disk cannot always be connected to an old PC.

SCSI (**Small Computer System Interface**) is a set of standards for physically connecting and transferring data between computers and peripheral devices. SCSI is most commonly used for hard disks and tape drives, but it can connect a wide range of other devices, including scanners, and optical drives (CD, DVD, etc.). SCSI is a bus. In the Classic SCSI bus, there are 25 signals, each represented by a pair of wires (50 wires all together). Nine of the wires hold the eight bits plus parity of a byte of data. The other wires carry control functions. Classic SCSI can transfer data up to 5 megabytes per second.

Q.9 What is Hard Disk? Explain how Data are stored and organized on a Hard Disk.

Ans.: The hard disk is the primary storage unit of the computer. A hard disk consists of a stack of disk platters that are made up of aluminum alloy of glass coated with a magnetic material. The surface of a disk is divided into imaginary tracks and sectors. Tracks are concentric circles where the data is stored. These tracks are numbered from the outermost ring to the innermost ring, starting from zero. Disk sectors refer to the number of fixed size areas that can be accessed by one of the disk drive's read/write heads, in one rotation of the disk, without the head having to change its position. An intersection of a track and a disk sector is known as track sector. Each sector is uniquely assigned a disk address before a disk drive can access a piece of data. In order to make the disk usable, first it

must be formatted to create tracks and sectors. The track sectors are grouped into a collection known as cluster. It refers to the basic allocation unit for storage on a disk.

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CHAPTER-5

Input and Output Devices

Q.1 Explain two Input Devices.

Ans.: The keyboard is an input device designed to enter text, characters and other commands into the computer. Keyboard is the set of typewriter-like keys that enables you to enter data into a computer. Computer keyboards are similar to electric-typewriter keyboards but contain additional keys. The keys on computer keyboards are often classified as follows :

- **Alphanumeric Keys –** letters and number.
- **Punctuation Keys –** comma, period, semicolon and so on.
- **Special Keys –** function keys, control keys, arrow keys, Caps Lock Key and so on.

The standard layout of letters, numbers and punctuation is known as a QWERTY keyboard because the first six keys on the top row of letters spell QWERTY. There are actually three different PC keyboards; the original PC keyboard, with 84 keys; the AT keyboard, also with 84 keys and the enhanced keyboard with 101 keys. The three differ somewhat in the placement of function keys, the Control key, the Return key, the Shift keys. In addition to these keys, IBM keyboards contain the following keys : Page Up, Page Down, Home, End, Insert, Pause, Num Lock, Scroll Lock, Break, Caps Lock, Print Screen.

Mouse is a device that controls the movement of the cursor or pointer on a display screen. A mouse is a small object you can roll along a hard, flat surface. Its name is derived from its shape, which looks a bit like a mouse, its connecting wire that one can imagine to be the mouse's tail and the fact that one must scurry

it along a surface. As you move the mouse, the pointer on the display screen moves in the same direction. Mice contain at least one button and sometimes as many as three, which have different functions depending on what program is running. Some newer mice also include a scroll wheel for scrolling through long documents. The mouse is important for graphical user interfaces because you can simply point to options and object and click a mouse button. Such applications are often called point-and-click programs. The mouse is also useful for graphics programs that allow you to draw pictures by using the mouse like a pen, pencil or paintbrush.

There are three basic types of mice :

i) **Mechanical :** Has a rubber or metal ball on its underside that can roll in all directions. Mechanical sensors within the mouse detect the direction the ball is rolling and move the screen pointer accordingly.

ii) **Optomechanical :** Same as a mechanical mouse, but uses optical sensors to detect motion of the ball.

iii) **Optical :** Uses a laser to detect the mouse's movement. You must move the mouse along a special mat with a grid so that the optical mechanism has a frame of reference. Optical mice have no mechanical moving parts. They respond more quickly and precisely than mechanical mice, but they are also more expensive.

Q.2 Explain in detail any two Output Devices.

Ans.: In computers, a **monitor** is a computer display and related parts packaged in a physical unit that is separate from other parts of the computer. There are many ways to classify monitors. The most basic is in terms of colour capabilities, which separates monitors into three classes :

- **Monochrome** : Monochrome monitors actually display two colours, one for the background and one for the foreground. The colours can be black and white, green and black or amber and black.
- **Gray-scale :** A gray-scale monitor is a special type of monochrome monitor capable of displaying shades of gray.
- **Colour :** Colour monitors can display anywhere from 16 to over 1 million different colours. Colour monitors are sometimes called RGB monitors because they accept three separate signals – red, green and blue.

After this classification, the most important aspect of a monitor is its screen size. Like televisions, screen sizes are measured in diagonal inches, the distance from one corner to the opposite corner diagonally. A typical size for small VGA monitors is 14 inches. Monitors that are 16 or more inches diagonally are often called full-page monitors. In addition to their size, monitors can be either portrait (height greater than width) or landscape (width greater than height). Larger landscape monitors can display two full pages, side by side. The screen size is sometimes misleading because there is always an area around the edge of the screen that can't be used. Therefore, monitor manufacturers must now also state the viewable area – that is, the area of screen that is actually used. The resolution of a monitor indicates how densely packed the pixels are. In general, the more pixels (often expressed in dots per inch), the sharper the image. Most modern monitors can display 1024 by 768 pixels, the SVGA standard. Some high-end models can display 1280 by 1024 or even 1600 by 1200.

Other factors that determine a monitor's quality include the following :

- **Band Width :** The range of signal frequencies the monitor can handle. This determines how much data it can process and therefore how fast it can refresh at higher resolutions.
- **Refresh Rate :** How many times per second the screen is refreshed (redrawn). To avoid flickering, the refresh rate should be at least 72 Hz.
- **Interlaced or Monitor-Laced :** Interlacing is a technique that enables a monitor to have more resolution, but it reduces the monitor's reaction speed.
- **Dot Pitch :** The amount of space between each pixel. The smaller the dot pitch, the sharper the image.
- **Coverage :** The clarity and sharpness of each pixel.

Laser Printer is a type of printer that utilizes a laser beam to produce an image on a drum. The light of the laser alters the electrical charge on the drum wherever it hits. The drum is then rolled through a reservoir of toner, which is picked up by the charged portions of the drum. Finally, the toner is transferred to the paper through a combination of heat and pressure. This is also the way copy machines work. Because an entire page is transmitted to a drum before the toner is applied, laser printers are sometimes called page printers. There are two other types of page printers that fall under the category of laser printers even though they do not use lasers at all. One uses an array of LEDs to expose the drum and the other uses LCDs. Once the drum is charged, however, they both

operate like a real laser printer. One of the chief characteristics of laser printers is their resolution – how many dots per inch (dpi) they lay down. The available resolutions range from 300 dpi at the low end to 1,200 dpi at the high end. In addition to text, laser printers are very adept at printing graphics, so you need significant amounts of memory in the printer to print high-resolution graphics. To print a full-page graphic at 300 dpi, for example, you need at least 1 MB (megabyte) of printer RAM. For a 600 dpi graphic, you need at least 4 MB RAM. Because laser printers are non-impact printers, they are much quieter than dot-matrix or daisy-wheel printers. They are also relatively fast, although not as fast as some dot-matrix or daisy-wheel printers. The speed of laser printers ranges from about 4 to 20 pages of text per minute (ppm). A typical rate of 6ppm is equivalent to about 40 characters per second (cps).

Q.3 What is a Dot-Matrix Printer?

Ans.: A **dot Matrix Printer** or **Impact Matrix Printer** refers to a type of computer printer with a print head that runs back and forth on the page and prints by impact, striking an ink-soaked cloth ribbon against the paper, much like a typewriter. Unlike a typewriter or daisy wheel printer, letters are drawn out of a dot matrix, and thus, varied fonts and arbitrary graphics can be produced. Because the printing involves mechanical pressure, these printers can create carbon copies and carbonless copies. Each dot is produced by a tiny metal rod, also called a "wire" or "pin", which is driven forward by the power of a tiny electromagnet or solenoid, either directly or through small levers (pawls). Facing the ribbon and the paper is a small guide plate pierced with holes to serve as guides for the pins. The moving portion of the printer is called the print head, and when running the printer as a generic text device it generally prints one line of text at a time. Most dot matrix printers have a single vertical line of dot-making equipment on their print heads; others have a few interleaved rows in order to improve dot density. These machines can be highly durable, but eventually wear out. Ink invades the guide plate of the print head, causing grit to adhere to it; this grit slowly causes the channels in the guide plate to wear from circles into ovals or slots, providing less and less accurate guidance to the printing wires.

Dot-matrix printers vary in two important characteristics :

- **Speed :** Given in characters per second (cps), the speed can vary from about 50 to over 500 cps. Most dot-matrix printers offer different speeds depending on the quality of print desired.
- **Print Quality :** Determined by the number of pins (the mechanisms that print the dots), it can vary from 9 to 24. The best dot-matrix printers (24 pins) can produce near letter-quality type, although you can still see a difference if you look closely.

Advantages :

- can print on multi-part stationery or make carbon copies.
- Impact printers have one of the lowest printing costs per page.
- They are able to use continuous paper rather than requiring individual sheets.
- The ink ribbon also does not easily dry out.

Disadvantages :

- Impact printers are usually noisy.
- They can only print low resolution graphics, with limited colour performance, limited quality and comparatively low speed.
- They are prone to bent pins (and therefore a destroyed printhead) caused by printing a character half-on and half-off the label.

Q.4 Explain Solid State Storage Devices.

Ans.: Solid state storage is a non volatile, removable storage medium that employs integrated circuits (ICs) rather than magnetic or optical media. It is the equivalent of large capacity non volatile memory. Examples include Flash memory, Universal serial bus etc. The main advantage of solid state storage is the fact that it contains no mechanical parts. Everything is done electronically. As a result, the data transfer to and from solid state storage media takes place at a much higher speed than is possible with electromechanical disk drives. The absence of moving parts may translate into longer operating life, provided the device is reasonably cared for and not exposed to electrostatic discharge.

Q.5 Briefly explain Floppy Disk Storage Device.

Ans.: A floppy disk is a removable round, flat piece of mylar plastic, coated with ferric oxide and encased in a protective plastic cover. This kind of disk is read and written by a floppy disk drive. A disk drive is a device that performs the basic operation on a disk, including rotating the disk, reading and writing the data on to the disk.

To read and write data on to a floppy disk, one has to insert it into the floppy disk drive. When a diskette is inserted into the drive, it presses against a system of levers. One layer opens the metal plate, to expose the data access area. Other levers and gears move two read / write heads until they almost touch the diskette on both sides. The drive's circuit board receives signals, including data and instruction for reading / writing data to disk. The circuit board first verify that no light is visible through a small window in the floppy disk housing.

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