PAPER – 7: INFORMATION TECHNOLOGY AND STRATEGIC MANAGEMENT

SECTION – A: INFORMATION TECHNOLOGY

QUESTIONS

1. Define the following terms briefly:

   (i) Bandwidth   (ii) Instruction Set

   (iii) Neural Networks   (iv) MMX

   (v) CMOS   (vi) Video Card

   (vii) Light Pen   (viii) Primary Key

   (ix) Push Technology   (x) Groupware

   (xi) Remote Job Terminal   (xii) Open Source Software

   (xiii) ASCII Code   (xiv) Algorithm

   (xv) Decision Table

2. Convert the following from one number system to another number system along with the working notes:

   (i) $(1100011)_2$ = (   )$_{10}$

   (ii) $(625)_{10}$ = (   )$_2$

   (iii) $(135.25)_{10}$ = (   )$_2$

   (iv) $(110001.11)_2$ = (   )$_{10}$

   (v) $(400)_{10}$ = (   )$_2$

3. Distinguish between the following:

   (i) Bridges and Repeaters

   (ii) Consumer–to–Business (C2B) and Consumer–to–Consumer (C2C)

   (iii) CRT and Plasma

   (iv) Drum Plotter and Flat-bed Plotter

   (v) Source Program and Load Program

   (vi) Database Administrator and Database Designer

   (vii) Web Information Server and Active Application Server

   (viii) Cold Site and Hot Site

   (ix) Transaction Log and Mirror Log

   (x) Serial Transmission and Parallel Transmission

Classification of Computers

4. (a) On the basis of size and data processing power, discuss various categories of the Computer System.

    (b) What are the limitations of computer systems?

Computer Bus

5. Discuss in brief the three different types of computer bus?

Characteristics of Storage

6. Discuss various types of storage distinguished on the basis of different factors.

On – Line Entry

7. Discuss in brief various Online Entry devices.

Operating System

8. (a) Discuss in brief various features of Operating System.

    (b) What are Utility Programs or Service Programs? What are the various tasks performed by them?

Printers

9. Discuss various types of printers.

General Purpose Software

10. What do you mean by General Purpose Software? Discuss in brief its basic types.

Data Independence and Database

11. (a) What do you understand by Data independence in DBMS? Discuss various types of Data Independence.

    (b) Discuss various record relationships in Database.

Database Models

12. Discus in brief the Distributed, Entity-Relationship and Object Oriented Database models.

Types of Databases

13. Discuss in brief various types of databases.

Classification of Networks

14. Discuss classification of networks based on different parameters.

Communication Channel

15. Discuss Guided media and Unguided media and provide an example of each.

Transmission Techniques

16. Discuss various transmission techniques.

Data Centre

17. (a) What do your understand by "Data Centre"?

    (b) Discuss the various features of Data Centres.

Electronic Payments

18. Discuss in brief different types of Electronic Payments?

Flowchart

19. Draw a flow chart to compute and print for 50 transactions (assuming all are correct).

    The Gross Sales (GS), Discount Allowed (DA), and Net Sales (NS).

    The input document shall provide the Quantity Sold (QS) and the Unit Price (UP). The discount is allowed as under:

No. of units sold	Discount admissible
Less than 100	Nil
100-200	2%
201-500	5%
501-1000	10%
More than 1000	20%

It should also be noted that 25 transactions must be printed on one page. Suitable column headings such as Gross Sales, Discount allowed and Net Sales must be printed on every page.

Decision Table

20. Prepare a decision table to select the largest of the three distinct numbers A, B, C.

SUGGESTED ANSWERS / HINTS

1. (i) **Bandwidth:** Bandwidth is defined as the number of bits processed in a single instruction. It is one of the characteristic that differentiates one microprocessor from other apart from the Instruction set and Clock speed.

   (ii) **Instruction Set:** It is defined as the set of instructions that the microprocessor can execute. The CPU's instructions for carrying out commands are built into the control unit. The instructions, or instruction set, list all the operations that the CPU can perform. Each instruction in the instruction set is expressed in microcode- a series

of basic directions that tell the CPU how to execute more complex operations. Before a program can be executed, every command in it must be broken down into instructions that correspond to the ones in the CPU's instruction set. When the program is executed, the CPU carries out the instructions, in order, by converting them into microcode. Different CPUs have different instruction sets.

(iii) **Neural Networks:** These are the systems that simulate intelligence by attempting to reproduce the types of physical connections that occur in animal brains. Neural networks are the hottest area of artificial intelligence which is proving successful in a number of disciplines such as voice recognition and natural-language processing.

(iv) **MMX:** MMX stands for Multimedia Extension, a set of instructions built into the CPU, specifically intended for improving the performance of multimedia or graphic applications. MMX is a Single Instruction Multiple Data (SIMD) instruction set designed by Intel in 1996.

(v) **CMOS:** CMOS stands for **Complementary Metal-Oxide Semiconductor**; and is used to store the date, time and system setup parameters. These parameters are loaded every time the computer is started.

(vi) **Video Card:** Video Card is an expansion card whose function is to generate output images to display video and animation. Many video cards offer added functions, such as accelerated rendering of 3D scenes and 2D graphics, video capture, TV-tuner adapter, MPEG-2/MPEG-4 decoding, FireWire, light pen, TV output, or the ability to connect multiple monitors and PC Games.

(vii) **Light Pen:** A light pen is a pointing device which can be used to select an option by simply pointing at it, or draw figures directly on the screen and move the figures around. Light-pen is useful for menu-based applications. A light pen is also useful for drawing graphics in CAD. Using a keyboard and a light pen, the designer can select colours and line thickness, reduce or enlarge drawings, and edit drawings. It is also used to read the bar charts on the goods available in big departmental stores.

(viii) **Primary Key:** The primary key of any table is any candidate key of that table which the database designer arbitrarily designates as "primary". The primary key may be selected for convenience, comprehension, performance, or any other reasons. It is entirely proper to change the selection of primary key to another candidate key.

Enrollment	
student	**class**
PK	

Enrollment		
student	**class**	**row id**
		PK

(ix) **Push Technology:** Push Technology or Webcasting is a Web-based technology which allows users to passively receive broadcast information rather than actively search the Web for information. Push technology allows users to choose from a

menu of sources, specifying what kind of information they want to receive. Once selected, the information is automatically forwarded to the user. Internet news services, which deliver the day's activities to the user's desktop, are an example of push technology. Users can also download software, select the frequency with which they will receive services, and subscribe to a variety of information sources.

(x) **Groupware:** GroupWare is the name given to software used in a Group Decision Support System, in which several people jointly solve a problem. In other words, it is software that enables computers within a group or organization to work together, allowing users to exchange electronic-mail messages, access shared files and databases, use video conferencing, etc.

(xi) **Remote Job Terminal:** Also referred to as Remote Job Entry (RJE); it groups data into blocks for transmission to a computer from a remote site. Some RJE terminals have the capability of receiving back and printing the results of the application program. Such a unit is in itself a small computer, which can be used either as job entry terminal or as a stand-alone computer. A terminal may be situated at the computer site or situated at a remote place where the data to be input is more readily available. Terminals linked to the computer system by a direct cable are known as hard-wired terminals.

(xii) **Open Source Software**: Open Source software is created by generous programmers and released into the public domain for public use. There is usually a copyright notice that must remain with the software product. Open Source software is not public domain in that the company or individual that develops the software retains ownership of the program but the software can be used freely. Many popular Open Source applications are being developed and upgraded regularly by individuals and companies that believe in the Open Source concept.

(xiii) **ASCII Code:** ASCII stands for **American Standard Code for Information Interchange** and is used extensively in small computers, peripherals, instruments and communication devices. It is a seven bit code that includes both unprintable control codes (0-31), used to control various devices in computer and printable control codes (32-127) that represents lower case and upper case letters, digits, punctuation marks, and other symbols. With 7 bits, up to 128 characters can be coded.

ASCII-8 Code: A newer version of ASCII is the ASCII-8 code, which is an 8-bit code. With 8 bits, the code capacity is extended to 256 characters. This includes graphics, symbols and mathematical representations.

(xiv) **Algorithm:** A specific procedure that exists as a finite list of instructions specifying a sequence of operations and that give the answer to any problem of a given type is called an Algorithm. Computer programs are based on the concept of an algorithm.

(xv) Decision Table: A decision table is a table which may accompany a flowchart, defining the possible contingencies that may be considered within the program and the appropriate course of action for each contingency. A decision table is divided into four parts:

- *Condition Stub* - (which comprehensively lists the comparisons or conditions);

- *Action Stub*- which comprehensively lists the actions to be taken along the various program branches;

- *Condition entries* - which list in its various columns the possible permutations of answer to the questions in the conditions stub); and

- **Action entries - (**which lists, in its columns corresponding to the condition entries the actions contingent upon the set of answers to questions of that column)

2. **(i)** $(1100011)_2$ = ( )$_{10}$

= $1 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

= $64 + 32 + 0 + 0 + 0 + 2 + 1$

$(1100011)_2$ = $(99)_{10}$

(ii) $(625)_{10}$ = ( )$_2$

2	625	Remainder
2	312	1
2	156	0
2	78	0
2	39	0
2	19	1
2	9	1
2	4	1
2	2	0
2	1	0
2	0	1

$(625)_{10}$ = $(1001110001)_2$

(iii) $(135.25)_{10}$ = ( )$_2$

To convert the given number from Decimal Number System to Binary Number System, first we will convert mantissa part, then the fractional part into Binary Number System.

Step – I

2	135	Remainder
2	67	1
2	33	1
2	16	1
2	8	0
2	4	0
2	2	0
2	1	0
2	0	1

$(135)_{10}$ = $(10000111)_2$ ………………..(i)

Step – II   Integer Part

.25 x 2   =   0.50   0

.50 x 2   =   1.00   1

$(.25)_{10}$ = $(0.01)_2$ ……………….(ii)

So, combining equations (i) and (ii), we get -

$(135.25)_{10}$ = $(10000111.01)_2$

(iv) $(110001.11)_2$ =   ($)_{10}$

        = $1 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2}$

        =   32 + 16 + 0 + 0 + 0+ 1 + 1/2 + 1/4

$(110001.11)_2$ = $(49.75)_{10}$

(v) $(400)_{10}$ = ($)_2$

2	400	
2	200	0
2	100	0
2	50	0
2	25	0
2	12	1
2	6	0
2	3	0
2	1	1
2	0	1

$(400)_{10}$ = $(110010000)_2$

3. (i) **Bridges:** The main task of a bridge computer is to receive and pass data from one LAN to another. In order to transmit this data successfully, the bridge magnifies the data transmission signal. This means that the bridge can act as a repeater as well as a link.

   Repeaters: These are the devices that solve the snag of signal degradation which results as data is transmitted along the various cables. The repeater boosts or amplifies the signal before passing it through to the next section of cable.

(ii) **Consumer-to-Business (C2B):** Consumer directly contacts with business vendors by posting their project work with set budge online so that the needy companies review it and contact the customer directly with bid. The consumer reviews all the bids and selects the company for further processing. Some examples are guru.com, rentacoder.com, getacoder.com, freelancer.com.

   Consumer-to-Consumer (C2C): Consumer-to-Consumer electronic commerce (abbreviated C2C) is an internet-facilitated form of commerce that has existed for the span of history in the form of barter, flea markets, swap meets, yard sales and the like. Most of the highly successful Consumer-to-Consumer (C2C) examples using the Internet take advantage of some type of corporate intermediary and are thus not strictly good examples of Consumer-to-Consumer (C2C).

   Companies using internal networks to offer their employees products and services online - not necessarily online on the Web are engaging in B2E (Business-to-Employee) ecommerce. G2G (Government-to-Government), G2E (Government-to-Employee), G2B (Government-to-Business), B2G (Business-to-Government), G2C (Government-to-Citizen), C2G (Citizen-to-Government) are other forms of ecommerce that involve transactions with the government-from procurement to filing taxes to business registrations to renewing licenses.

(iii) **CRT and Plasma**

CRT	Plasma
1. Having high dynamic range of colors, wide gamut and low black level.	1. Compact and light weighted.
2. It can display natively in almost any resolution and refresh rate.	2. High contrast ratios, excellent color, wide gamut and low black level.
3. It has low response time generally in Sub-milliseconds.	3. High speed response time.
4. It has zero color, saturation, contrast or brightness distortion as well as excellent viewing angle.	4. Near zero color, saturation, contrast or brightness distortion as well as excellent viewing angle.
5. Geometric distortion caused by variable beam travel distances.	5. No geometric distortion.

6. Large size and weight, especially for bigger screens (a 20-inch unit weighs about 20 to 30 Kg).	6. Highly scalable, with less weight gain per increase in size from less than 30 inches (760 mm) wide to the world's largest at 150 inches (3,800 mm).
7. Usually much cheaper than LCD or Plasma screens.	7. Fixed bit depth, many cheaper Plasma are incapable of producing true color.

(iv) **Drum Plotter**: A drum plotter plots on paper affixed to a drum. The drum revolves back and forth, and a pen suspended from a bar above moves from side-to-side taking up new plot positions or plotting as it moves. This device is suitable for routine graph plotting and also for fashion designs.

Flat-bed Plotter: On a flat-bed plotter, the paper lies flat. The bar on which the pen is suspended itself moves on a gantry to provide the necessary two-way movement. Colour plotting is usually possible through Flat-bed plotter.

(v) **Source Program:** The program submitted for compilation is called a **source program** (or source module). The compiler then translates the program into machine language, producing an object program (or object module). Then, another software program called a **linkage editor** binds the object module of this program to object modules of any subprograms that must be used to complete processing.

Load Program: The resultant program (after the binding) which is ready for computer execution, is called a **load program** (or load module). It is the load program that the computer actually executes.

(vi) **Database Administrator (DBA)**: DBA is responsible for authorization access to the database, for coordinating and monitoring its use, and for acquiring the needed software and hardware resources.

Database Designer: Database designer is responsible for identifying the data to be stored in the database for choosing appropriate structures to represent and store the data.

(vii) **Web Information Server:** This type of server employs HTML templates and scripts to generate pages incorporating values from the database in them. These types of servers are stateless servers. Such servers include Netscape Server, HAHT, Allaire, Sybase, and SilverStream.

Active Application Server: This type of server supports and provides a rich environment for server-side logic expressed as objects, rules and components. These types of servers are most suitable for dealing with based e-commerce and decision processing.
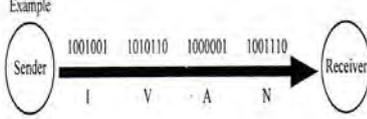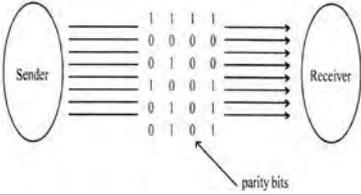
(viii) **Cold Site:** It is a type of disaster recovery plan that is devoid of any resources or equipments except air conditioning and raised flooring. Equipment and resources must be installed in such a facility to duplicate the critical business functions of an organization. Cold sites have many variations depending on their communication facilities.

Hot Site: It is also a type of disaster recovery plan that has the equipment and resources to recover business functions that are affected by a disaster. Hot sites may vary in the type of facilities offered (such as data processing, communications, or any other critical business functions needing duplication). The location and size of the hot site must be proportional to the equipment and resources needed.

(ix) **Transaction Log**: A transaction log is a file that records database modifications that consists of inserts, updates, deletes, commits, rollbacks, and database schema changes. A transaction log is not required but is recommended. The database engine uses a transaction log to apply any changes made between the most recent checkpoint and the system failure. The checkpoint ensures that all committed transactions are written to disk.

Mirror Log: A mirror log is an optional file and has a file extension of .mlg. It is a copy of a transaction log and provides additional protection against the loss of data in the event the transaction log becomes unusable.

(x) **Serial Transmission and Parallel Transmission**

S. No	SERIAL TRANSMISSION	PARALLEL TRANSMISSION
1	In serial transmission, the bits of each byte are sent along a single path one after another as shown in the Fig. below.	In parallel transmission, there are separate, parallel path corresponding to each bit of the byte so that all character bits are transmitted simultaneously as shown in the Fig. below.
2		
3	Data is transmitted over a single wire.	Data is transmitted over 8 different wires.
4	A cheaper mode of transferring data.	Relatively expensive.
5	Applicable for long distance data transmissions.	Not practical for long distance communications as it uses

		parallel path, so cross talk may occur.
6	Relatively slower.	Relatively faster.
7	An example is the serial port (RS-232) for the mouse or MODEM.	Example of this transmission is the parallel port (Centronic port) used for printer.

4. (a) On the basis of size and data processing power, computer systems are often categorized into Personal / Micro computers, Minicomputers, Mainframe computers and Super computers, Workstations and Servers.

   (i) **Personal / Micro Computers:** A small computer also known as microcomputer is a full-fledged computer system that uses a microprocessor as its CPU. A microprocessor is a product of the microminiaturization of electronic circuitry; it is a "computer on a chip", where a chip refers to any self-contained integrated circuit. This chip must be mounted together with memory, input and output chips on a single circuit board to make it a microcomputer. Thus, a microcomputer often called a micro is a small computer consisting of a processor on a single silicon chip which is mounted on a circuit board with other chips containing the computer's internal memory in the form of Read-Only-Memory (ROM) and Random-Access-Memory (RAM). Examples of microcomputers are IBM PCs, PS/2 and Apple's Macintosh.

   (ii) **Mini Computers:** A minicomputer is a class of multi-user computers that lies in the middle range of the computing spectrum, in between the largest multi-user systems (mainframe computers) and the smallest single-user systems (microcomputers or personal computers). These systems use Integrated Circuit (IC) and core memory technologies and thus had relatively high processing power and capacity that mostly fit the needs of mid range organizations. They were used in manufacturing processes or handling email that was sent and received by a company. The most popular minicomputer or minis are the Data General Nova, DEC, PDP-11 and the IBM series/1. These systems can serve as information processors in small-to-medium sized firms or as processors in computer networks for large firms. A mini computer supports programming languages that includes BASIC, PASCAL COBOL, C and FORTRAN.

   (iii) **Mainframe Computers**: Mainframes are powerful computers used mainly by large organizations for critical applications, typically bulk data processing such as census, industry and consumer statistics, enterprise resource planning, and financial processing. They are more powerful and costlier than Mini computers. However, they are big general-purpose computers capable of handling all kinds of scientific and business applications. Mainframes can process at

several million instructions per second and can support more than 1,000 remote terminals.

Mainframes have large on-line secondary storage capacity. A number of different types of peripheral devices like magnetic tape drive, hard disk drive, visual display units, plotters, printers and telecommunication terminals can be attached with main-frame computers. They have high-speed cache memory which enables them to process applications at a faster rate than mini or microcomputers and also offer the facility of multiprogramming and time-sharing. One of the biggest factors associated with mainframes is its huge cost which made its usage only possible for big companies and corporate.

(iv) **Super Computers:** Supercomputers are very expensive and are employed for specialized applications that require immense amounts of mathematical calculations. They are the largest and fastest machines typically used in specialized areas. They have high processing speed by interconnecting hundreds of microprocessors compared to other computers and have also multiprocessing technique. Supercomputers are mainly being used for defence, whether forecasting, biomedical research, remote sensing, aircraft design and other areas of science and technology.

In general, the speed of a supercomputer is measured in "**FLOPS**" (**FL**oating point **O**perations **P**er **S**econd). The FLOPS is a measure of a computer's performance, especially in fields of scientific calculations that make heavy use of floating point calculations, similar to the older, simpler, instructions per second.

(v) **Workstations:** These are a high-end microcomputer designed for technical or scientific applications. Intended primarily to be used by one person at a time, they are commonly connected to a LAN and run multi-user operating systems. These offer higher performance than personal computers, especially with respect to CPU and graphics, memory capacity and multitasking capability. They are optimized for the visualization and manipulation of different types of complex data such as 3D mechanical design, engineering simulation (e.g. computational fluid dynamics), animation and rendering of images, and mathematical plots.

Internally, different workstations are based on different architecture of CPU called **Reduced Instruction Set Computing (RISC)**, which results in faster processing of instructions. Further, workstations generally run the Unix Operating Systems or a variation of it.

(vi) **Servers:** Servers are computers, or series of computers, that link other computers or electronic devices together. They often provide essential services across a network, either to private users inside a large organization or to public users via the Internet. Many servers have dedicated functionality such

as web servers, print servers, and database servers. Enterprise servers used in a business context provide services to other computing systems called clients over a network. The typical server is a computer system that operates continuously on a network and waits for requests for services from other computers on the network.

Servers often run for long periods without interruption and availability. Although servers can be built from commodity computer parts, mission-critical servers use specialized hardware with low failure rates in order to maximize uptime.

(b) **Limitations of Computer Systems are discussed as under:**

- **Programmed by human:** Though computer is programmed to work efficiently and accurately, but it is programmed by human beings to do so. Without a program, computer is nothing. A program is a set of instructions which perform particular task and if the instructions are not accurate, the working of computer will not be accurate.

- **No Intelligence**: Although computers are faster, more diligent, accurate and versatile than human beings, it cannot replace them. Unlike human beings, computers do not have any intelligence and cannot carry any task at its own. Its performance depends on instructions given to it.

- **No decision making power**: Computer cannot make any decisions nor can it render any help to solve a problem at its own like. For example - if we play chess with computer, the computer can take only those steps which are entered by the programmer. It cannot move at its own.

- **Emotionless**: Computers are emotionless and do not have emotions as human beings have. They are simply machines which work as per the instruction given to them.

- **Curtail human Capabilities**: Although computers are great help to human beings, it is commonly felt that we have become so dependant on calculator that we cannot make very simple calculation without calculator. Further, excessive use of computers is causing various type of health injuries such as cervical and back pain, pain in eye, headache.

5. **The bus:** A bus in a computer is a collection of wires through which data is transmitted between the various components of a PC. A bus connects the various components of the PC with the CPU and the main memory (RAM). Logically, a bus consists of three parts - **a Data bus, an Address bus** and a **Control bus**.

- **Data Bus:** The Data Bus is an electrical path that connects the CPU, memory, and the other hardware devices on the motherboard. Actually, the bus is a group of parallel wires. The number of wires in the bus affects the speed at which data can

travel between hardware components, just as the number of lanes on a highway affects how long it takes people to get to their destinations. Because each wire can transfer one bit at a time, an eight-wire bus can move eight bits at a time, which is a full byte. A 16-bit bus can transfer two bytes, and a 32-bit bus can transfer four bytes at a time.

- **Address Bus:** The second bus that is found in every microcomputer is the address bus. The address bus is a set of wires similar to the data bus that connects the CPU and RAM and carries the memory addresses. The number of wires in it determines the maximum number of memory addresses. For example, one byte of data is enough to represent 256 different values. If the address bus could carry only eight bits at a time, the CPU could address only 256 bytes of RAM. Today, most CPUs have 32-bit address buses that can address 4 GB (over 4 million bytes) of RAM.

- **Control bus:** A Control bus is a computer bus, used by CPUs for communicating with other devices within the computer. Also referred as **Command bus**, it transports orders and synchronizes signals coming from the control unit and travelling to all other hardware components. It is a bidirectional bus, as it also transmits response signals from the hardware. The control bus is used by the CPU to direct and monitor the actions of the other functional areas of the computer. It is used to transmit a variety of individual signals (read, write, interrupt, acknowledge, and so forth) necessary to control and coordinate the operations of the computer.

6. **Various types of storage:** On the basis of different factors, the storage can be distinguished into various types:

   (i) On the basis of "Volatility of information"

   - **Volatile memory** requires constant power to maintain the stored information. Volatile memory is typically used only for primary storage.

   - **Non-volatile memory** retains the stored information even if it is not constantly supplied with electric power. It is suitable for long-term storage of information, and therefore used for secondary, tertiary, and off-line storage.

   (ii) On the basis of "Differentiation of Information"

   - **Dynamic memory** is volatile memory which also requires that stored information is periodically refreshed, or read and written without modification.

   - **Static memory** is a form of volatile memory similar to DRAM with the exception that it never needs to be refreshed as long as power is supplied. (It loses its content if power is removed).

   (iii) On the basis of "Ability to access non-contiguous information"

   - **Random access** means that any location in storage can be accessed at any moment in the same, usually small, amount of time. This makes Random Access Memory (RAM) well suited for primary storage.

- **Sequential access** means that accessing a piece of information will take a varying amount of time, depending on which piece of information was accessed last. The device may need to seek (e.g. to position the read/write head correctly), or cycle (e.g. to wait for the correct location in a constantly revolving medium to appear below the read/write head).

(iv) On the basis of "Ability to change information"

- **Read/write storage**, or **mutable storage**, allows information to be overwritten at any time. A computer without some amount of read/write storage for primary storage purposes would be useless for many tasks. Modern computers typically use read/write storage also for secondary storage.

- **Read only storage** retains the information stored at the time of manufacture, and **Write Once Storage** (WORM) allows the information to be written only once at some point after manufacture. These are called **immutable storage** and are used for tertiary and off-line storage. Examples include CD-R.

- **Slow write, fast read storage** is read/write storage which allows information to be overwritten multiple times, but with the write operation being much slower than the read operation. Examples include CD-RW.

(v) On the basis of "Addressability of information"

- In **location-addressable storage**, each individually accessible unit of information in storage is selected with its numerical memory address. In modern computers, location-addressable storage usually limits to primary storage, accessed internally by computer programs, since location-addressability is very efficient, but burdensome for humans.

- In **file system storage**, information is divided into **files** of variable length, and a particular file is selected with human-readable directory and file names. The underlying device is still location-addressable, but the operating system of a computer provides the file system abstraction to make the operation more understandable. In modern computers, secondary, tertiary and off-line storage use file systems.

- In **content-addressable storage**, each individually accessible unit of information is   selected with a hash value or a short identifier with no pertaining to the memory address the information is stored on. Content-addressable storage can be implemented using software (computer program) or hardware (computer device), with hardware being faster but more expensive option.

(vi) On the basis of "Capacity and performance"

- **Storage capacity** is the total amount of stored information that a storage device or medium can hold. It is expressed as a quantity of bits or bytes (e.g. 10.4 megabytes).

- **Storage density** refers to the compactness of stored information. It is the storage capacity of a medium divided with a unit of length, area or volume (e.g. 1.2 megabytes per square centimeter).

- **Latency** is the time it takes to access a particular location in storage. The relevant is typically nanosecond for primary storage, millisecond for secondary storage, and second for tertiary storage. It may make sense to separate read latency and write latency, and in case of sequential access storage, minimum, maximum and average latency.

- **Throughput** is the rate at which information can read from or written to the storage. In computer storage, throughput is usually expressed in terms of Megabytes per Second or MB/s, though bit rate may also be used. As with latency, read rate and write rate may need to be differentiated.

7. Various On-Line Entry devices are discussed as follows:

(i) **Keyboard:** A keyboard is a primary input device that allows the user to enter alphabets, numbers and other characters. One can enter data and issue commands via the keyboard. A keyboard typically has characters engraved or printed on the keys and each press of a key typically corresponds to a single written symbol. In normal usage, the keyboard is used to type text and numbers into a word processor, text editor or other program. In a modern computer, the interpretation of key presses is generally left to the software. Keyboards are also used for computer gaming, either with regular keyboards or by using keyboards with special gaming features, which can expedite frequently used keystroke combinations. A keyboard is also used to give commands to the operating system of a computer, such as Windows' Control-Alt-Delete combination, which brings up a task window or shuts down the machine.

(ii) **Mouse:** Mouse is a pointing device that controls the movement of the cursor on a display screen. The user pushes across a desk surface in order to point to a place on a display screen and to select one or more actions to take from that position. A mouse consists of a metal or plastic housing or casing, a ball that sticks out of the bottom of the casing and is rolled on a flat surface, one or more buttons on the top of the casing, and a cable that connects the mouse to the computer. As the ball is moved over the surface in any direction, a sensor sends impulses to the computer that causes a mouse-responsive program to reposition a visible indicator (called a cursor) on the display screen.

(iii) **Touch Screen:** The 'Touch Screen' is a Hewlett Packard innovation in which an invisible microwave beam 'matrix' criss crosses the screen, emanating from holes along the bottom and sides of the display unit. By pressing the finger against a function or program displayed on the screen, the infrared beam is broken at that intersection and the system activated.

Two popular technologies exist for touch screens. In one, the screen is made sensitive to touch and the exact position is detected. In the other, the screen is lined with light emitting devices on its vertical sides, photo-detectors are placed on the horizontal sides. When the user's finger approaches the screen, the light beam is broken and is detected by the photo-detectors. Touch screens are used in information-providing systems. For example, while performing an operation, if the doctor wants to see some test reports of the patient that have been stored in a computer, he can get the information just by touch of his finger. It is also used in airline and railway reservation counters.

(iv) **Light Pen:** A light pen is a pointing device which can be used to select an option by simply pointing at it, or draw figures directly on the screen and move the figures around. A light pen has a photo-detector at its tip that can detect changes in brightness of the screen. When the pen is pointed at a particular point on the screen, it records the instant change in brightness that occurs and informs the computer about this. The computer can find out the exact spot with this information. Thus, the computer can identify where the user is pointing on the screen.

Light-pens are useful for menu-based applications. Instead of moving the mouse around or using a keyboard, the user can select an option by pointing at it. A light pen is also useful for drawing graphics in CAD. An engineer, architect or a fashion designer can draw sketches or pictures directly on the screen with the pen. These are also used to read the bar charts that are now appearing so frequently on the goods which are available in big departmental stores.

(v) **The Track Ball**: A track ball is a pointing device that works like an upside-down mouse. The user rests his thumb on the exposed ball and his fingers on the buttons. To move the cursor around the screen, the ball is rolled with the thumb. Since the whole device is not moved, a track ball requires less space than a mouse. So when space is limited, a track ball can be a boom. Track balls are particularly popular among users of notebook computers.

(vi) **Joystick:** The joystick is a vertical stick which moves the graphic cursor in a direction the stick is moved. It typically has a button on top that is used to select the option pointed by the cursor. Joystick is used as an input device primarily used with video games, training simulators and controlling robots. The joystick is used for flight control in the cockpit of many aircraft, controlling machines such as cranes, trucks, underwater unmanned vehicles, wheelchairs and surveillance cameras. Miniature finger-operated joysticks have been adopted as input devices for smaller electronic equipment such as mobile phones.

(vii) **Scanner:** It is an input device used for optically scanning images, printed text, handwriting, or an object, and converts it to a digital image. Capturing information this way reduces the possibility of errors typically experienced during large data entry. Hand-held scanners (bar code readers) are also commonly seen in big stores

to scan codes and price information for each of the items. Mechanically driven scanners that move the document are typically used for large-format documents.

(viii) **Camera:** Two types of cameras are used for input on a computer. The digital camera is a device that takes digital images and saves them to memory. The user then connects the camera to the computer where images are uploaded and saved. Web cams are the other type of camera that is known as video capture device that is connected to a computer or computer network, often using a USB port. Web cams are ways for people to take images from the computer and communicate visually with other users on the Internet.

(ix) **Microphone and Speech recognition:** The "Microphones - Speech Recognition" is a speech input device. Sound is used most often in multimedia, where the presentation can benefit from narration, music, or sound effects. For this type of sound input, basically a digitized recording is required using a microphone (or some other audio input device, such as a CD player) and a sound card that translates the electrical signal from the microphone into a digitized form that the computer can store and process. Sound cards can also translate digitized sounds back into analog signals that can then be sent to the speakers.

(x) **Digitizing Tablets:** It is also known as graphics tablet which is a computer input device that allows hand-draw images and graphics, similar to the way one draws images with a pencil and paper. These tablets may also be used to capture data or handwritten signatures. It can also be used to trace an image from a piece of paper which is taped or otherwise secured to the surface. Capturing data in this way, either by tracing or entering the corners of linear poly-lines or shapes is called digitizing.

(xi) **MIDI Devices:** MIDI (Musical Instrument Digital Interface) is a system designed to transmit information between electronic musical instruments. A MIDI musical keyboard can be attached to a computer and allow a performer to play music that is captured by the computer system as a sequence of notes with the associated timing (instead of recording digitized sound waves).

8. (a) Features of Operating System are discussed as below:

(i) **Multiprogramming –** Multiprogramming is defined as execution of two or more programs that all reside in primary storage. Since the CPU can execute only one instruction at a time, it cannot simultaneously execute instructions from two or more programs. However, it can execute instructions from one program then from second program then from first again, and so on. This type of processing is referred to as "Concurrent Execution".

When processing is interrupted on one program, the processor switches to another program enabling all parts of the system, the processor, input and output peripherals to be operated concurrently thereby utilizing the whole

system more fully. In this system, storage is allocated for each program called "partitions". Each partition must have some form of storage protection and priority protection to ensure that a program in one portion will not accidentally write over and destroy the instructions of another partition and priority (when two or more programs are residing in primary storage) because both programs will need access to the CPU's facilities (*e.g.,* the arithmetic and logic section).

(ii) **Multi-threading –** It is an application typically implemented as a separate process with several threads of control. In some situations, a single application may be required to perform several similar tasks, for example a web server accepts client requests for web pages, images, sound, and so forth. A busy web server may have several of clients concurrently accessing it. If the web server runs as a traditional single-threaded process, it would be able to service only one client at a time. The amount of time that a client might have to wait for its request to be serviced could be enormous. So it is efficient to have one process that contains multiple threads to serve the same purpose. This approach would multithread the web-server process. To get the advantages like responsiveness, resource sharing economy and utilization of multiprocessor architectures; multithreading concept can be used. Multithreading allows a process to keep running even if some threads within the process are stalled, working on a lengthy task, or awaiting user interaction, thus improve the performance of processing the task.

(iii) **Multi-tasking –** Multi-tasking refers to the operating system's ability to execute two or more of a single user's tasks concurrently. Multitasking operating systems are often contrasted with single-user operating systems. **Single-user operating systems** have traditionally been the most common type of operating system for microcomputers. These only allow the user to work on one task at a time. For example, with many single-user operating systems for microcomputer systems, a word-processing user cannot effectively type in a document while another document is being printed out on an attached printer. For microcomputers, multi-tasking operating systems provide single users with multiprogramming capabilities.

(iv) **Virtual Memory –** A programmer has to take into account the size of the memory to fit all his instructions and the data to be operated in the primary storage. If the program is large, then the programmer has to use the concept of virtual memory. Virtual memory systems, sometimes called Virtual Storage Systems extend primary memory by treating disk storage as a logical extension of RAM. The technique works by dividing a program on disk into fixed-length pages or into logical, variable-length segments. By allowing programs to be broken up into smaller parts, and by allowing only certain parts to be in main memory at any one time, virtual memory enables computers to get by with less main memory than usual.

(v) **Multiprocessing** – Multiprocessing (or parallel processing) refers to the use of two or more central processing units, linked together, to perform coordinated work simultaneously. Instructions are executed simultaneously because the available CPUs can execute different instructions of the same program or of different programs at any given time. Multiprocessing offers data-processing capabilities that are not present when only one CPU is used. Many complex operations can be performed at the same time. CPU can function on complementary units to provide data and control for one another. Multiprocessing is used for nation's major control applications such as rail road control, traffic control, or airways etc.

(vi) **Time-sharing –** Time sharing is a methodology created to satisfy the processing needs of multiprogramming and batch operating system. In time sharing systems, the execution time is divided into small slots called "time slice". Each process is processed for a time slice and then the other process is taken for processing by the processor. This process goes on till all the jobs are processed. The process of shifting a microprocessor from processing of one job to the other is so rapid that each user feels like the processor is dedicatedly processing his job only. The main objective of the time sharing systems is to reduce the response time. The response time is time in which the operating system responds to the commands supplied by the user.

(b) **Utility Programs or Service Programs:** Utility programs are systems programs that perform general system support tasks. These programs are provided by the computer manufacturers to perform tasks that are common to all data processing installations. Some of them may either be programs in their own right or subordinates to be assembled / compiled in the application programs. Some of the tasks performed by the utility programs are as follows:

(i) Sorting and storing the data.

(ii) Checking or scanning the data stored on hard disk for security reason.

(iii) Making a copy of all information stored on a disk, and restore either the entire disk.

(iv) Performing routine data management tasks, such as deleting, renaming, moving, copying, merging, generating and modifying data sets.

(v) Providing encryption and decryption of data.

(vi) Analyzing the computer's network connectivity, configure network settings, check data transfer or log events.

(vii) Partitioning of drive into multiple logical drives, each with its own file system which can be mounted by the operating system and treated as an individual drive.

(viii) Converting data from one recording medium to another, viz., floppy disk to hard disc, tape to printer, etc.

(ix) Dumping of data to disc or tape.

(x) Tracing the operation of program.

9. **Printers:** These are most commonly used output devices that are used to get documents print on the paper. It provides the user with a permanent visual record of the data output from the computer. The output printed on the paper is called hard copy/print out. Printers are broadly classified into two categories depending upon their printing mechanisms - **Impact** and **Non-impact printers**.

- **Impact printers:** Impact printers can be described as printers which utilize some form of striking device to transfer ink from an inked ribbon onto the paper being printed to form images or characters. The characters printed are formed by one of two methods:

   (i) They are either distinct, whole alphanumeric images produced by a process known as full character or formed character printer or,

   (ii) They are formed by a dot matrix method which arranges a series of dots to assume the shape of each character being printed.

   Impact printers fall into two basic categories - **Serial printers** or **Line printers**.

   (a) **Serial Printers:** Regardless of which character generation method is used, serial printers print one character at a time, usually from left to right. Some printers, however, can also print in a bidirectional format at an increased speed. In most business organisations two types of serial printers are used: Dot-matrix Printers and Daisywheel Printers.

   (b) **Line Printers:** A line printer operates at much higher speeds and prints what appears to be a full line at a time. It is a form of high speed impact printer in which one line of type is printed at a time. It is a high-speed printer capable of printing an entire line at one time with a speed of 60 to 1200 lines-per-minute (approximately 10 to 20 pages per minute). A fast line printer can print as many as 3,000 lines per minute. Line printers are only used where high speed and volume is necessary rather than quality of printing. Chain printers and Drum printers are examples of Line Printers.

- **Non-impact printers:** The printers that produce the output on a paper without striking the paper are known as non-impact printers. They use electro static, chemicals, ink jet and thermal technologies for printing. A non-impact printer forms characters by chemical or electronic means. Non-impact printers are the most widely used printers for PCs today. Non impact printers can produce both text and graphics. The main features of non-impact printers are faster than impact printers,

print high quality output and produce no noise during printing. Some of the non – impact printers are Thermal printers, Ink-jet printers and Laser printers.

10. General Purpose Software provides the framework for a great number of business, scientific, and personal applications. Spreadsheet, Databases, Computer-Aided Design (CAD) and Word processing software etc. fall into this category. Most general-purpose software is accompanied by user-oriented documentation such as reference manuals, keyboard templates, and so on and is sold as a package. It is then upto the user of the software to create the application. For example, an accountant can use spreadsheet software to create a template for preparing a balance sheet of a company. An aeronautical engineer can use CAD software to design an airplane or an airport. Some of the examples of General Purpose Software are as follows:

- **Word Processor:** A word processor is a computer application used for the production including composition, editing, formatting, and possibly printing of any sort of printable material. Most modern word processors have GUI consisting of one or more programs that can produce any arbitrary combination of images, graphics and text, the latter handled with type-setting capability.

- **Spreadsheet Program**: A spreadsheet is a computer application that generally simulates accounting and financial information on the worksheet. It displays multiple cells that together make up a grid consisting of rows and columns, each cell containing alphanumeric text, numeric values or formulas. Spreadsheets are frequently used for financial information because of their ability to re-calculate the entire sheet automatically after a change to a single cell is made. Lotus 1-2-3 and Excel are some of the powerful and common Spreadsheet programs.

- **Database Management System:** A Database Management System (DBMS) is a system or software designed to manage a database, and run operations on the data requested by numerous clients. Typical examples of DBMS use include accounting, human resources and Customer Support Systems.

- **Internet Browser:** An Internet Browser or a Web Browser is a software application that enables a user to display and interact with text, images, and other information typically located on a web page at a website on the World Wide Web or Local Area Network. Text and images on a web page can contain hyperlinks to other web pages at the same or different websites. Web browsers allow a user to quickly and easily access information provided on many web pages at many websites by traversing these links. Web browsers available for personal computers include Microsoft Internet Explorer, Mozilla Firefox, Apple Safari, Netscape, and Opera.

- **Electronic mail**, abbreviated as **email**, is a method of composing, sending, storing, and receiving messages over electronic communication systems. The term e-mail applies both to the Internet e-mail system based on the Simple Mail Transfer Protocol (SMTP) and to intranet systems allowing users within one company to e-mail each other.

The three basic types of software are: **Commercial**, **Shareware** and **Open Source Software**. Some software is also released into the public domain without a license.

- **Commercial** software comes prepackaged and is available from software stores and through the Internet.

- **Shareware** is software developed by individual and small companies that cannot afford to market their software world wide or by a company that wants to release a demonstration version of their commercial product.

- **Open Source software** is created by generous programmers and released into the public domain for public use. There is usually a copyright notice that must remain with the software product. Open Source software is not public domain in that the company or individual that develops the software retains ownership of the program but the software can be used freely. Many popular Open Source applications are being developed and upgraded regularly by individuals and companies that believe in the Open Source concept.

11. (a) **Data Independence:** It is an ability of a database to modify a schema definition at one level without affecting a schema in the next higher level. The architecture of the database allows the feature of data independence. Data independence occurs because when the schema is changed at one level, the schema at next level remains unchanged and only the mapping between the two levels is changed. Two types of Data Independence are as follows:

- **Physical Data Independence**: To change in the internal schema, it does not need to be changed in conceptual schema. Changes in internal schema may be needed because of changes in physical structure - by upgrading storage structure, to improve the performance of the system.

- **Logical Data Independence**: To change in the conceptual schema, it does not need to be changed in external schema. We may change conceptual schema to expand the database by adding, deleting, updating the records in the database.

(b) **Record relationship in Database:** Organizing a large database logically into records and identifying the relationships among those records are complex and time-consuming tasks. There are large number of different records that are likely to be part of a corporate database and the numerous data elements constituting those records. Further, there can be several general types of record relationships that can be represented in a database. The various types of relationships are discussed as as below:

(i) **One-to-one relationship**, as in a single parent record to a single child record or as in a husband record and wife record in a monogamous society.

(ii) **One-to-many relationships**, as in a single parent record to two or more child records – for example, a teacher who teaches three single-section courses.

.(iii) **Many-to-one relationships**, as in two or more parent records to a single child record-for example, when three administrators in a small town share one minister.

(iv) **Many-to-many relationships**, as in two or more parent records to two or more child records – for example, when two or more students are enrolled in two or more courses.

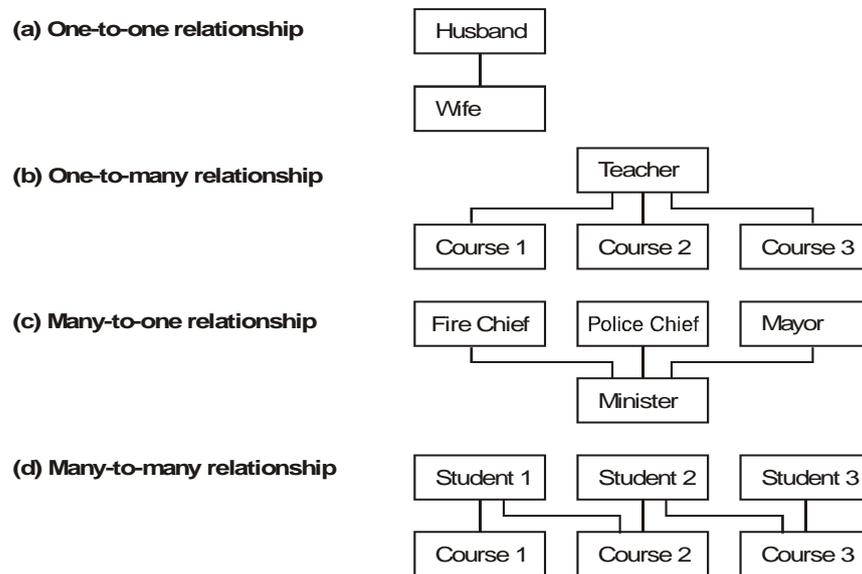The relationships are well depicted in the Fig. below:

(a) One-to-one relationship

```
Husband
Wife
```

(b) One-to-many relationship

```
            Teacher
Course 1   Course 2   Course 3
```

(c) Many-to-one relationship

```
Fire Chief   Police Chief   Mayor
            Minister
```

(d) Many-to-many relationship

```
Student 1   Student 2   Student 3
Course 1    Course 2    Course 3
```

Fig. : Example of relationship in the database

12. (i) **Distributed Database**: When an organization follows a centralized system, its database is confined to a single location under the management of a single group. Sometimes an organization may require decentralizing its database by scattering it with computing resources to several locations so that running of applications programs and data processing are performed at more than one site. This is known as Distributed Data Processing to facilitate savings in time and costs by concurrent running of application programs and data processing at various sites. When processing is distributed since the data to be processed should be located at the processing site, the database needs to be distributed fully or partly, depending on the organizational requirements. There are two methodologies of distribution of a database.

- In a **replicated database,** duplicates of data are provided to the sites so that the sites can have frequent access to the same data concurrently. But this

method of replication is costly in terms of system resources and also maintaining the consistency of the data elements.

- In a **partitioned database,** the database is divided into parts or segments that are required and appropriate for the respective sites so that only those segments are distributed without costly replication of the entire data. A database can be partitioned along functional lines or geographical lines or hierarchically.

(ii) **Entity-Relationship Model or Database**: An E-R model is a specialized graphic that illustrates the interrelationships between entities in a database. It is an abstract and conceptual representation of data. Entity-relationship modeling is a database modeling method used to produce a type of conceptual schema of a system.

Entity: The entity is defined as a distinguishable object that exists in isolation and is described by a set of attributes. An entity may be a physical object such as a house or a car, an event such as a house sale or a car service, or a concept such as a customer transaction or order. A computer, an employee, a song, a department, a city are examples of E/R Model.

Relationship: A relationship is the association among several entities. For examples, a **works** relationship between an employee and a department, a **contain** relationship between an order and Item, a **perform** relationship between an artist and a song, and many more.

The set of all entities or relationships of the same type is called the entity set or relationship set. The degree of relationship indicates the link between the two entities for a specified occurrence of each. The degree of relationship is also called "Cardinality". Cardinality specifies how many instances of an entity relate to one instance of another entity.

(iii) **Object Oriented Database**: It is based on the concept that the world can be modeled in terms of objects and their interactions. Objects are entities possessing certain attributes to characterize them and interacting with each other. An Object-Oriented database provides a mechanism to store complex data such as images, audio and video, etc. An Object-Oriented Database Management System (OODBMS) helps programmers make objects created in a programming language behave as a database object. Object-oriented programming is based on a series of working objects. Each object is an independently functioning application or program, assigned with a specific task or role to perform. An object-oriented database management system is a relational database designed to manage all of these independent programs, using the data produced to quickly respond to requests for information by a larger application.

13. The growth of distributed processing, end user computing, decision support and executive information systems has caused the development of several types of databases. Some of the main databases that may be found in computer using organizations are discussed as below:

- **Operational Databases:** These databases store detailed data needed to support the operations of the entire organization. They are also called Subject Area Databases (SADB), transaction databases, and production databases. Examples are a customer database, personnel database, inventory database, and other databases containing data generated by business operations.

- **Management Databases:** These databases store data and information extracted from selected operational and external database. They consist of summarized data and information most needed by the organization's managers and other end users. Management databases are also called Information databases which are the databases accessed by executive end-users as part of DSS and Executive Information Systems to support managerial decision making.

- **Information Warehouse Databases:** An information warehouse stores data from current and previous years. This is usually data that has been extracted from the various operational and management databases of an organization. It is a central source of data that has been standardized and integrated so that it can be used by managers and other end-user professionals throughout an organization. For example, an important use of information warehouse databases is pattern processing, where operational data is processed to identify key factors and trends in historical patterns of the business activity.

- **End User Databases:** These databases consist of a variety of data files developed by end users at their workstations. For example, users may have their own electronic copies of documents they generated with word processing packages or received by electronic mail. Or they may have their own data files generated from spreadsheet and DBMS packages.

- **External Databases:** Access to external, privately owned online databases or data banks is available, for a fee, to end users and organizations from commercial information services. Data is available in the form of statistics on economic and demographic activity from statistical data banks. One can receive abstracts from hundreds of newspapers, magazines, and other periodicals from bibliographic data banks.

- **Text Databases:** Text databases are natural outgrowth of the use of computers to create and store documents electronically. Text databases are also available on CD-ROM optical disks for use with microcomputer systems. Big corporations and government agencies have developed large text databases containing documents of all kinds. They use text database management systems software to help create,

store, search, retrieve, modify, and assemble documents and other information stored as text data in such databases.

- **Image Databases:** The main appeal of image database for business users are in document image processing. Thousands of pages of business documents, such as customer correspondence, purchase orders and invoices, as well as sales catalogues and service manuals, can be optically scanned and stored as document images on a single optical disk. Image database management software allows employees to hold millions of pages of document images. Workers can view and modify documents at their own workstations and electronically transfer them to the workstations of other end users in the organization.

14. Computer Networks can be classified in different parameters like: Function Based, Area Coverage Based, Forwarding-based, Ownership-based and Media-based etc. Their classification is defined as follows:

1	Class I	Function Based Classification
	Data Networks	A communications network that transmits data.
	Voice Networks	A communications network that transmits voice.
	Multimedia Networks	A communications network that transmits data, voice, image, video etc.
2	Class II	Area Coverage Based Classification
	LAN	A Local Area Network (LAN) is a group of computers and network devices connected together, usually within the same building, campus or spanned over limited distance. High speed and relatively inexpensive.
	MAN	A Metropolitan Area Network (MAN) is a larger network that usually spans in the same city or town. Cable network is an example of a MAN.
	WAN	A Wide Area Network (WAN) is not restricted to a geographical location, although it might be confined within the bounds of a state or country. The technology is high speed and relatively expensive. The Internet is an example of a worldwide public WAN.
3	Class III	Forwarding-based Classification
	Switched Networks	Switched network is a type of network that provide switched communication system and in which users are connected with each other through the circuits, packets, sometimes message switching and the control devices. Active network elements like switch, router, gateways etc. participate in communication. Example is public switch

		telephone network.
	Shared Networks	A shared network is also known as hubbed network which is connected with a hub. When packets arrive in to the network all segments can see packets. LAN using hub is an example of shared networks.
	Hybrid Networks	Network comprising the features of switched and shared networks.
4	Class IV	Ownership-based Classification
	Public Networks	Networks established for all user across the world is known as public networks. Internet is an example of public networks.
	Private Networks	Private network s used by particular organization, particular campus or particular enterprise only. This is a network that is not available to the outside world. Intranet is an example of it.
	Virtual Private Networks	A Virtual Private Network (VPN) is a network that uses a public network, such as the Internet, to provide secure access to organization's private network. A key feature of a VPN is its ability to work over both private networks as well as public networks like the Internet. Using a method called *tunneling*, a VPN use the same hardware infrastructure as existing Internet or intranet links.
	Leased Networks	Dedicated or leased lines exist to support network communication.
5	Class V	Media-based Classification
	Wired Networks	Networks communication supported by physical (wired) medium.
	Wireless Networks	Networks communication supported by wireless medium.

15. Communication media comprises different types of cables and wireless techniques that are used to connect network devices in a Local Area Network (LAN), Wireless Local Area Network (WLAN) or Wide Area Network (WAN). Choice of correct type of media is very important for the implementation of any network. Communication media is divided into two groups:

(i) **Guided Media:** Twisted Pair, Coaxial cable and Optical fibre.

(ii) **Unguided Media:** Wireless

Guided Media: Twisted-Pair cables are most commonly used transmission media to transmit electrical signal. These cables contain pairs of insulated copper wires twisted together that reduce the impact of interferences. There are two types of twisted-pair

cables called Unshielded Twisted-Pair (UTP) cable and Shielded Twisted-Pair (STP) cable. Main difference between both cables is that 8-wires in Shielded Twisted-Pair (STP) cables are surrounded by an additional braided shielding, which makes STP cables more secure, less prone to interferences but expensive. Cost of these cable are comparably very low. Twisted-Pair cables can carry data at a speed of 10 Mbps, 100Mbps and 1000Mbps and can transmit data up to 100 meters.

Fig 3.4.3.1: Twisted Pair

Unguided Media: Wireless networks do not require any physical media or cables for data transmission. Radio waves and Infrared signals are used for communication. Microwave is also used in different scenario. Radio waves are most commonly used transmission media in the wireless Local Area Networks. Radio waves of different frequencies are used in a wide range of wireless communications such as AM radio (300 to 3000 KHz), FM radio (30 to 300 MHz),

16. The three Transmission Techniques are discussed as below:

    (i)   **Circuit Switching:** A Circuit Switching network is one that establishes a fixed bandwidth circuit (or channel) between nodes and terminals before the users may communicate, as if the nodes were physically connected with an electrical circuit. In circuit-switching, this path is decided upon before the data transmission starts. The system decides on which route to follow, based on a resource-optimizing algorithm, and transmission goes according to the path. For the whole length of the communication session between the two communicating bodies, the route is dedicated and exclusive, and released only when the session terminates.

    (ii) **Message Switching:** Some organizations with a heavy volume of data to transmit use a special computer for the purpose of data message switching. The computer receives all transmitted data; stores it; and, when an outgoing communication line is available, forwards it to the receiving point.

    (iii) **Packet Switching**: It is a sophisticated means of maximizing transmission capacity of networks. Packet switching refers to protocols in which messages are broken up into small transmission units called packets, before they are sent. Each packet is transmitted individually across the net. The packets may even follow different routes to the destination, thus, each packet has header information which enables to route the packet to its destination. At the destination, the packets are reassembled into the original message. Passwords and all types of data can be included within the packet and the transmission cost is by packet and not by message, routes or distance.

17. (a) A Data Centre is a centralized repository for the storage, management and dissemination of data and information. Data centres can be defined as highly

secure, fault-resistant facilities, hosting customer equipment that connects to telecommunications networks. Often referred to as an Internet hotel/ server farm, data farm, data warehouse, corporate data centre, Internet Service Provider (ISP) or Wireless Application Service Provider (WASP), the purpose of a data centre is to provide space and bandwidth connectivity for servers in a reliable, secure and scalable environment. A data centre also provides certain facilities, like housing websites, providing data serving and other services for companies.

(b) Various features of data centers are as follows:

(i) **Size:** Data centres are characterized foremost by the size of their operations. A financially viable data centre could contain from a hundred to several thousand servers. Apart from this, the physical structure containing a data centre should be able to withstand the sheer weight of the servers to be installed inside. Thus, there is a need for high quality construction.

(ii) **Data Security:** Another issue critical for data centre is the need to ensure maximum data security and 100 per cent availability. Data centres have to be protected against intruders by controlling access to the facility and by video surveillance. They should be able to withstand natural disasters and calamities, like fire and power failures.

(iii) **Availability of Data:** The goal of a data centre is to maximize the availability of data, and to minimize potential downtime. To do this, redundancy has to be built in to all the mission critical infrastructure of the data centre, such as connectivity, electrical supply, security and surveillance, air conditioning and fire suppression.

(iv) **Electrical and power systems:** A data centre should provide the highest power availability with uninterrupted power systems (UPS).

(v) **Security**: Physical security and systems security are critical to operations. Thus, it should provide both types of security measures to ensure the security of equipment and data placed at the data centre.

(a) **Physical security***:* It can be achieved through security guards, proximity card and PIN for door access, biometrics access and PIN for door access and 24 x 365 CCTV surveillance and recording.

(b) **Data security:** Data security within a data centre should be addressed at multiple levels.

- **Perimeter security:** This is to manage both internal and external threats. This consists of firewalls, intrusion detection and content

> inspections; host security; anti-virus and access control and administrative tools.

- **Access management:** This is for both applications and operating systems that host these critical applications.

(vi) **System monitoring and support:** The data centre should provide system monitoring and support, so that user can be assured that the servers are being monitored round the clock. 24x7x365 hours network monitoring, proactive customer notification, notification to customers for pre-determined events, monitoring of power supply, precision air conditioning system, fire and smoke detection systems, water detection systems, generators and uninterruptible power supply (UPS) systems are some of the major features provided by Data Centre.

(vii) **Storage:** Data centres offer more than just network storage solutions. While SAN (Storage Area Network) are used primarily for the storage needs of large enterprises and service providers, data centres host websites and act as convergence points for service providers' networks as well. Due to differing customer requirements, data centres usually have hybrid storage and backup infrastructure. Primarily, data centre storage can be differentiated into: **Primary storage** (SAN, NAS, DAS), **Secondary storage** (tape libraries) and **Tertiary storage** (offline tape storage, such as DAT drives, and magneto-optical drives).

Most data centres today operate in hands-off mode, where no individual enters the data centre unless there is a genuine need to do so. All the storage is operated and managed from remote consoles, which are located outside the data centres. This reduces dust and also accidental damage by people, like tripping over cables or accidentally touching the reset buttons on a server.

18. Some of the various types of Electronic payments are discussed as below:

(i) **Credit Cards:** In a credit card transaction, the consumer presents preliminary proof of his ability to pay by presenting his credit card number to the merchant. The merchant can verify this with the bank, and create a purchase slip for the consumer to endorse. The merchant then uses this purchase slip to a collect funds form the bank, and, on the next billing cycle, the consumer receives a statement form the bank with a record of the transaction.

(ii) **Electronic Cheques:** Credit card payments will undoubtedly be popular for commerce on the Internet. However, the two systems – FSTC and CyberCash have been developed to let consumers use electronic cheques to pay Web merchants directly.

- **By the Financial Services Technology Corporation (FSTC):** The FSTC is a consortium of banks and clearing houses that has designed an electronic cheque. Modeled on the traditional paper cheque, this new cheque is initiated electronically, and uses a digital signature for signing and endorsing.

- **By CyberCash:** CyberCash's system for electronic checking is an extension of their wallet for credit cards, and it can be used in the same way to make payments with participating vendors. CyberCash will not serve as an intermediate party for processing the cheque, that function will be handled directly by banks.

(iii) **Smart Cards**: Smart cards have an embedded microchip instead of magnetic strip. The chip contains all the information a magnetic strip contains but offers the possibility of manipulating the data and executing applications on the card. Three types of smart cards have established themselves.

- **Contact Cards –** Smart cards that need to insert into a reader in order to work, such as a smart card reader or automatic teller machines.

- **Contactless Cards –** Contactless smart cards don't need to be inserted into a reader. This type of cards is used for opening doors by just waving them near a reader on door.

- **Combi Cards –** Combi cards contain both technologies and allow a wider range of applications.

(iv) **Electronic Purses:** Electronic purse is another way to make payments over the net and is very similar to a pre paid card. For eg: Bank issues a stored value cards to its customers, the customer can then transfer value from their accounts to the cards at an ATM, a personal computer, or a specially equipped telephone. The electronic purse card can be used as an ATM card as well as a credit card. While making purchases, customers pass their cards through a vendor's point of sale terminal. Validation is done through a Personal Identification Number (PIN Number). Once the transaction is complete, funds are deducted directly from the cards and transferred to the vendor's terminal. Merchants can transfer the value of accumulated transactions to their bank accounts by telephone as frequently as they choose. When the value on a card is spent, consumers can load additional funds from their accounts to the card.

19. The required flowchart is given as below:

QS: Quantity Sold   **UP:** Unit Price
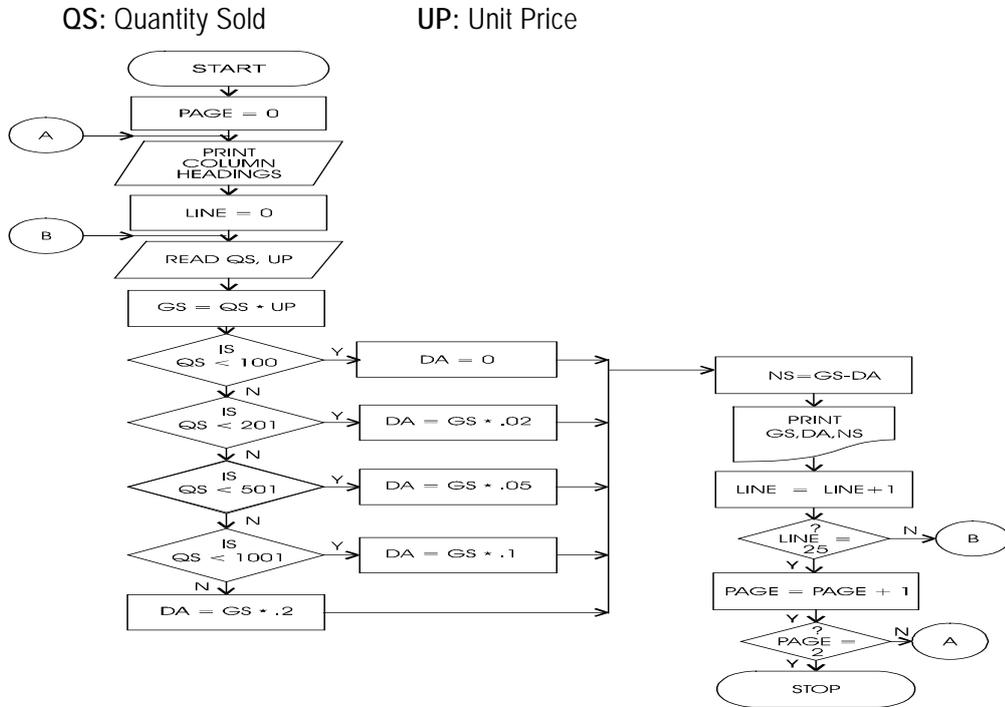
20. *Step 1* - Conditions involved in the problem is as follows:

1. A > B
2. A > C
3. B > A
4. B > C
5. C > A
6. C > B

Actions involved in the problem are as follows:

1. A is largest
2. B is largest
3. C is largest

Step 2 - Conditions 1 & 3 can be combined

　　　　Conditions 2 & 5 can be combined

　　　　Conditions 4 & 6 can be combined

Therefore, there are only three conditions:

1. A > B

2.   A > C

3.   B > C

Step 3 - No. of rules = $2^{\text{no. of conditions}}$

$$= 2^3 = 8$$

	Select Largest	R1	R2	R3	R4	R5	R6	R7	R8
C1	A > B	Y	Y	Y	Y	N	N	N	N
C2	A > C	Y	Y	N	N	Y	Y	N	N
C3	B > C	Y	N	Y	N	Y	N	Y	N
A1	A is largest	X	X						
A2	B is largest					X		X	
A3	C is largest				X				X

*R3 and R6 contain impossible combination of condition entries.

Step 4 - R1 & R2 can be combined

R3 & R4 can be combined

R5 & R7 can be combined

R6 & R8 can be combined

	Select largest	R1	R2	R3	R4
C1	A > B	Y	Y	N	N
C2	A > C	Y	N	—	—
C3	B > C	—	—	Y	N
A1	A is largest	X			
A2	B is largest			X	
A3	C is largest		X		X

Step 5 - All the rules in the reduced table have one dash. Therefore, the sum of the rules represented by rules in the reduced table is $2^1 + 2^1 + 2^1 + 2^1$ which is equal to 2^3 or 8. No. of conditions is 3 and hence the No. of rules to be accounted for is 2^3 or, 8. Therefore the reduced table is complete.

If problem has many conditions, the decision table may become quite large and difficult to follow. Since the objective of the table is to show the logic of the procedure as clearly and as simply as possible, a large, complex table should be avoided. In most cases, a large problem with many conditions can be subdivided into two or more tables. One or more of the actions of the first table will specify that the user should proceed to another table to complete the logic.

SECTION – B: STRATEGIC MANAGEMENT
QUESTIONS

Correct/Incorrect with reasoning

1. State with reasons which of the following statements are correct/incorrect:

    (a) Environment is static in nature.

    (b) Strategies provide an integrated framework for the top management.

    (c) Socio-cultural environment consists of factors related to government and politics.

    (d) Strategic management is not needed in not-for-profit organisations.

    (e) For a small entrepreneur vision and mission are irrelevant.

    (f) A strategic group is a cluster of firms with dissimilar competitive approaches.

    (g) Strategic planning is an attempt to improve operational efficiency.

    (h) Augmented marketing is provision of additional customer services and benefits.

    (i) Changes in strategy may lead to changes in organizational structure.

    (j) Reengineering mean partial modification or marginal improvement in the existing work processes.

Explain the concepts

2. Explain the meaning of the following concepts:

    (a) Kieretsus

    (b) Environmental Scanning

    (c) Market Development

    (d) Benchmarking

Differences between the two concepts

3. Distinguish between the following:

    (a) Top-down and bottom-up strategic planning.

    (b) Concentric diversification and conglomerate diversification.

    (c) Micro environment and Macro environment.

    (d) 'Shared vision and 'vision shared'.

Short notes

4. Write short notes on the following:

    (a) Product life cycle

(b) Premise control

(c) Dealing with strategic uncertainty

(d) Concept of strategic Intent

Brief answers

5. Briefly answer the following questions:

   (a) What is an opportunity?

   (b) Does HRM function play a role in organizational strategy?

   (c) What do you mean by core competencies?

   (d) Explain the term dogs in the context of BCG matrix.

   (e) Define strategic business unit (SBU).

Chapter 1-Business Environment

6. Discuss the Porter's model for systematically diagnosing the significant competitive pressures in a market.

7. Explain how technological factors present an opportunity as well as threat to a particular business organization.

Chapter 2-Business Policy and Strategic Management

8. What is Strategic Management? What benefits accrue by following a strategic approach to managing?

9. Explain in detail the term corporate strategy with its characteristics.

Chapter 3-Strategic Analysis

10. Explain how TOWS matrix can generate strategic options within external and internal environment.

11. Explain the model which has been inspired from traffic control lights.

Chapter 4-Strategic Planning

12. What are the various bases on which an existing firm can diversify strategically?

13. How a company can deal with strategic uncertainty.

Chapter 5-Formulation of Functional Strategy

14. What is meant by Functional strategies? In term of level where will you put them? Are functional strategies really important for business?

15. What is logistics strategy? What are the areas to examine while developing a logistics strategy?

Chapter 6-Strategic Implementation and Control

16. How the management of internal linkages in the value chain analysis creates competitive advantage?

17. An important part of strategic management process is implementation of strategy. Discuss the relationship of soundness of strategy formulation with the quality of implementation.

Chapter 7-Reaching Strategic Edge

18. Explain the strategy-shaping characteristics of the E-commerce environment.

19. Define each of the following and analyze its role in strategic implementation:

    (1)   B.P.R.

    (2)   Six sigma

    (3)   Benchmarking

SUGGESTED ANSWERS / HINTS

1   (a)   **Incorrect:** The environment of business consists of a number of factors, events, conditions and influences arising from different sources. All these do not exist in isolation but interact with each other to create entirely new sets of influences. Different factors such as economic conditions, technology, laws, taste & preference keeps on changing. All in all, environment is a complex that is highly dynamic.

    (b)   **Correct:** Strategies provide a framework for management to negotiate its way through a complex and turbulent external environment. They provide a systematic basis for the enterprise to stand its ground in the face of challenge and change as also to quickly adjust to them.

    (c)   **Incorrect**:   Socio-cultural environment consist of factors related to human relationships and the impact of social attitudes and cultural values which have bearing on the business of the organization. The beliefs, values and norms and general fabric of society determine how individuals and organizations should be interrelated.

    (d)   **Incorrect** – Strategic management applies equally to profit as well as not-for-profit organizations. Though not-for-profit organizations are not working for the profit, they have to have purpose, vision and mission. They also work within the environmental forces and need to manage strategically to stay afloat to accomplish their objectives. For the purpose of continuity and meeting their goals, they also need to have and manage funds and other resources just like any other for-profit-organization.

(e) **Incorrect:** Entrepreneur, big or small has to function within several influences on external forces. Competition in different form and different degree is present in all kind and sizes of business. Even entrepreneur with small businesses can have complicated environment. To grow and prosper they need to have clear vision and mission.

(f) **Incorrect:** Strategic groups are clusters of competitors that share similar strategies and therefore compete more directly with one another than with other firms in the same industry. Strong economic compulsions often constrain these firms from switching one competitive posture to another. Any industry contains only one strategic group when all firms essentially have identical strategies and have comparable market positions. At the other extreme, there are as many strategic groups as there are competitors when each rival pursues a distinctively different competitive approach.

(g) **Incorrect:** Strategic planning, an important component of strategic management, involves developing a strategy to meet competition and ensure long-term survival and growth. They relate to the top level in the organisation and relate the organisation with its environment. Operational efficiency is not a direct outcome of strategic planning.

(h) **Correct**: Augmented marketing refers to deliberate and accelerated efforts to get better marketing returns through additional means. It includes provision of additional customer services and benefits built around the care and actual products that relate to introduction of hi-tech services like movies on demand, online computer repair services, secretarial services, etc. Such innovative offerings provide a set of benefits that promise to elevate customer service to unprecedented levels.

(i) **Correct:** Changes in strategy may require changes in structure as the structure dictates how resources will be allocated. Structure should be designed to facilitate the strategic pursuit of a firm and, therefore, should follow strategy. Without a strategy or reasons for being, companies find it difficult to design an effective structure.

(j) **Incorrect:** Reengineering does not mean any partial modification or marginal improvement in the existing work processes. Reengineering is a revolutionary approach towards radical and total redesigning of the business processes.

2   (a) *Kieretsus* is a loosely-coupled group of companies, usually in related industries. It is a Japanese term which is used for large cooperative networks of businesses. *Kieretsus* members are peers and may own significant amounts of each other's stock and have many board members in common.

(b) Environmental scanning is the process of gathering information regarding company's environment, analysing it and forecasting the impact of all predictable

environmental changes. Successful marketing depends largely on how a company can synchronise its marketing programmes with its environmental changes.

(c) Market development refers to a growth strategy where the business seeks to sell its existing products into new markets. It is a strategy for company growth by identifying and developing new markets for current company products. This strategy may be achieved through new geographical markets, new product dimensions or packaging, new distribution channels or different pricing policies to attract different customers or create new market segments.

(d) Benchmarking is an approach of setting goals and measuring productivity based on best industry practices. The concept developed out of need to have information or standards against which performances can be measured. It is a process of continuous improvement in search for competitive advantage. It measures a company's products, services and practices against those of its competitors or other acknowledged leaders in their field.

3   (a) **Top-Down and Bottom-Up Strategic Planning**

Strategic planning determines where an organization is going over the next year or more and the ways for going there. The process is organization-wide, or focused on a major function such as a division. There are two approaches for strategic planning - top down or bottom up.

Top down strategic planning describes a centralized approach to strategy formulation in which the corporate centre or head office determines mission, strategic intent, objectives and strategies for the organization as a whole and for all parts. Unit managers are seen as implementers of pre-specified corporate strategies.

Bottom up strategic planning is the characteristic of autonomous or semi-autonomous divisions or subsidiary companies in which the corporate centre does not conceptualize its strategic role as being directly responsible for determining the mission, objectives, or strategies of its operational activities. It may prefer to act as a catalyst and facilitator, keeping things reasonably simple and confining itself to perspective and broader strategic intent.

(b) Concentric diversification occurs when a firm adds related products or markets. On the other hand conglomerate diversification occurs when a firm diversifies into areas that are unrelated to its current line of business.

In concentric diversification, the new business is linked to the existing businesses through process, technology or marketing. In conglomerate diversification, no such linkages exist; the new business/product is disjointed from the existing businesses/products.

The most common reasons for pursuing a concentric diversification are that opportunities in a firm's existing line of business are available. However, common

reasons for pursuing a conglomerate growth strategy is that opportunities in a firm's current line of business are limited or opportunities outside are highly lucrative.

(c) The business environment consists of both the macro environment and the micro environment. Following are the differences between the two:

- The micro environment refers to the forces that are very close to the company and affect its ability to do routine functions. Macro environment refers to all forces that are part of the larger periphery and distantly affect organization and micro environment.

- Micro environment includes the company itself, its suppliers, marketing intermediaries, customer markets and competitors. Whereas macro environment includes demography, economy, natural forces, technology, politics, legal and socio-cultural.

- The elements of micro environment are specific to the said business and affects it's working on short term basis. The elements of macro environment are general environment and affect the working of all the firms in an industry.

(d) Individuals in organisations relate themselves with the vision of their organisations in different manner. When the individuals are able to bring organisational vision close to their hearts and minds they have "shared vision". Shared vision is a force that creates a sense of commonality that permeates the organization and gives coherence to diverse activities. However, 'vision shared' shows imposition of vision from the top management. It may demand compliance rather than commitment. For success of organisations having shared vision is better than vision shared.

4. (a) Product life cycle (PLC) is an S-shaped curve which exhibits the relationship of sales with respect of time for a product that passes through the four successive stages of introduction (slow sales growth), growth (rapid market acceptance) maturity (slow down in growth rate) and decline (sharp downward drift).

The first stage of PLC is the introduction stage in which competition is almost negligible, prices are relatively high and markets are limited. The growth in sales is at a lower rate because of lack of knowledge on the part of customers. The second phase of PLC is growth stage. In the growth stage, the demand expands rapidly, prices fall, competition increases and market expands. The customer has knowledge about the product and shows interest in purchasing it. The third phase of PLC is maturity stage. In this stage, the competition gets tough and market gets stablised. Profit come down because of stiff competition. At this stage organisations may work for maintaining stability. In the declining stage of PLC, the sales and profits fall down sharply due to some new product replaces the existing product. So a combination of strategies can be implemented to stay in the market either by diversification or retrenchment.

(b) **Premise control:** A strategy is formed on the basis of certain assumptions or premises about the complex and turbulent organizational environment. Over a period of time these premises may not remain valid. Premise control is a tool for systematic and continuous monitoring of the environment to verify the validity and accuracy of the premises on which the strategy has been built. It primarily involves monitoring two types of factors:

(i) Environmental factors such as economic (inflation, liquidity, interest rates), technology, social and regulatory.

(ii) Industry factors such as competitors, suppliers, substitutes.

It is neither feasible nor desirable to control all types of premises in the same manner. Different premises may require different amount of control. Thus, managers are required to select those premises that are likely to change and would severely impact the functioning of the organization and its strategy.

(c) *Dealing with strategic uncertainty:* Strategic uncertainty, uncertainty that has strategic implications, is a key construct in strategy formulation. A typical external analysis will emerge with dozens of strategic uncertainties. To be manageable, they need to be grouped into logical clusters or themes. It is then useful to assess the importance of each cluster in order to set priorities with respect to Information gathering and analysis.

Sometimes the strategic uncertainty is represented by a future trend or event that has inherent unpredictability. Information gathering and additional analysis will not be able to reduce the uncertainty. In that case, scenario analysis can be employed. Scenario analysis basically accepts the uncertainty as given and uses it to drive a description of two or more future scenarios. Strategies are then developed for each. One outcome could be a decision to create organizational and strategic flexibility so that as the business context changes the strategy will adapt.

(d) *Concept of Strategic Intent:* A company exhibits strategic intent when it relentlessly pursues an ambitious strategic objective and concentrates its full resources and competitive actions on achieving that objective. A company's objectives sometimes play an other role – that of signaling unmistakable strategic intent to make quantum gains in competing against key rivals and establish itself as a clear-cut winner in the marketplace, often against long odds. A company's strategic intent can entail becoming the dominant company in the industry, unseating the existing industry leader, delivering the best customer service of any company in the industry (or the world), or turning a new technology into products capable of changing the way people work and live. Ambitious companies almost invariably begin with strategic intents that are out of proportion to their immediate capabilities and market positions. They set aggressive objectives and pursue them relentlessly, sometimes even obsessively.

5   (a)   An opportunity is a favourable condition in the organization's environment which enables it to consolidate and strengthen its position. An example of an opportunity is growing demand for the products or services that a company provides.

(b)   The role of human resources in enabling the organization to effectively deal with the external environmental challenges, the human resource management function has been accepted as a strategic partner in the formulation of organization's strategies and in the implementation of such strategies through human resource planning, employment, training, appraisal and rewarding of personnel. An organization's recruitment, selection, training, performance appraisal, and compensation practices can have a strong influence on employee competence is very important.

(c)   A core competence is a unique strength of an organization which may not be shared by others. Core competencies are those capabilities that are critical to a business achieving competitive advantage. In order to qualify as a core competence, the competency should differentiate the business from any other similar businesses.

(d)   **Dogs** are low-growth, low-share businesses and products. They may generate enough cash to maintain themselves, but do not have much future. Sometimes they may need cash to survive. Dogs should be minimised by means of divestment or liquidation.

(e)   A strategic business unit (SBU) is an operating division of firm which serves a distinct product-market segment or a well-defined set of customers or a geographic area. The SBU is given the authority to make its own strategic decisions within corporate guidelines as long as it meets corporate objectives.

6.   Five forces model of Michael Porter is a powerful and widely used tool for systematically diagnosing the significant competitive pressures in the market and assessing their strength and importance. The model holds that the state of competition in an industry is a composite of competitive pressures operating in five areas of the over all market. These five forces are:

1.   **Threat of new entrants:** New entrants are a powerful source of competition. The new capacity and product range they bring in throw up new competitive pressures. The bigger the new entrant, the more severe the competitive effect. New entrants also place a limit on prices and affect the profitability of existing players.

2.   **Bargaining power of customers:** This is another force that influences the competitive condition of the industry. This force will become heavier depending on the possibilities of the buyers forming groups or cartels. The bargaining power of the buyers influences not only the prices that the producer can charge but also influences in many cases, costs and investments of the producer because powerful buyers usually bargain for better services which involve costs and investment on the part of the producer.

3.   **Bargaining power of suppliers:** Quite often suppliers, too, exercise considerable bargaining power. The more specialised the offering from the supplier, greater is his clout. And, if the suppliers are also limited in number they stand a still better chance

to exhibit their bargaining power. The bargaining power of suppliers determines the cost of raw materials and other inputs of the industry and, therefore, industry attractiveness and profitability.

4. **Rivalry among current players:** The rivalry among existing players is quite obvious. This is what is normally understood as competition. For any player, the competitors influence strategic decisions at different strategic levels. The impact is evident more at functional level in the prices being changed, advertising, and pressures on costs, product and so on.

5. **Threats from substitutes:** Substitute products are a latent source of competition in an industry. In many cases they become a major constituent of competition. Substitute products offering a price advantage and/or performance improvement to the consumer can drastically alter the competitive character of an industry. And they can bring it about all of a sudden. For example, coir suffered at the hands of synthetic fibre. Wherever substantial investment in R&D is taking place, threats from substitute products can be expected.
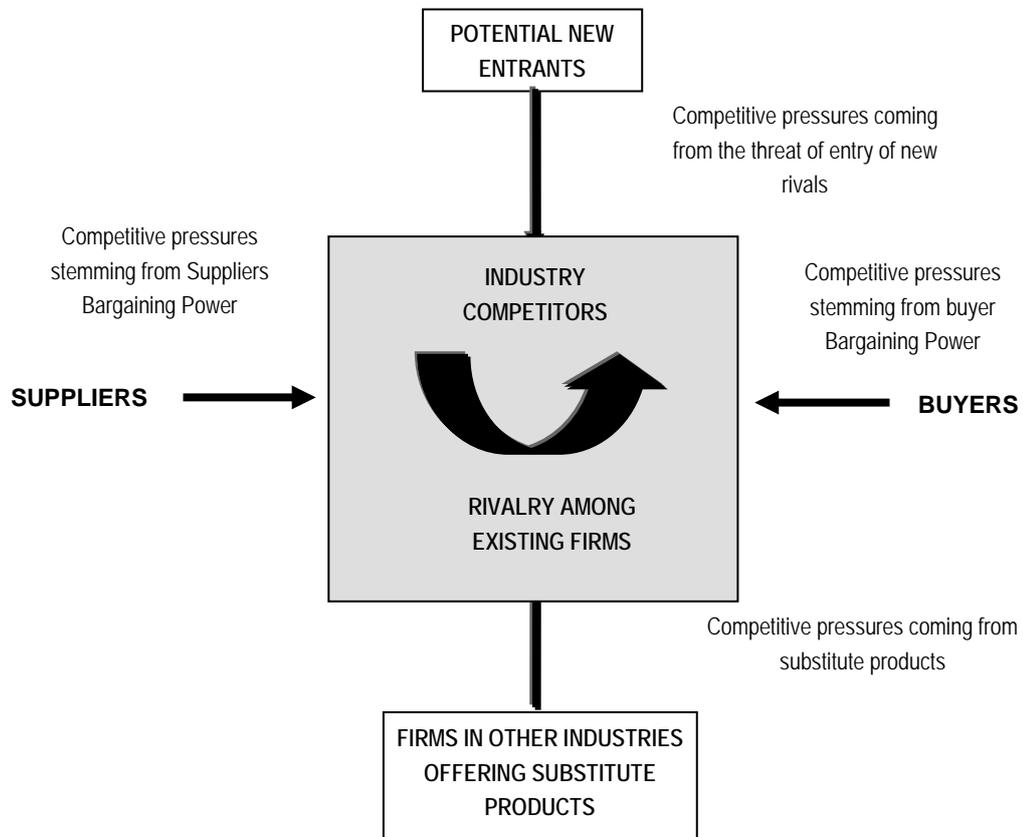
7. Technology is the most dynamic of all the environmental factors. An individual enterprise is concerned with the dynamics of its product and process technology, research and development activities in the industry and elsewhere, innovations in products and processes, technological obsolescence and so on. Changes in technology vitally affect the enterprise's costs, profitability, plant location decisions, product lines, growth and development.

    The technology and business are highly interrelated and interdependent also. Technology is patronized by business. Technology also drives business and makes a total change on how it is carried out.

    Technology can act as both opportunity and threat to a business. It can act as opportunity as business can take advantage of adopting technological innovations to their strategic advantage. However, at the same time technology can act as threat if organisations are not able to adopt it to their advantage. For example, an innovative and modern production system can act as weakness if the business is not able to change their production system. New entrants or existing competitors can always use availability of technological improvements in products or production methods that can be a threat to a business.

    Technological opportunities and threats are not limited to the product or production. Technology permeates whole gambit of business. It can transform how a business acts and functions.

8. In a highly competitive marketplace, companies can operate successfully by creating and delivering superior value to target customers and also learning how to adapt to a continuously changing business environment. Strategic management starts with developing a company mission (to give it direction), objectives and goals (to give it means and methods for accomplishing its mission), business portfolio (to allow management to utilise all facets of the organisation), and functional plans (plans to carry out daily operations from the different functional disciplines).

    The overall objective of strategic management is two fold:

    (1) To create competitive advantage, so that the company can outperform the competitors in order to have dominance over the market.

    (2) To guide the company successfully through all changes in the environment.

    The following are the benefits of strategic approach to managing:

    •   Strategic management helps organisations to be more proactive instead of reactive in shaping its future. Organisations are able to analyse and take actions instead of being mere spectators. Thereby they are able to control there own destiny in a better manner. It helps them in working within vagaries of environment and shaping it, instead of getting carried away by its turbulence or uncertainties.

- Strategic management provides framework for all the major business decisions of an enterprise such as decisions on businesses, products, markets, manufacturing facilities, investments and organisational structure. It provides better guidance to entire organisation on the crucial point - what it is trying to do.

- Strategic management is concerned with ensuring a good future for the firm. It seeks to prepare the corporation to face the future and act as pathfinder to various business opportunities. Organisations are able to identify the available opportunities and identify ways and means as how to reach them.

- Strategic management serves as a corporate defence mechanism against mistakes and pitfalls. It help organisations to avoid costly mistakes in product market choices or investments. Over a period of time strategic management helps organisation to evolve certain core competencies and competitive advantages that assist in its fight for survival and growth.

9. The term strategy is associated with unified design and action for achieving major goals, gaining command over the situation with a long-range perspective and securing a critically advantageous position. Strategies are formulated at the corporate, divisional and functional level. Corporate strategies are formulated by the top managers. They include the determination of the business lines, expansion and growth, vertical and horizontal integration, diversification, takeovers and mergers, new investment and divestment areas, R & D projects, and so on. These corporate wide strategies need to be operationalized by divisional and functional strategies regarding product lines, production volumes, quality ranges, prices, product promotion, market penetration, purchasing sources, personnel development and like.

In general, a corporate strategy has the following characteristics:

- It is generally long-range in nature, though it is valid for short-range situations also and has short-range implications.

- It is action oriented and is more specific than objectives.

- It is multi-pronged and integrated.

- It is flexible and dynamic.

- It is formulated at the top management level, though middle and lower level managers are associated in their formulation and in designing sub-strategies.

- It is generally meant to cope with a competitive and complex setting.

- It flows out of the goals and objectives of the enterprise and is meant to translate them into realities.

- It is concerned with perceiving opportunities and threats and seizing initiatives to cope with them. It is also concerned with deployment of limited organizational resources in the best possible manner.

- It gives importance to combination, sequence, timing, direction and depth of various moves and action initiatives taken by managers to handle environmental uncertainties and complexities.

- It provides unified criteria for managers in function of decision making.

10. Through SWOT analysis organisations identify their strengths, weaknesses, opportunities and threats. While conducting the SWOT Analysis managers are often not able to come to terms with the strategic choices that the outcomes demand. Heinz Weihrich developed a matrix called TOWS matrix by matching strengths and weaknesses of an organization with the external opportunities and threats. The incremental benefit of the TOWS matrix lies in systematically identifying relationships between these factors and selecting strategies on their basis. Thus TOWS matrix has a wider scope when compared to SWOT analysis. TOWS analysis is an action tool whereas SWOT analysis is a planning tool. The matrix is outlined below:

Internal elements *External Elements*	*Organizational Strengths*	*Organizational Weaknesses*
	Strategic Options	
Environmental opportunities (and risks)	*SO : Maxi – Maxi*	*WO : Mini – Maxi*
Environmental threats	*ST : Maxi – Mini*	*WT : Mini – Mini*

Figure: The TOWS Matrix (Source: Weihrich, H)

The TOWS Matrix is a relatively simple tool for generating strategic options. Through TOWS matrix four distinct alternative kinds of strategic choices can be identified.

SO(Maxi-Maxi): SO is a position that any firm would like to achieve. The strengths can be used to capitalize or build upon existing or emerging opportunities. Such firms can take lead from their strengths and utilize the resources to take the competitive advantage.

ST(Maxi-Mini): ST is a position in which a firm strives to minimize existing or emerging threats through its strengths.

WO(Mini-Maxi): The strategies developed need to overcome organizational weaknesses if existing or emerging opportunities are to be exploited to maximum.

WT(Mini-Mini): WT is a position that any firm will try to avoid. An organization facing external threats and internal weaknesses may have to struggle for its survival. WT strategy is a strategy which is pursued to minimize or overcome weaknesses and as far as possible, cope with existing or emerging threats.

By using TOWS Matrix, one can look intelligently at how one can best take advantage of the opportunities open to him, at the same time that one can minimize the impact of weaknesses and protect oneself against threats. Used after detailed analysis of threats, opportunities, strength and weaknesses, it helps one to consider how to use the external environment to strategic advantage, and so one can identify some of the strategic options that are available.

11. The model has been used by General Electric Company (developed by GE with the assistance of the consulting firm McKinsey & Company) known as "Stop-Light" Strategy Model. This model is also known as Business Planning Matrix, GE Nine-Cell Matrix and GE Model. The strategic planning approach in this model has been inspired from traffic control lights. The lights that are used at crossings to manage traffic are: green for go, amber or yellow for caution, and red for stop. This model uses two factors while taking strategic decisions: Business Strength and Market Attractiveness. The vertical axis indicates market attractiveness and the horizontal axis shows the business strength in the industry. The market attractiveness is measured by a number of factors like:

- Size of the market.
- Market growth rate.
- Industry profitability.
- Competitive intensity.
- Availability of Technology.
- Pricing trends.
- Overall risk of returns in the industry.
- Opportunity for differentiation of products and services.
- Demand variability.
- Segmentation.
- Distribution structure (e.g. retail, direct, wholesale) etc.

Business strength is measured by considering the typical drivers like:

- Market share.
- Market share growth rate.
- Profit margin.
- Distribution efficiency.
- Brand image.
- Ability to compete on price and quality.
- Customer loyalty.

- Production capacity.
- Technological capability.
- Relative cost position.
- Management caliber, etc.
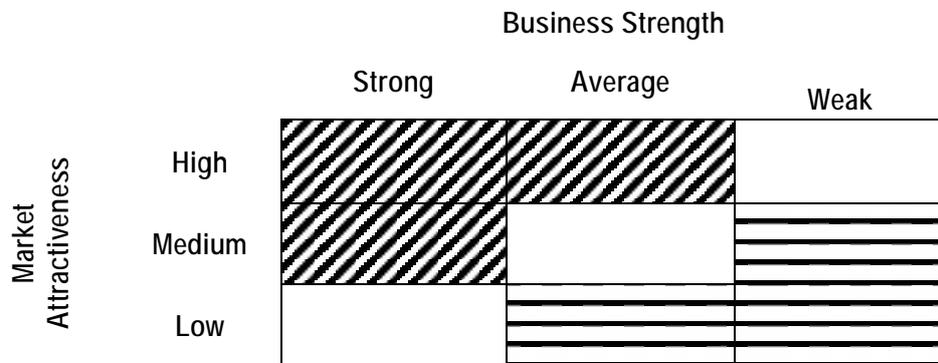
Business Strength

Figure : The GE Portfolio Matrix

If a product falls in the green section, the business is at advantageous position. To reap the benefits, the strategic decision can be to expand, to invest and grow. If a product is in the amber or yellow zone, it needs caution and managerial discretion is called for making the strategic choices. If a product is in the red zone, it will eventually lead to losses that would make things difficult for organisations. In such cases, the appropriate strategy should be retrenchment, divestment or liquidation.

12. **Diversification Strategy:** Diversification endeavours can be related or unrelated to existing businesses of the firm. Based on the nature and extent of their relationship to existing businesses, diversification endeavours have been classified into four broad categories:

(i)   Vertically integrated diversification

(ii) Horizontally integrated diversification

(iii)   Concentric diversification

(iv)   Conglomerate diversification

In vertically integrated diversification, firms opt to engage in businesses that are related to the existing business of the firm. The firm remains vertically within the same process. Sequence It moves forward or backward in the chain and enters specific product/process steps with the intention of making them into new businesses for the firm. The characteristic feature of vertically integrated diversification is that here, the firm does not jump outside the vertically linked product-process chain.

Horizontal Integrated Diversification: Through the acquisition of one or more similar business operating at the same stage of the production-marketing chain that is going into complementary products, by-products or taking over competitors' products.

Concentric Diversification: Concentric diversification too amounts to related diversification. In concentric diversification, the new business is linked to the existing businesses through process, technology or marketing. The new product is a spin-off from the existing facilities and products/processes. This means that in concentric diversification too, there are benefits of synergy with the current operations. However, concentric diversification differs from vertically integrated diversification in the nature of the linkage the new product has with the existing ones. The new product is only connected in a loop-like manner at one or more points in the firm's existing process/technology/product chain.

Conglomerate Diversification: In conglomerate diversification, no such linkages exist; the new businesses/ products are disjointed from the existing businesses/products in every way; it is a totally unrelated diversification. In process/technology/function, there is no connection between the new products and the existing ones. Conglomerate diversification has no common thread at all with the firm's present position.

13. A typical external analysis will emerge with dozens of strategic uncertainties. To be manageable, they need to be grouped into logical clusters or themes. It is then useful to assess the importance of each cluster in order to set priorities with respect to Information gathering and analysis.

Sometimes the strategic uncertainty is represented by a future trend or event that has inherent unpredictability. Information gathering and additional analysis will not be able to reduce the uncertainty. In that case, scenario analysis can be employed. Scenario analysis basically accepts the uncertainty as given and uses it to drive a description of two or more future scenarios. Strategies are then developed for each. One outcome could be a decision to create organizational and strategic flexibility so that as the business context changes the strategy will adapt.

14. Once higher level corporate and business strategies are developed, management need to formulate and implement strategies for each functional area. For effective implementation, strategists have to provide direction to functional managers regarding

the plans and policies to be adopted. In fact, the effectiveness of strategic management depends critically on the manner in which strategies are implemented. Strategy of one functional area can not be looked at in isolation, because it is the extent to which all the functional tasks are interwoven that determines the effectiveness of the major strategy.

Functional area strategy such as marketing, financial, production and Human Resource are based on the functional capabilities of an organisation. For each functional area, first the major sub areas are identified and then for each of these sub functional areas, contents of functional strategies, important factors, and their importance in the process of strategy implementation is identified.

In terms of the levels of strategy formulation, functional strategies operate below the SBU or business-level strategies. Within functional strategies there might be several sub-functional areas. Functional strategies are made within the higher level strategies and guidelines therein that are set at higher levels of an organisation. Functional managers need guidance from the business strategy in order to make decisions. Operational plans tell the functional managers what has to be done while policies state how the plans are to be implemented.

Major strategies need to be translated to lower levels to give holistic strategic direction to an organisation. Functional strategies provide details to business strategy & govern as to how key activities of the business will be managed. Functional strategies play two important roles. Firstly, they provide support to the overall business strategy. Secondly, they spell out as to how functional managers will work so as to ensure better performance in their respective functional areas. The reasons why functional strategies are really important and needed for business can be enumerated as follows:

The development of functional strategies is aimed at making the strategies-formulated at the top management level-practically feasible at the functional level.

- Functional strategies facilitate flow of strategic decisions to the different parts of an organisation.
- They act as basis for controlling activities in the different functional areas of business.
- The time spent by functional managers in decision-making is reduced as plans lay down clearly what is to be done and policies provide the discretionary framework within which decisions need to be taken.
- Functional strategies help in bringing harmony and coordination as they remain part of major strategies.
- Similar situations occurring in different functional areas are handled in a consistent manner by the functional managers.

15. Management of logistics is a process that integrates the flow of supplies into, through and out of an organization to achieve a level of service that facilitate movement and

availability of materials in a proper manner. When a company creates a logistics strategy it is defining the service levels at which its logistics is smooth and is cost effective.

A company may develop a number of logistic strategies for specific product lines, specific countries or specific customers because of constant changes in supply chains. There are different areas that should be examined for each company that should be considered and should include:

- **Transportation:** Does the current transportation strategies help service levels required by the organisation?

- **Outsourcing:** Areas of outsourcing of logistics function are to be identified. The effect of partnership with external service providers on the desired service level of organisation is also to be examined.

- **Competitors:** Review the procedures adopted by competitors. It is also to be judged whether adopting the procedures followed by the competitors will be overall beneficial to the organisation. This will also help in identifying the areas that may be avoided.

- **Availability of information:** The information regarding logistics should be timely and accurate. If the data is inaccurate then the decisions that are made will be incorrect. With the newer technologies it is possible to maintain information on movement of fleets and materials on real time basis.

- **Strategic uniformity:** The objectives of the logistics should be in line with overall objectives and strategies of the organisation. They should aid in the accomplishment of major strategies of the business organisation.

16. Management of organization's value chain or linkages provide 'leverage' and levels of performance which are difficult to match. The ability to co-ordinate the activities of specialist teams or departments may create competitive advantage through improving value for money in the product or service. Specialization of roles and responsibilities is common in most organizations and is one way in which high levels of competence in separate activities is achieved. However, it often results in a set of activities which are incompatible – different departments pulling in different directions - adding overall cost and/or diminishing value in the product or service.

This management of internal linkages in the value chain could create competitive advantage in a number of ways:

- There may be important linkages between the primary activities. For example, a decision to hold high levels of finished stock might ease production scheduling problems and provide for a faster response time to the customer. However, it will probably add to the overall cost of operations. An assessment needs to be made of whether the value added to the customer by this faster response through holding stocks is greater than the added cost.

- It is easy to miss this issue of managing linkages between primary activities in an analysis if, for example, the organization's competences in marketing activities and

operations are assessed separately. The operations may look good because they are geared to high-volume, low-variety, low-unit-cost production. However, at the same time, the marketing team may be selling speed, flexibility and variety to the customers. So high levels of competence in separate activities are not enough if, as here, the competences are incompatible: that is, they are not related to the same view of what value for money means to the customer.

- The management of the linkages between a primary activity and a support activity may be the basis of a core competence. It may be key investments in systems or infrastructure which provide the basis on which the company outperforms competition. Computer-based systems have been exploited in many different types of service organization and have fundamentally transformed the customer experience.

- Linkages between different support activities may also be the basis of core competences. For example, the extent to which human resource development is in tune with new technologies has been a key feature in the implementation of new production and office technologies. Many companies have failed to become competent in managing this linkage properly and have lost out competitively.

In addition to the management of internal linkage, competitive advantage may also be gained by the ability to complement/co-ordinate the organization's own activities with those of suppliers, channels or customers. Again, this could occur in a number of different ways:

- Vertical integration attempts to improve performance through ownership of more parts of the value system, making more linkages internal to the organization. However, the practical difficulties and costs of co-ordinating a wider range of internal activities can outweigh the theoretical benefits.

- Within manufacturing industry the competence in closely specifying requirements and controlling the performance of suppliers (sometimes linked to quality checking and/or penalties for poor performance) can be critical to both quality enhancement and cost reduction.

- A more recent philosophy has been total quality management, which seeks to improve performance through closer working relationships between the specialists within the value system. For example, many manufacturers will now involve their suppliers and distributors at the design stage of a product or project.

- The merchandising activities which manufacturers undertake with their distributors are now much improved and are an important.

17. Strategy implementation concerns the managerial exercise of putting a freshly chosen strategy into place. Strategy execution deals with the managerial exercise of supervising the ongoing pursuit of strategy, making it work, improving the competence with which it is executed and showing measurable progress in achieving the targeted results. Strategic implementation is concerned with translating a decision into action, with presupposes

that the decision itself was made with some thought being given to feasibility and acceptability.

It is crucial to realize the difference between strategy formulation and strategy implementation because they both require very different skills. Also, a company will be successful only when the strategy formulation is sound and implementation is excellent. There is no such thing as successful strategic design. This sounds obvious, but in practice the distinction is not always made. The matrix in the figure below represents various combinations of strategy formulation and implementation:

18. Refer to chapter 7. We need to understand how growing use of the Internet by businesses and consumers reshapes the economic landscape and alters traditional industry boundaries. The following characteristics of the strategy-shaping E-Commerce environment are:

- The Internet makes it feasible for companies everywhere to compete in global markets.
- Competition in an industry is greatly intensified by the new e-commerce strategic initiatives of existing rivals and by the entry of new, enterprising e-commerce rivals.
- Entry barriers into the e-commerce world are relatively low.
- Online buyers gain bargaining power because they confront far fewer obstacles to comparing the products, prices, and shipping times of rival vendors.
- The Internet makes it feasible for companies to reach beyond their borders to find the best suppliers and, further, to collaborate closely with them to achieve efficiency gains and cost savings.
- Internet and PC technologies are advancing rapidly, often in uncertain and unexpected directions.
- The internet results in much faster diffusion of new technology and new idea across the world.
- The e-commerce environment demands that companies move swiftly.

- E-commerce technology opens up a host of opportunities for reconfiguring industry and company value chains.
- The Internet can be an economical means of delivering customer service.
- The capital for funding potentially profitable e-commerce businesses is readily available.
- The needed e-commerce resource in short supply is human talent-in the form of both technological expertise and managerial know-how.

19. (1) **BPR:** BPR stands for business process reengineering. It refers to the analysis and redesign of workflows both within and between the organisation and the external entities. Its objective is to improve performance in terms of time, cost, quality, and responsiveness to customers. It implies giving up old practices and adopting the improved ones. It is an effective tool of realising new strategies.

    Improving business processes is paramount for businesses to stay competitive in today's marketplace. New technologies are rapidly bringing new capabilities to businesses, thereby raising the strategical options and the need to improve business processes dramatically. Even the competition has become harder. In today's market place, major changes are required to just stay even.

   (2) **Six sigma:** Six sigma is a highly disciplined process that helps in developing and delivering near-perfect products and services. It strives to meet and improve organizational outputs in terms of quality, cost, scheduling, manpower, new products and so on. It works continuously towards revising the current standards and establishing higher ones. It means taking systemic and integrated efforts toward improving quality and reducing cost.

   (3) **Benchmarking:** It is a process of finding the best practices within and outside the industry to which an organisation belongs. Knowledge of the best helps in standards setting and finding ways to match or even surpass the best performances.

    Benchmarking is a process of continuous improvement in search for competitive advantage. Firms can use benchmarking process to achieve improvement in diverse range of management function like maintenance operations, assessment of total manufacturing costs, product development, product distribution, customer services, plant utilisation levels and human resource management.