

Q.No	Rubrics	Total
SECTION-I		
1 (a)	Definition + List + Characteristics with Examples (all 4)	1M + 1M + (2M*4) 10M
(b)	Stepwise conversion	3M + 2M 5M
(c)	Stepwise conversion	2M + 3M 5M
2 (a)	List + Logic Symbol + Expression + Truth table	(1M*2) + (1M*2) + (1M*2) + (2M*2) 10M
(b)	Logic symbol + Logic Circuit + Truth table	1M + 2M + 2M 5M
(c)	Correct Procedure	2.5M*2 5M
SECTION-II		
3 (a)	Statement + Proof	1M + 4M 5M
(b)	Explanation + Logic Diagram + Truth table	1M + 2M + 2M 5M
(c)	Differentiating features-any 3	2M*3 6M
(d)	Individual Character conversion + Final answer	3M + 1M 4M
4 (a)	Definition + List	1M + 4M 5M
(b)	Explanation + Logic Diagram + Truth table	1M + 2M + 2M 5M
(c)	Differentiating features-any 3	2M*3 6M
(d)	Stepwise conversion + Output	4M + 1M 4M
SECTION-III		
5 (a)	Definition + block diagram + logic diagram + truth table	1M + 2M + 2M + 1M 6M
(b)	Any 4 applications	1M*4 4M
(c)	(All Flip Flops) Figure	1.5M*4 6M
(d)	Logic Symbol + Block diagram	2M + 2M 4M
6 (a)	Definition + Listing + Any 2	1M + 1M + 2M * 2 6M
(b)	Differentiating features-any 2	2M*2 4M
(c)	Explanation + Figure	3M + 3M 6M
(d)	Classification with types	2M*2 4M
SECTION-IV		
7 (a)	List + Explanation – Any 4	2M + 2M*4 10M
(b)	Differentiating features-any 2	2M*2 4M
(c)	Arrangement according to speed + Cost	3M + 3M 6M
8 (a)	Figure + Explanation	4M + 6M 10M
(b)	Figure + Classification	2M + 2M 4M
(c)	Differentiating features-any 3	3M*2 6M
SECTION-V		
9 (a)	Definition + Characteristics – Any 4	1M + 4M*1 5M
(b)	Definition + Listing Phases + Explanation	1M + 2M*1 + 2M 5M
(c)	FC conversion + Input + Process + Output	2M + 1M + 1M + 1M 5M
(d)	Input + Logic + Output	1M + 3M + 1M 5M
10(a)	Flowchart Symbols – Any 5	1M*5 5M
(b)	Definition + Rules - 4	1M + 1M*4 5M
(c)	Input + Logic + Output	1M + 3M + 1M 5M
(d)	FC conversion + Input + Process + Output	2M + 1M + 1M + 1M 5M

1. (a). Define Number System. Explain different types of Number Systems with examples. 10M

The number system is the system of representing numbers. It represents basic symbols as individual digits or a specific number. It is the mathematical notation for representing numbers of a given set by using digits or other symbols. There are various types of number systems:

1. Binary number system (Base-2).
2. Octal number system (Base-8).
3. Decimal number system (Base-10).
4. Hexadecimal number system (Base-16).

Characteristics of binary number system:

- The binary number system is base 2 systems where only digits 0 & 1 are used.
- All digital computers use this number system.
- Therefore, the data entered computer is converted into its binary equivalent.
- Binary number system is a positional value system.
- This means that each binary digit has its own value or weight expressed as a power of 2.
- Example: - $(110)_2$

Characteristics of Octal number system:

- It is also called as base 8 number system.
- Uses eight digits from 0 to 7 (0,1,2,3,4,5,6,7).
- Octal number system is a positional value system.
- This means that each digit has its own value or weight expressed as a power of 8.
- Example: - $(175)_8$.

Characteristics of Decimal number system:

- It is a base 10 number system.
- It has 10 digits. They are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.
- Each position in a decimal number represents specific power of the base 10.
- Decimal Number System is easily readable, used by human.
- So, we use this number system in our day-to-day life.
- Decimal number system is a positional value system.
- Example: - $(452)_{10}$.

Characteristics of Hexadecimal number system:

- It is a base 16 number system.
- It has a total of 16 digits, numbers from 0-9 and letters from A-F.
- They are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F.
- The letters represent A = 10, B = 11, C = 12, D = 13, E = 14, F = 15.
- It is used to represent Computer memory addresses.
- It is also helpful to describe colors on web pages.
- Hexadecimal number system is a positional value system.
- This means that each digit has its own value or weight expressed as a power of 16.
- Example: - $(2C)_{16}$.

1. (b). Convert the following:

5M

2+2

- (i) $(671)_{10} = (1010011111)_2$
 $671 / 2 = 335$ with 1 remainder
 $335 / 2 = 167$ with 1 remainder
 $167 / 2 = 83$ with 1 remainder
 $83 / 2 = 41$ with 1 remainder
 $41 / 2 = 20$ with 1 remainder
 $20 / 2 = 10$ with 0 remainder
 $10 / 2 = 5$ with 0 remainder
 $5 / 2 = 2$ with 1 remainder
 $2 / 2 = 1$ with 0 remainder
 $1 / 2 = 0$ with 1 remainder
- (ii) $(FD)_{16} = (253)_{10}$
 $= F * 16^1 + D * 16^0$
 $= 15 * 16^1 + 13 * 16^0$
 $= 15 * 16 + 13 * 1$
 $= 240 + 13$
 $= (253)_{10}$

1. (c). (i). Find 1's Complement of 11000011111_2

5M

2+3

1100001111_2

1	1	0	0	0	0	1	1	1	1	1
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
0	0	1	1	1	1	0	0	0	0	0

1's Complement of 11000011111_2 is 00111100000_2

(ii). Find 2's Complement of 11000100_2

Step 1: Find 1's Complement

1	1	0	0	0	1	0	0
↓	↓	↓	↓	↓	↓	↓	↓
0	0	1	1	1	0	1	1

Step 2: Add 1 to 1's Complement

0	0	0	1	1	0	1	1
						+	1
↓	↓	↓	↓	↓	↓	↓	↓
0	0	0	1	1	1	0	0

2's Complement of $11000100_{(2)}$ is $00011100_{(2)}$

QUESTION 2

2. (a). List & explain universal gates with logic symbol, expressions & truth table. 10M

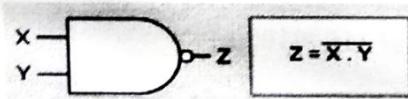
Universal gates are listed as follows:

1. NAND gate
2. NOR gate

NAND Gate: The NAND gate represents the complement of the AND operation. Its name is an abbreviation of NOT AND. The graphic symbol for the NAND gate consists of an AND symbol with a bubble on the output, denoting that a complement operation is performed on the output of the AND gate.

The truth table and the logic circuit of NAND gate is shown in the figure.

INPUTS		OUTPUT
X	Y	Z
0	0	1
0	1	1
1	0	1
1	1	0



$$z = \overline{x \cdot y}$$

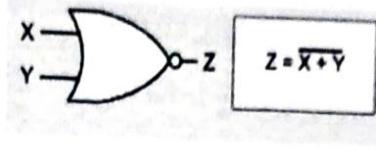
The truth table clearly shows that the NAND operation is the complement of the AND.

NOR Gate: The NOR gate represents the complement of the OR operation. Its name is an abbreviation of NOT OR. The graphic symbol for the NOR gate consists of an OR symbol with a bubble on the output, denoting that a complement operation is performed on the output of the OR gate.

The truth table and the logic circuit of NOR gate is shown in the figure.

INPUTS		OUTPUT
X	Y	Z
0	0	1

0	0	1
0	1	0
1	0	0
1	1	0



The truth table clearly shows that the NOR operation is the complement of the OR.

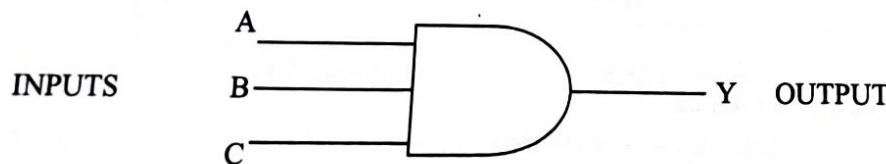
2. (b). Develop a truth table for 3-input AND gate.

5M ~~1+2+2~~

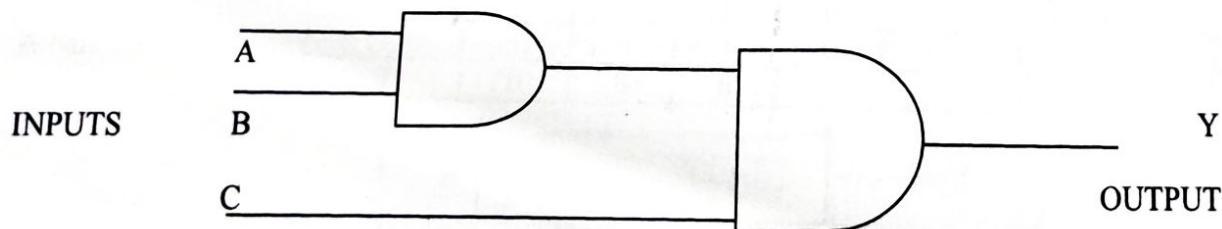
TRUTH TABLE:

INPUTS			OUTPUT
A	B	C	Y
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

LOGIC CIRCUIT:



OR



LOGIC SYMBOL:

$$(A \cdot B) \cdot C = Y \quad \text{OR} \quad A \cdot B \cdot C = Y$$

2. (c). Perform the following: *Binary addition*

5M

$$(i) \quad 1100_{(2)}$$

$$(ii) \quad 1101_{(2)}$$

$$\begin{array}{r} 1001_{(2)} \\ + 1010_{(2)} \\ \hline 10101_{(2)} \end{array}$$

$$\begin{array}{r} 1010_{(2)} \\ + 1011_{(2)} \\ \hline 10111_{(2)} \end{array}$$

2.5+2

SECTION-II

3. (a). State & prove De Morgan's theorem using truth table.

5M

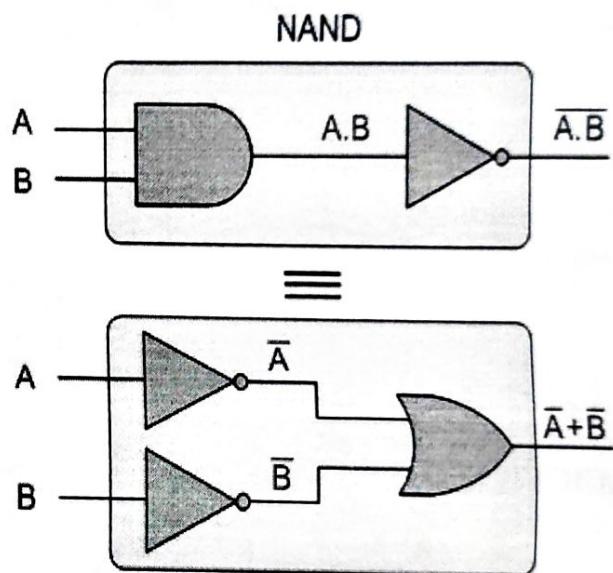
De Morgan's First theorem:

Pf4

It states that "the complement of a product of variables is equal to the sum of complement of the variables."

The Boolean expression for 2 variables is as follows:

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



The Logical circuit & truth table outputs are as follows:

Negative-OR

A	B	A.B	$\overline{A \cdot B}$	\overline{A}	\overline{B}	$\overline{A} + \overline{B}$
0	0	0	1	1	1	1
0	1	0	1	1	0	1
1	0	0	1	0	1	1
1	1	1	0	0	0	0



Both are same

OR

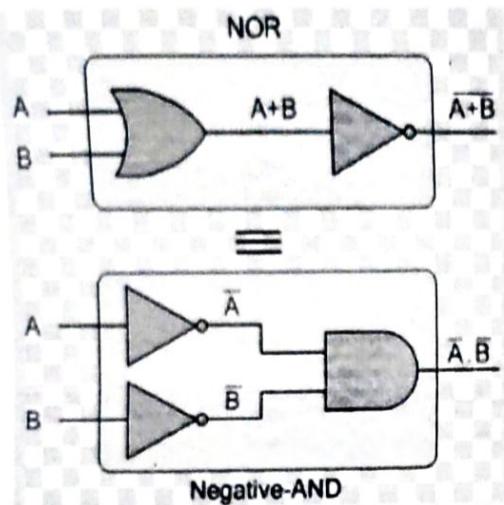
De Morgan's Second theorem:

states that "the complement of a sum of variables is equal to the product of the complements of the variables".

The Boolean expression for 2 variables is as follows:

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

The Logical circuit & truth table outputs are as follows:



A	B	A+B	$\overline{A+B}$	\overline{A}	\overline{B}	$\overline{A} \cdot \overline{B}$
0	0	0	1	1	1	1
0	1	1	0	1	0	0
1	0	1	0	0	1	0
1	1	1	0	0	0	0

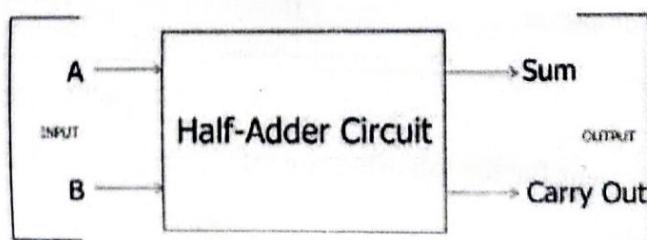
Both are same

3. (b). Describe half adder with logic diagram and truth table.

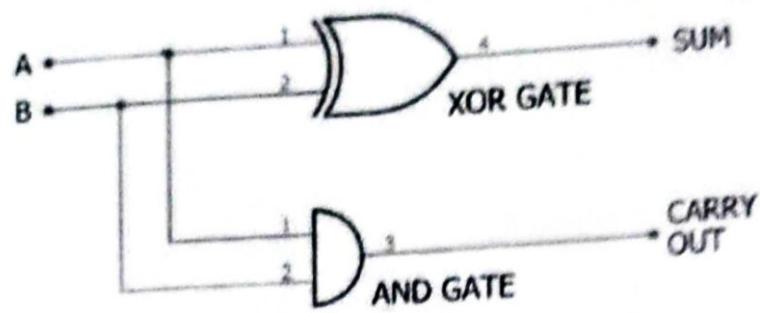
(+2+2) 5M

Half adder is a combinational circuit that performs addition of two binary digits. It accepts two binary digits as inputs & generates two binary digits as its output i.e Sum bit (Sum) and carry bit (Carry out).

A half adder is represented by the logic symbol as shown in figure below:



A half adder is represented by the logic diagram as shown in figure below:



The truth table for arithmetic operation of an Half-Adder is shown as follows:

A	B	Sum	Carry
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

Logical Expression:

For Sum: Sum = A XOR B , For Carry: Carry = A .B

3. (c). Differentiate between multiplexer & demultiplexer.

2+3

6M

SL No	Multiplexer	Demultiplexer
1	Multiplexers are known as Data Selectors.	Demultiplexers are known as Data Distributors.
2	Multiplexer circuit consist of 2^n data-input lines.	Demultiplexer circuit consist of only one input line.
3	Multiplexer circuit consist of single output data line.	Demultiplexer circuit consist of 2^n output data lines.
4	Multiplexer processes the digital information from various sources into a single source.	Demultiplexer receives digital information from a single source and converts it into several sources.
5	Multiplexer works on many to one operational principle.	Demultiplexer works on one to many operational principle.
6	Examples include: 8:1 Multiplexer, 16:1 Multiplexer, 32:1 Multiplexer.	Examples include: 1:2 Demultiplexer, 1:4 Demultiplexer, 1:8 Demultiplexer, 1:16 Demultiplexer

3. (d). Write ASCII equivalent for the following words:

3+1

4M

Program (Hint: 'A' = 65)

P	R	O	G	R	A	M
80	82	79	71	82	65	77

P	r	o	g	r	a	m
80	114	111	103	114	97	109

4. (a). Define Flip-flop. List different types of Flip flops.

1+4

5M

A flip-flop in digital electronics is a circuit with two stable states that can be used to store binary data.

Types of Flip-flops are:

- 1.
- 2.
- 3.
- 4.

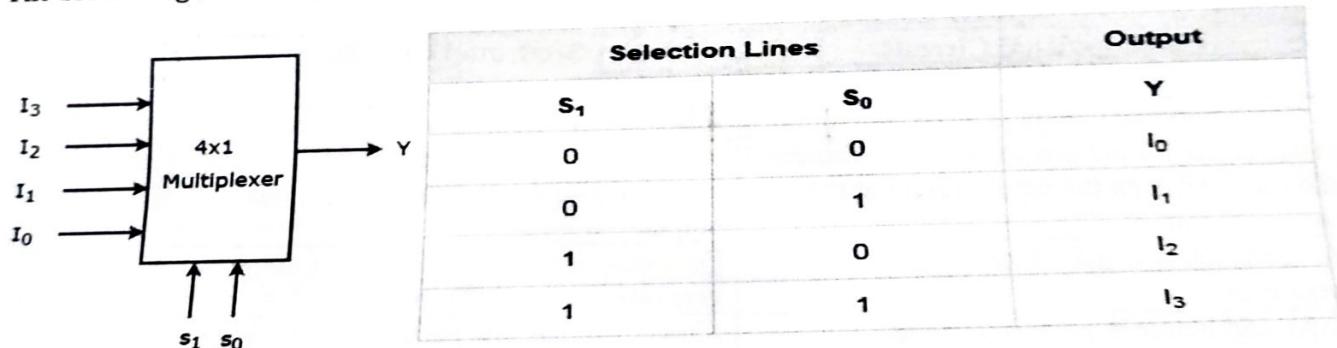
R-S Flip-flop.
J K Flip-flop.
T Flip-flop.
D Flip-flop.

4. (b). Describe 4:1 Multiplexer with logic circuit & truth table.

5M 1+2+2

A 4:1 Multiplexer is a multiplexer circuit having four data input lines { I_3, I_2, I_1, I_0 } & two data select control lines { $S_1 \& S_0$ } & one output line Y. One of these 4 inputs will be selected at each time.

The block diagram of 4:1 Multiplexer is shown in the following figure.



Truth table of 4:1 Multiplexer is shown below:

From Truth table, we can directly write the Boolean function for output, Y as

$$Y = S_1'S_0'I_0 + S_1'S_0I_1 + S_1S_0'I_2 + S_1S_0I_3$$

- The data output $Y=D_0$ if and only if $S_1=0, S_0=0$

i.e., $Y' = D_0' \quad S_1 \quad S_0$

- The data output $Y=D_1$ if and only if $S_1=0, S_0=1$

i.e., $Y' = D_1 \quad S_1 \quad S_0$

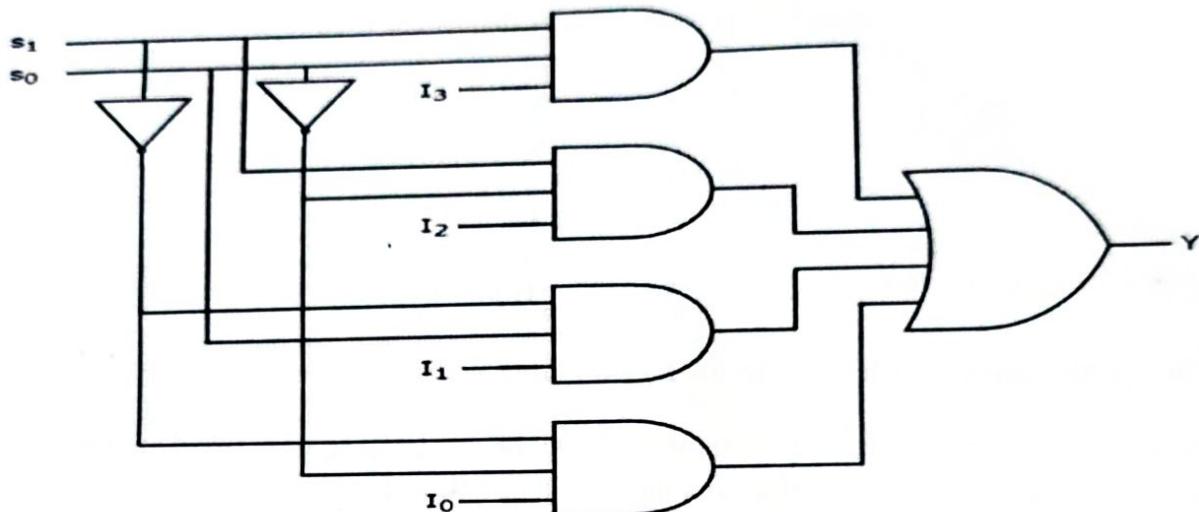
- The data output $Y = D_2$ if and only if $S_1=1, S_0=0$

i.e., $Y = D_2 \cdot S_1 \cdot S_0$

- The data output $Y = D_3$ if and only if $S_1=1, S_0=1$

i.e., $Y = D_3 \cdot S_1 \cdot S_0$

The Logic circuit for 4:1 Multiplexer is illustrated in the figure below:



4. (c). Differentiate between combinational circuits & sequential circuits.

6M 2+3

SL No	Combinational Circuits	Sequential Circuits
1	A Combinational Circuit is a type of circuit in which the output is independent of time and only relies on the input present at that particular instant.	A Sequential circuit is a type of circuit where output not only relies on the current input but also depends on the previous output.
2	No feedback is required for its next output generation.	Feedback is required for its next output generation along with input.
3	Faster and better in performance as compared to that of Sequential circuit.	Slower and has low performance as compared to that of Combinational circuit.
4	Elementary building blocks are its logic gates.	Building blocks are the logic gates along with flip flops.
5	Examples: Adders, Encoders & Decoders, Multiplexers & De multiplexers.	Examples: Flip-Flops, Shift Registers & Counters.
6	Used for arithmetic as well as Boolean operations.	Used for storing data.

4. (d). Apply Boolean algebra rules/laws and prove $(A+B)(A+C) = A+BC$

4M

$(A+B)(A+C)$

3x1

$= A \cdot A + A \cdot C + B \cdot A + B \cdot C$

Distributive Law

$= A + A \cdot C + B \cdot A + B \cdot C$

Rule 7: $A \cdot A = A$

$$\begin{aligned}
 & A(1+C) + AB + BC \\
 & = A \cdot 1 + AB + BC \\
 & = A(1+B) + BC \\
 & = A \cdot 1 + BC \\
 & = A + BC
 \end{aligned}$$

Rule 2: $A+1=1$
 Factoring (Distributive Law)
 Factoring
 Rule 2: $A+1=1$
 Rule 4: $A \cdot 1=A$

SECTION-III

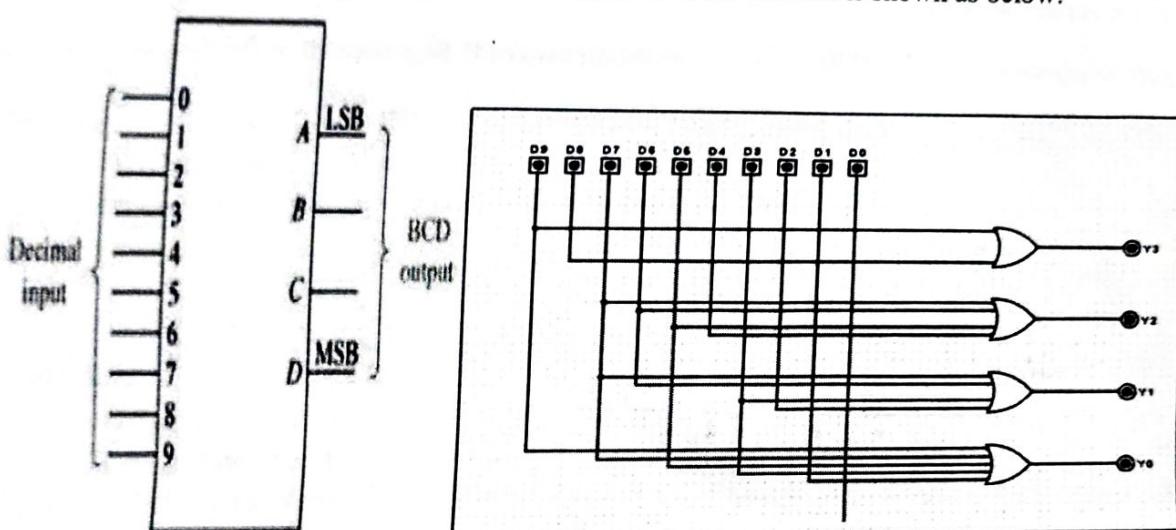
5. (a). Define Encoder. Explain Decimal to BCD encoder with block diagram & logic diagram.

6M

An Encoder is a combinational logic circuit that accepts an (high) active input level on one of its inputs representing a digit & converts it to a coded output such as BCD/Binary.

Decimal to BCD encoder is also called as 10-line-to-4-line encoder. It consists of 10 inputs for 10 decimal digits & 4 outputs which suggests BCD code.

The block diagram and logic diagram for decimal-to-BCD encoder is shown as below:



The following table depict the relationship between the decimal digits & 8421 BCD code output.

Decimal	BCD Code			
	Y ₃	Y ₂	Y ₁	Y ₀
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

5. (b). Discuss the applications of Counters.

4M

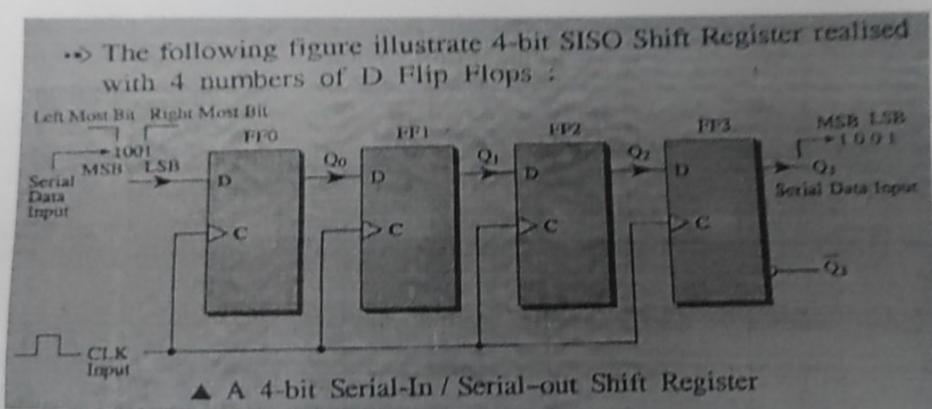
Counters are used in a number of applications.

1. Digital Clock.
2. Automobile Parking control.
3. Parallel to serial data conversion (Multiplexing).
4. In time measurement.
5. Frequency counters.
6. Analog to digital converters.
7. Used as frequency divider circuits.
8. Design digital triangular wave generator by using counters.

5. (c). Construct 4-bit SISO (Serial In Serial Out) shift register with neat block diagram. 6M

The Serial In Serial Out Shift register accepts data bits '0' or '1' serially bit-by-bit at each subsequent clock pulse input but one-bit at a time on a single line. It generates the stored bits of information at the output bit-by-bit at each clock pulse in the serial out fashion.

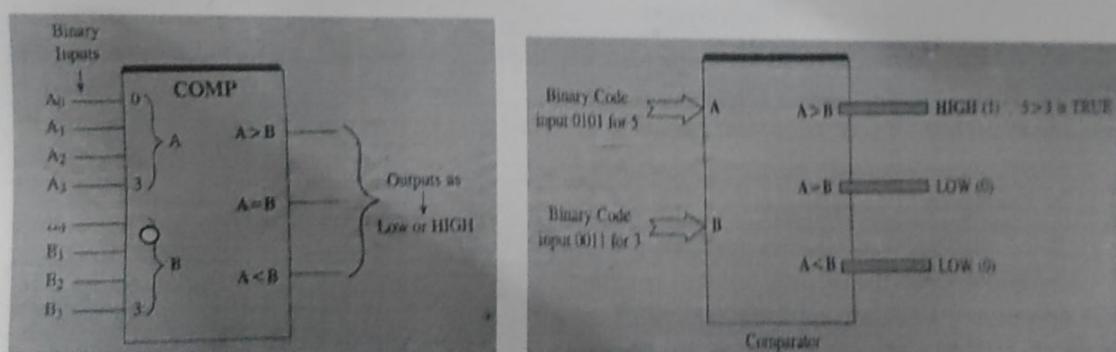
The following figure illustrate 4-bit SISO Shift Register with 4 numbers of D Flip flops:



5. (d). Illustrate 4-bit comparator with block diagram. 4M

The value or magnitude comparison in binary is performed by a logic circuit called comparator. A Comparator circuit compares pairs of binary digits & outputs whether they are equal or not equal.

Block diagram:



6. (a). Define Computer Network. Explain different categories of network. 6M

A computer network is a group of computers linked to each other that enables the computer to communicate with another computer and share their resources, data and applications.

Different categories of network are:

1. Local Area Networks (LAN)
2. Metropolitan Area Networks (MAN)
3. Wide Area Networks (WAN)

Local Area Networks (LAN) :

- o Local Area Network is a group of computers connected to each other in a small area such as building, office.
- o LAN is used for connecting two or more personal computers through a communication medium such as twisted pair, coaxial cable, etc.
- o It is less costly as it is built with inexpensive hardware such as hubs, network adapters, and ethernet cables.
- o The data is transferred at an extremely faster rate in Local Area Network.
- o Local Area Network provides higher security.

Metropolitan Area Network (MAN):

- o A metropolitan area network is a network that covers a larger geographic area by interconnecting a different LAN to form a larger network.
- o Government agencies use MAN to connect to the citizens and private industries.
- o In MAN, various LANs are connected to each other through a telephone exchange line.
- o It has a higher range than Local Area Network(LAN)

Wide Area Network (WAN):

- o A Wide Area Network is a network that extends over a large geographical area such as states or countries.
- o A Wide Area Network is quite bigger network than the LAN.
- o A Wide Area Network is not limited to a single location, but it spans over a large geographical area through a telephone line, fiber optic cable or satellite links.
- o A Wide Area Network is widely used in the field of Business, government, and education.

6. (b). Distinguish between Open source software & proprietary software. 4M

Sl. No	Open Source Software	Proprietary Software
1	Source code is available openly on the internet and programmers can modify it to add new features and capabilities without any cost.	Source codes are publicly not available, only the company which has created can modify it.
2	Can be installed on any computer.	Cannot be installed on any computer without a valid license.
3	Users can get open software free of charge.	Users must have to pay to get the proprietary software.
4	Examples: Android, Ubuntu, Firefox, Open Office, etc.	Examples: Windows, macOS, Internet Explorer, Google Earth, Microsoft Office, etc.

6. (c). Illustrate the working of Keyboard with neat diagram.

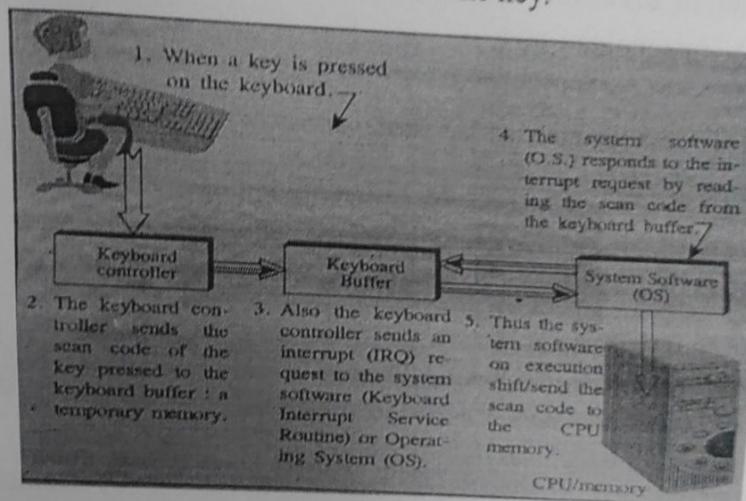
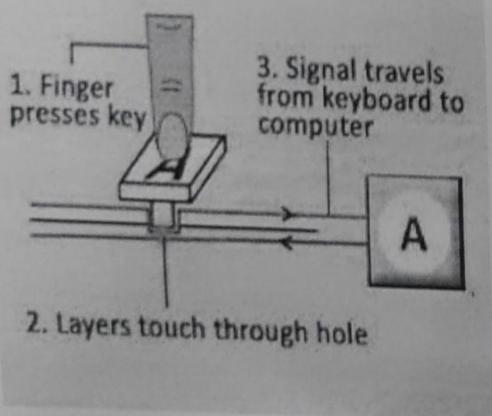
6M

It has its own processor and circuitry that carries information to and from that processor. When a key is pressed on the keyboard. The keyboard consists of set of key switches. The key switches are connected in a matrix of rows and columns. Each key switch has a fixed set of co-ordinates : row number & column number.

Keyboard functions: Keyboard consists of electronic circuit to decide which key has been pressed. Thus the keyboard control electronic circuit has to perform the following functions:

- Sensing a key pressed.
 - Encode the sensed key.
 - Send the encoded data.
1. When a key is pressed, corresponding key switch is activated. Keyboard electronic circuit use matrix scanning technique to determine which key has been pressed. Standard 8 bit binary code (scan-code) is generated & sent to computer, to correspond to activated key switch.
 2. Keyboard electronic circuit keep track when the operator or user releases the key.

Working of the Keyboard



6. (d). Classify data processing methods according to number of users.

4M

1. Single User Operating System.

An operating system that allows a single user to perform only one task at a time is called a Single-User Single-Tasking Operating System. Functions like printing a document, downloading images, etc., can be performed only one at a time. Examples include MS-DOS, Palm OS, etc.

2. Multi-User Operating System.

Multi-user operating system is a computer operating system (OS) that allows multiple users on different computers or terminals to access a single system with one OS on it.

Examples of multi-user operating system are: Linux, Ubuntu, Unix, Mac OS X, Windows.

SECTION-IV

7. (a) List & explain different generation of computers.

10M

I + 2x4

Different generation of computers are:

First Generation Computers (1940-1956)

Second Generation Computers (1956-1963)

Third Generation Computers (1964-1971)

Fourth Generation Computers (1971-Present)

Fifth Generation Computers (Present and Beyond)

1. First Generation Computers (1940-1956):

Computers of this generation used vacuum tubes as active electronic component. These computers were built using stored program concept. Computers use about 10,000 vacuum tubes. Programming was done with the use of machine language. Examples include: ENIAC, EDSAC, EDVAC, UNIVAC-I.

Characteristics of this generation computer are:

- Bulky in size.
- Slow operating speed.
- Short life time.
- Limited programming facilities.
- Expensive & heavy consumption of electricity to operate.
- Generated large amount of heat

2. Second Generation Computers (1956-1963):

Computers of this generation used germanium transistors as active electronic component.

High level programming languages like Fortran, Cobol were developed during second generation.

Examples include: IBM 7000, IBM 1401.

Characteristics of this generation computer are:

- Small in size.
- 10 times faster operating speed.
- Less power consumption.
- Higher availability.
- Availability of large memory.

3. Third Generation Computers (1964-1971):

Computers of this generation used silicon transistors & Integrated Circuits as active electronic components. Examples include: HP 2100A, IBM system 360.

Characteristics of this generation computer are:

- Comparatively smaller in size.
- Very less power consumption.
- Large main memory
- Powerful CPUs with capacity of executing 1 million instructions per second.

4. Fourth Generation Computers (1971-Present)

Computers of this generation used LSI (Large Scale Integrated Circuits) chips & VLSI (Very Large Scale Integrated Circuits) chips. Examples include: HCL horizen III, ICL 2900.

Characteristics of this generation computer are:

- Larger storage capacity disk memories.
- User friendly & highly reliable systems.
- Cost wise cheap, portable systems & reliable.
- Use of high speed microprocessor chips as CPU.

5. Fifth Generation Computers (Present and Beyond)

Computers are marked by the introduction & implementation of Expert systems, Artificial Intelligence, Neural Networks, Machine learning etc. These computers use parallel computing concepts. Speech synthesis, Natural language processing, Multimedia, & video conferencing using robotic surgery are most common applications of fifth generation. Examples include: supercomputers like PARAM.

7. (b). Differentiate between multitasking operating system & multiprocessing operating system.

4M

2+2

Multitasking Operating System

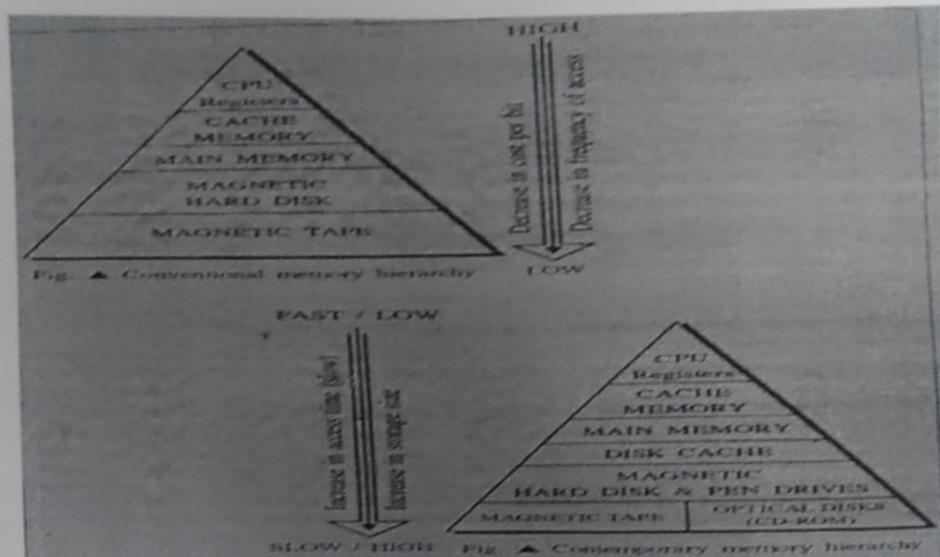
- Operating System permits execution of two/more tasks at a time by time sharing, resource sharing.
- The processor is empowered to switch rapidly among different processes.
- Advantages include speedy execution & attending different tasks at the same time.
- Saves time.
- Examples: Microsoft Windows 2000, IBM's OS/390, and Linux.

Multiprocessing Operating System

- Having more than one processor operating on the same memory but executing separate processes simultaneously.
- Operating System manages process allocation & synchronization among multiple processes.
- System multiple processes are employed to execute more than one activity at a time.
- Operating System offers high speed parallel processing.
- Examples: Windows NT, 2000, XP, and Unix.

7(c). Arrange different types of memory in hierarchy of increasing access speed & cost. 6M

3 X



Examples include :

CPU registers: Memory Address Register (MAR), Memory Data Register (MDR).

Cache Memory: L1 Cache, L2 Cache, L3 Cache.

Main Memory: Random Access Memory (RAM), Read Only Memory (ROM).

Secondary Memory: Hard Disk Drives (HDDs), Optical Storage Medias.

8. (a) Explain various functional units of computer with neat diagram.

10M

A computer consists of five main components namely, Input unit, Central Processing Unit, Memory unit Arithmetic & logical unit, Control unit and an Output unit.

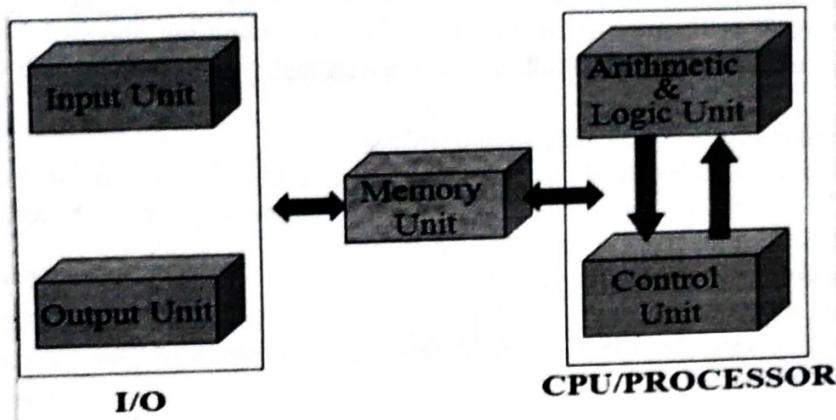
The following figure depicts basic block diagram of a computer system:

Input unit:

- Input units are used by the computer to read the data. The most commonly used input devices are keyboards, mouse, joysticks, trackballs, microphones, etc.

Central processing unit:

- o Central processing unit commonly known as CPU can be referred as an electronic circuitry within a computer that carries out the instructions given by a computer program by performing the basic arithmetic, logical, control and input/output (I/O) operations specified by the instructions.



Memory unit:

- o The Memory unit can be referred to as the storage area in which programs are kept which are running, and that contains data needed by the running programs.
- o The Memory unit can be categorized in two ways namely, primary memory and secondary memory.
- o Primary storage is the fastest memory that operates at electronic speeds. Primary memory contains a large number of semiconductor storage cells, capable of storing a bit of information. It is also known as the volatile form of memory. The most common examples of primary memory are RAM and ROM.
- o Cache memory is also a kind of memory which is used to fetch the data very soon. They are highly coupled with the processor.
- o Secondary memory is used when a large amount of data and programs have to be stored for a long-term basis. It is also known as the Non-volatile memory form of memory. The most common examples of secondary memory are magnetic disks, magnetic tapes, and optical disks.

Arithmetic & logical unit:

- o Most of all the arithmetic and logical operations of a computer are executed in the ALU (Arithmetic and Logical Unit) of the processor. It performs arithmetic operations like addition, subtraction, multiplication, division and also the logical operations like AND, OR, NOT operations.

Control unit:

- o The control unit is a component of a computer's central processing unit that coordinates the operation of the processor. It tells the computer's memory, arithmetic/logic unit and input and output devices how to respond to a program's instructions.

Output Unit:

- o The primary function of the output unit is to send the processed results to the user. Output devices display information in a way that the user can understand.
- o The most common example of an output device is a monitor.

4M

8. (b). Classify computers based on Flynn's classification.

Flynn's classification divides computers into four major groups that are:

1. Single instruction stream, single data stream (SISD)

It represents the organization of a single computer containing a control unit, a processor unit, and a memory unit. Instructions are executed sequentially, and the system may or may not have internal parallel processing capabilities.

2. Single instruction stream, multiple data stream (SIMD)

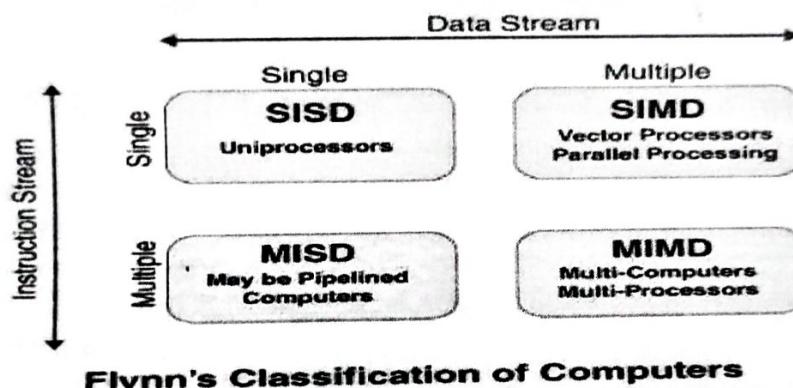
It represents an organization that includes many processing units under the supervision of a common control unit. All processors receive the same instruction from the control unit but operate on different items of data. The shared memory unit must contain multiple modules so that it can communicate with all the processors simultaneously.

3. Multiple instruction stream, single data stream (MISD)

MISD structure is only of theoretical interest since no practical system has been constructed using this organization. In MISD, multiple processing units operate on one single-data stream. Each processing unit operates on the data independently via separate instruction stream.

4. Multiple instruction stream, multiple data stream (MIMD)

In this organization, all processors in a parallel computer can execute different instructions and operate on various data at the same time. In MIMD, each processor has a separate program and an instruction stream is generated from each program.



8. (c). Differentiate between BIOS & UEFI.

6M

Sl. No	BIOS	UEFI
1	Abbreviated as Basic Input Output System.	Abbreviated as Unified Extensible Firmware Interface.
2	Has only 1 MB of space to execute.	Has more addressable address space than BIOS.
3	Runs in 32-bit mode only.	Runs in 32-bit and 64-bit mode.
4	Does not support remote diagnosis & repair support.	Supports remote diagnosis & repair if OS don't boot.
5	Does not support secure booting option.	Supports secure boot facility to stop loading malicious software.
6	Can boot from drives of less than 2 TB	Can boot from drives of 2.2 TB or larger with the theoretical upper limit being 9.4 zettabytes

SECTION-V

9. (a). Define auxiliary memory. Explain the characteristics of auxiliary memory.

5M

17/2

non volatile permanent storage for recording & maintaining voluminous data, large program files comprising hundreds of thousands of lines of code for future use.

Characteristics of auxiliary memory:

- It is non-volatile in nature.
- It is less costly in comparison to primary memory.
- The storage capacity is quite high and scalable.
- It can be removable or fixed as per the requirement.

Examples include : Hard disk drives and Optical storage media like CDs, DVDs, and Blu-ray.

5M 1+2+2

9. (b). Explain stored program concept.

Stored Program Concept refers to the storage of instructions in computer memory to enable it to perform a variety of tasks in sequence or intermittently. ENIAC (Electronic Numerical Integrator and Computer) was the first computing system designed in the early 1940s. It was based on Stored Program Concept in which machine uses memory for processing data.

A computer that incorporates stored program concept must organize execution of instructions in two separate phases.

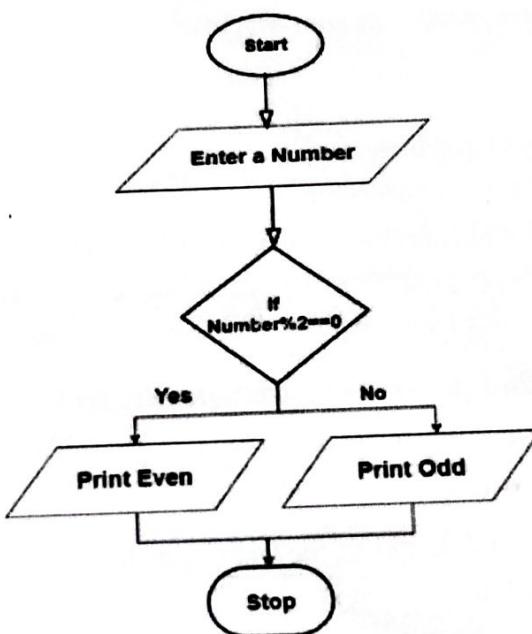
1. **Fetch phase** – Memory fetch for opcode & operands of an instruction.
2. **Execution phase** – Decode & execute instruction.

Advantages of stored program concept:

- Allows processor to execute same set of instructions for repeated number of times.
- One can modify program instructions according to the need & modified program version remains in memory for execution.

9. (c) Design a flowchart to determine whether a given number is even or odd. 5M

2+1+1+1



9. (d) A user enters the input. Write an algorithm to check whether entered input is a character or a number. 5M

1+3+1

Step 1 – Start.

Step 2 – Read input character from console at runtime.

Step 3 – If the value of the character is in the range of 0 and 9, Then, print "Number".

Step 5 – If the value of the character is in the range of 'a' and 'z' or 'A' and 'Z', Then, print "Character".

Step 6 – Else, print "Special Character".

Step 7 – Stop.

10. (a) Draw any 5 symbols used in flowchart.

5M

Symbol	Symbol Name	Description
→	Flow Lines	Used to connect symbols
←		
○	Terminal	Used to start, pause or halt in the program logic
平行四边形	Input/output	Represents the information entering or leaving the system
长方形	Processing	Represents arithmetic and logical instructions
菱形	Decision	Represents a decision to be made
圆圈	Connector	Used to join different flow lines
平行四边形	Sub function	used to call function

10. (b). Define Variable. Mention the rules for naming variable.

5M

A variable is a name given to a memory location where data can be stored.

Rules for naming variable:

1. Can contain letters, digits and underscores.
2. Must begin with a letter or an underscore (_)
3. Case sensitive (myVar and myvar are different variables)
4. Cannot contain whitespaces or special characters like !, #, %, etc.
5. Reserved words (such as int) cannot be used as variable names.

10. (c) Write an algorithm to find the area of a triangle with its base and height as input. 5M

Step 1 – Start

Step 2 - Read base and height.

Step 3 - base of the triangle as b and height of the triangle as h

Step 4 - Compute area = $1/2 * b * h$

Step 5 - Print the area.

Step 6 – Stop.

19. (d). Draw a flowchart to accept the age of a person & check whether he/she is eligible to vote. A person can vote if age is greater than or equal to 18. A person cannot vote if age is less than 18.

5M

