



CHAPTER- 2:-

Things and Connections

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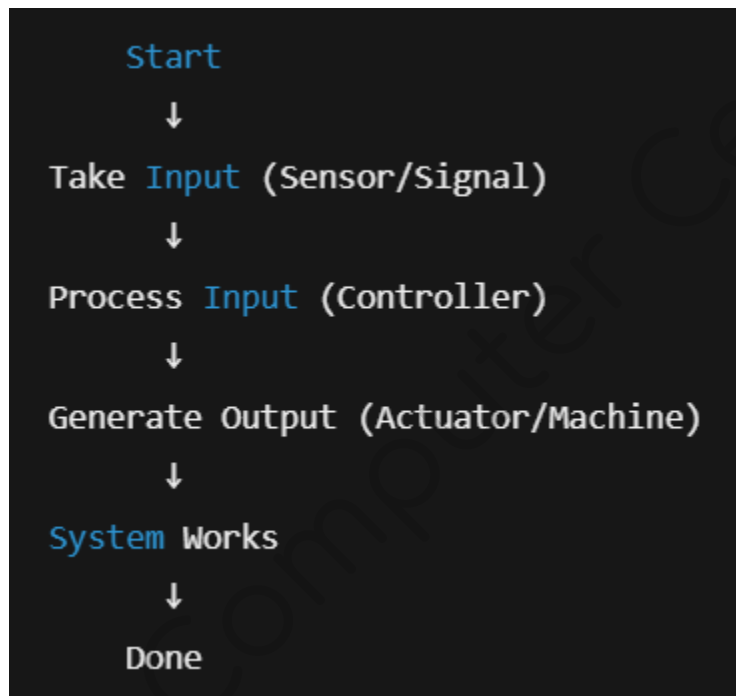
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Control Systems



- A control system makes things work automatically and stay stable.

- **Example:**

A thermostat turns heating or cooling ON/OFF to keep the room comfortable.

How It Works

It takes input, processes it, and controls a machine or device.

Main parts:

- **Input** – Sensors or switches that collect information.
- **Controller** – Thinks and decides what to do.
- **Output** – Machines or devices that do the work.
- **Power** – Provides energy to the system.
- **Connections** – Help all parts talk to each other.

Types of Control Systems


- **Simple**: A switch turns a heater on/off.
- **Complex**: Machines in a factory work together using computers.

Importance of Control Systems

1. **Automation** – Machines work by themselves, reducing manual work.
2. **Accuracy** – Makes sure machines work correctly.
3. **Efficiency** – Saves time and energy by working faster.
4. **Safety** – Prevents accidents by controlling machines.
5. **Cost-saving** – Reduces waste and increases production.

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Features of a Control System

- **Accuracy** – Correct output without errors.
 - **Energy Saving** – Uses less electricity/fuel.
 - **Safety** – Detects and avoids accidents.
 - **Stability** – Smooth, steady working.
 - **Speed** – Quick response to changes.
 - **Oscillation** – Reduces unnecessary movement.
 - **Sensitivity** – Reacts to real input, ignores noise.
 - **Noise** – Unwanted signals; should be reduced.
 - **Bandwidth** – Frequency range for good performance.
- 

Feedback Mechanism

The system checks the result again and again.

If something is wrong, it fixes it automatically.

👉 Example: An AC keeps checking room temperature and turns ON or OFF to keep it cool.

Control Loop

A loop means the system works in a circle.


It takes input, decides, and gives output — again and again.

👉 Sensor → Controller → Machine → Repeat

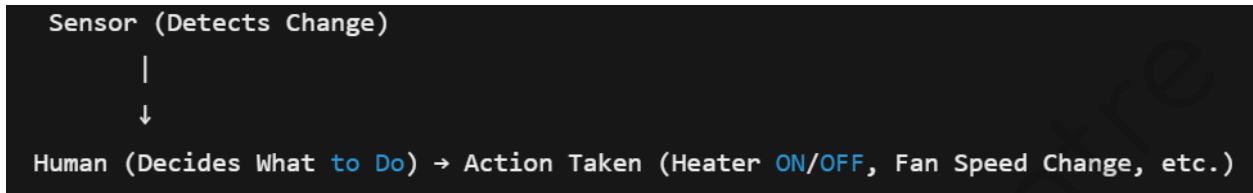
Real-life Industrial Uses

- Farms – to give water to plants
- Factories – to run machines
- Power plants – to make electricity
- Chemical plants – to mix things safely

Modern Control Devices

- PLC (Programmable Logic Controller) – A small computer that controls machines automatically
 - RTU (Remote Terminal Unit) – Controls machines from far places
 - Control Server – A computer that manages and controls many systems together
 - Sensor – A device that collects live data like temperature, pressure, etc.
- 

Manual Control System



📌 A system that needs a person to operate.

- ◆ Example: A person turning a heater ON and OFF to keep the room warm.

- ◆ Problem: Needs human effort all the time.

Manual Control = Open-Loop System – It does not check the output or fix errors by itself.

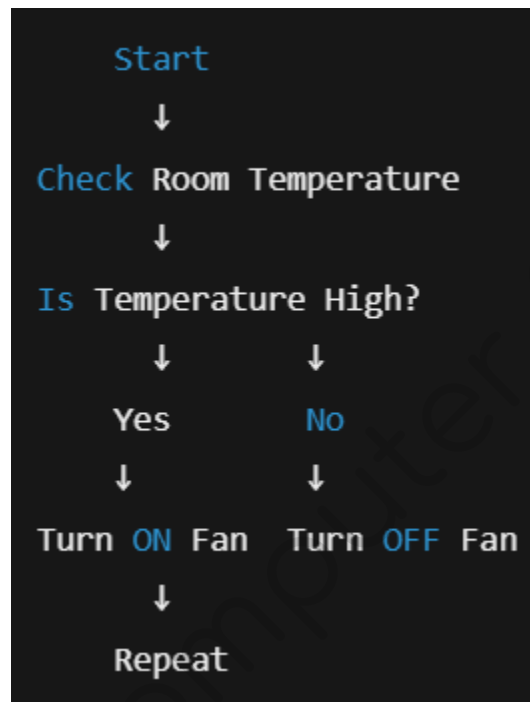
✓ Advantages

- Easy to Use – Anyone can operate it without special training.
- Low Cost – No need for expensive machines or sensors.
- Full Human Control – People decide and act as per the situation.
- Works Without Electricity – Many manual systems work without power.
- Easy to Repair – Can be fixed easily if something goes wrong.

✗ Disadvantages

- Slow Process – Depends on human action.
- Mistakes Can Happen – Human errors can reduce accuracy.
- Needs Full Attention – Someone must be present all the time.
- Not Good for Big Systems – Large industries need automatic systems.
- Wastes Energy – If not turned off, it may waste electricity.

Automatic Control System




- 📌 A system that works on its own without human help.
 - ◆ Example: A thermostat that turns the heater ON and OFF automatically.
 - ◆ How it works: Uses sensors to check the temperature and adjust the heater.
 - ◆ Benefit: Saves time, energy, and works better than manual control.

✓ Advantages

- Fast – Quick response.
- More accurate – Fewer errors.
- Saves time – No human watching needed.
- Energy efficient – Uses power only when needed.
- Best for Big Systems – Ideal for large/complex systems.

✗ Disadvantages

- Expensive – Needs costly setup.
 - Difficult to Repair – Experts needed.
 - Needs Electricity – Stops without power.
 - Less Human Control – People can't change settings easily.
 - Can Fail – If sensors or controllers stop, the system may not work properly.
- 

Quiz-1


1. What is the main function of a control system?

- a) To manually operate machines
- b) To make machines work automatically and stay stable
- c) To increase human effort
- d) To make machines stop working

2. Which of the following is an example of a control system?

- a) A person switching on a fan
- b) A thermostat controlling room temperature
- c) A person opening a door manually
- d) A book placed on a table

3. What is the role of the input in a control system?

- a) To collect information using sensors or switches
 - b) To make final decisions
 - c) To provide power to the system
 - d) To do the actual work
- 

4. Which part of a control system makes decisions?

- a) Input
- b) Controller
- c) Output
- d) Power

5. What is an example of a simple control system?

- a) A robot in a factory
- b) A self-driving car
- c) A switch turning a heater on and off
- d) A traffic light system

6. Why are control systems important?

- a) They reduce automation
- b) They increase errors
- c) They improve accuracy, efficiency, and safety
- d) They make machines work slower

7. Which of the following is NOT a feature of a good control system?

- a) Saves energy
- b) Works slowly
- c) Reacts quickly to changes
- d) Detects problems and prevents accidents

8. What is a manual control system?

- a) A system that works automatically
- b) A system that requires human operation
- c) A system that never needs power
- d) A system that fixes itself when broken

9. Which of these is an example of a manual control system?

- a) A washing machine that starts on its own
- b) A car driver shifting gears manually
- c) An automatic streetlight
- d) A motion sensor alarm


10. What is the main difference between a manual and an automatic control system?

- a) Manual systems are faster
- b) Automatic systems require no human intervention
- c) Manual systems are more accurate
- d) Automatic systems cannot be adjusted

11. Which feature helps a control system maintain accuracy?

- a) Noise
- b) Sensitivity
- c) Feedback elements
- d) Bandwidth

12. How does a control system achieve stability?

- a) By increasing noise
 - b) By maintaining bounded outputs for bounded inputs
 - c) By decreasing bandwidth
 - d) By reducing speed
- 


13. What happens in a control system when the actual output exceeds the desired value?

- a) Output increases further
- b) System stops functioning
- c) Corrective measures are taken to reduce the output
- d) No changes occur

14. Which characteristic of a control system indicates its responsiveness to changes?

- a) Accuracy
- b) Stability
- c) Sensitivity
- d) Energy savings

15. Why are automatic control systems best for big industries?

- a) They require human effort for every task
 - b) They are slow and unreliable
 - c) They work efficiently without much manual effort
 - d) They do not need electricity
- 

16. What is a control system primarily designed to do?

- a) Add instability to processes
- b) Achieve desired output by adjusting inputs
- c) Increase system complexity
- d) Decrease efficiency

17. Which of the following is NOT a component of a control system?

- a) Controller
- b) Input device
- c) Refrigerator
- d) Output device

18. What is the main purpose of a feedback mechanism in control systems?

- a) To complicate the process
- b) To maintain the desired output by making adjustments
- c) To increase manual operation
- d) To remove sensors from the system

19. In which industry are control systems most commonly used?

- a) Agriculture
- b) Education
- c) Manufacturing
- d) Retail

20. Which device processes input signals to adjust system operations?

- a) Sensor
- b) Controller
- c) Actuator
- d) Power supply

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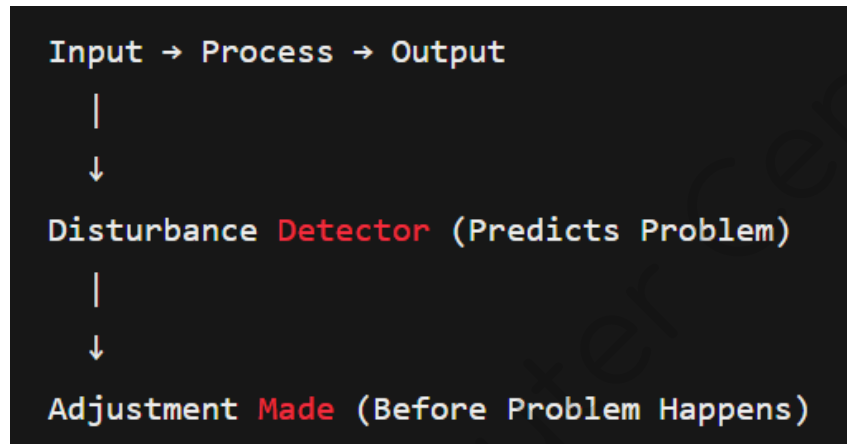
Q.No	Answer
1	b
2	b
3	a
4	b
5	c
6	c
7	b
8	b
9	b
10	b
11	c
12	b
13	c
14	c
15	c
16	b

17	c
18	b
19	c
20	b

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Types of Control Systems

1. Feedforward Control System



📌 **What it does:** Stops problems before they happen by predicting changes.

- ◆ **How it works:** It checks for changes early and fixes them before they cause issues.

- ◆ **Example:** A car adjusts fuel based on speed and road conditions to keep driving smooth.

- ◆ **Why it is useful:** Prevents big problems and helps things work better and faster.

- ◆ **Also called:** Predictive control system because it acts before a problem occurs.

✓ Advantages

- Prevents Errors Early – Problems are fixed before they happen.
- Fast Response – Reacts quickly to any changes.
- Improves Stability – Stops sudden changes and keeps balance.
- Reduces Need for Feedback – Needs less correction during work.
- Works Well in Predictable Systems – Best for stable and fixed environments.

✗ Disadvantages

- Cannot Fix Unexpected Errors – Can't adjust to sudden changes.
- Needs Accurate Data – Must have correct system model.
- Hard to Design – Setup and planning is complicated.
- Not Good for Changing Systems – Doesn't work well in unpredictable conditions.
- High Setup Cost – Expensive to install and maintain.

2. Open-Loop Control System

Input → Controller → Output
(No feedback loop)

📌 **What it does:** Works in a fixed way without checking if the output is correct.

- ◆ **How it works:** It follows a set of rules and does not change even if something goes wrong.

- ◆ **Example:** A toaster heats for a fixed time, even if the bread is already brown.

- ◆ **Why it is useful:** Simple, easy to use, and cheap, good for basic tasks.

- ◆ **Limitation:** It cannot correct mistakes or respond to changes.

✓ Advantages

- **Simple to Use** – Easy to design and operate
- **Low Cost** – No need for expensive sensors or feedback system.
- **Works Fast** – No need to wait for feedback, so it runs quickly.
- **Easy to Repair** – Fewer parts, so it is easy to fix.
- **Good for Simple Tasks** – Best for basic and repeatable actions.

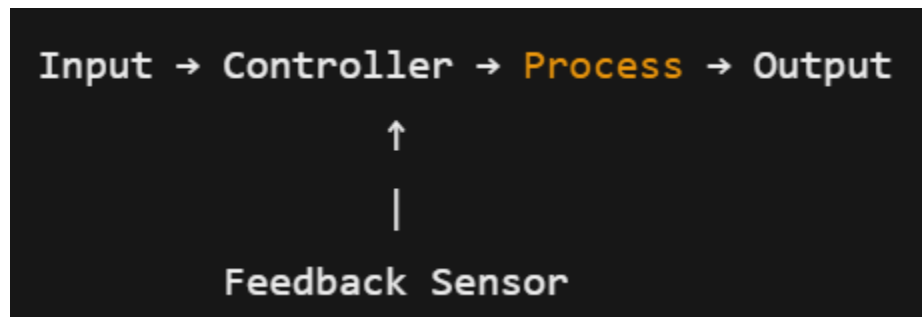
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✗ Disadvantages

- **No Self-Correction** – It cannot fix mistakes by itself.
- **Less Accurate** – Output may be wrong sometimes.
- **Cannot Adjust** – It does not change based on situation or environment.
- **Not Good for Complex Systems** – Hard to work in changing conditions.
- **Wastes Power** – May keep running even when not needed.

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3. Closed-Loop Control System (Feedback System)



📌 **What it does:** Checks its output and fixes mistakes if needed.

- ◆ **How it works:** It compares the actual result with the expected result and makes changes.

- ◆ **Example:** An air conditioner adjusts cooling based on the room temperature.

- ◆ **Why it is useful:** More accurate, reliable, and smart because it keeps improving itself.

- ◆ **Also called:** Feedback control system because it uses feedback to adjust.

✓ Advantages

- **More Accurate** – Gives correct results by adjusting automatically
- **Self-Correcting** – Fixes its own mistakes without human help
- **Works in Changing Conditions** – Keeps working even when the environment or situation changes
- **More Reliable** – Works properly again and again without failing
- **Better Control** – Manages complex or sensitive systems easily
- **Robustness** – Doesn't stop or fail even if there's a small problem or disturbance

✗ Disadvantages


- **Expensive** – Costs more money because of extra components
- **Complex Design** – Hard to build and needs skilled maintenance
- **Slower Response** – Takes more time to react because it checks results first
- **Needs Power** – Stops working if there is no power
- **Can Be Unstable** – Wrong design can cause overcorrections or system failure
- **Sensitivity** – Too many quick changes can make it unstable

Quiz-2

1. What is the main purpose of a feedforward control system?

- a) To respond after a problem occurs
- b) To predict and fix issues before they happen
- c) To work without checking for errors
- d) To follow fixed rules without adjustment

2. Why is a feedforward control system also called a predictive control system?

- a) Because it reacts to errors after they occur
 - b) Because it predicts and prevents problems early
 - c) Because it ignores system changes
 - d) Because it depends on human control
- 


3. Which of the following is an example of a feedforward control system?

- a) A toaster heating for a fixed time
- b) An air conditioner adjusting temperature based on feedback
- c) A car adjusting fuel based on speed and road conditions
- d) A person manually controlling a fan

4. What is a major disadvantage of feedforward control systems?

- a) They react too slowly
- b) They cannot handle unexpected errors
- c) They always require human supervision
- d) They are not useful in predictable systems

5. What does an open-loop control system do?

- a) It follows a fixed set of rules without feedback
 - b) It adjusts output based on feedback
 - c) It always corrects errors automatically
 - d) It constantly changes based on external conditions
- 


6. Which of these is an example of an open-loop system?

- a) A thermostat adjusting the heater
- b) A person steering a car based on road conditions
- c) A washing machine running a fixed cycle
- d) An elevator stopping at the right floor based on user input

7. Why is an open-loop system simple and cheap?

- a) Because it does not use feedback sensors
- b) Because it can correct errors automatically
- c) Because it works in unpredictable environments
- d) Because it requires human monitoring at all times

8. What is a limitation of an open-loop system?

- a) It is too complex to design
 - b) It cannot self-correct mistakes
 - c) It stops working without human input
 - d) It always works slowly
- 

9. Why do open-loop systems waste power?

- a) They always turn off automatically
- b) They only run when needed
- c) They continue working even if not required
- d) They always depend on human input

10. What is a closed-loop control system also called?

- a) Manual control system
- b) Feedback control system
- c) Open-loop system
- d) Predictive control system

11. How does a closed-loop system work?

- a) It ignores feedback and follows a set program
- b) It adjusts output based on feedback
- c) It only works in simple conditions
- d) It requires human control for every action


12. Which of these is an example of a closed-loop system?

- a) A toaster heating for a fixed time
- b) A traffic signal changing at fixed intervals
- c) An air conditioner adjusting cooling based on room temperature
- d) A microwave running for a set time

13. Why are closed-loop systems more accurate?

- a) They adjust based on feedback and correct mistakes
- b) They work without checking the output
- c) They always require manual control
- d) They run on a fixed program without changes

14. What is a disadvantage of a closed-loop system?

- a) It is very simple to design
 - b) It is always inaccurate
 - c) It is more expensive and complex to set up
 - d) It cannot handle unpredictable changes
- 

15. Why do closed-loop systems sometimes respond slowly?

- a) Because they process feedback before making adjustments
- b) Because they do not use sensors
- c) Because they work without power
- d) Because they do not have an automatic response system

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Answer

Q.No	Answer
1	b
2	b
3	c
4	b
5	a
6	c
7	a
8	b
9	c
10	b

11	b
12	c
13	a
14	c
15	a


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Types of Feedback Systems

1. SISO (Single-Input Single-Output) System

- Simple system with one input and one output.
- How it Works:
 1. A sensor measures the output.
 2. The output is sent back as feedback.
 3. The controller checks if there is any difference (error).
 4. The controller adjusts the system to reduce error.

SISO Example: Room Heater (Closed-Loop System)

- How it Works:
 1. The temperature sensor measures the room temperature.
 2. The system compares it with the set temperature.
- 

-
3. If the room is too cold, the heater turns ON.
 4. If the room is warm enough, the heater turns OFF.

2. MIMO (Multiple-Input Multiple-Output) System

- Has more than one input and output.
- Used in advanced technology like mobile networks, robots, and amplifiers.
- More difficult to design compared to SISO.

MIMO Example: Mobile Network (Closed-Loop System)

- **How it Works:**
 1. Multiple users make calls.
 2. The system receives multiple signals from different phones.
 3. The system processes each signal separately.
 4. It sends multiple outputs (calls, internet, SMS) to different users.

3. Switchable Feedback Systems

Explanation:

- Some systems can switch between open-loop and closed-loop modes.
- In open mode – it works manually (needs human input).
- In closed mode – it works automatically (no human input).

Example:

- A washing machine: Manual mode lets you control everything, while automatic mode uses sensors and runs by itself.

Classification of Feedback Systems


A feedback system is a system that adjusts itself based on its output. There are two types:

- ① Positive Feedback
- ② Negative Feedback

Positive Feedback System

- ✓ "Positive" means adding or increasing.
- ✓ The feedback adds to the input, so the output increases.

How It Works?

- ① Takes input
 - ② Processes and increases output
 - ③ Sends output back to input
 - ④ Repeats, making output stronger
- 

Easy Example: Microphone & Speaker 🗣️ 🎧

- Mic near a speaker → Loud noise (whistling sound).
- The mic picks up the speaker's sound, sends it back, and the sound keeps increasing.

Negative Feedback System

- ✓ "Negative" means reducing or controlling.
- ✓ The feedback reduces errors by adjusting the input, keeping the system stable.

♦ How It Works?

- 1 Takes input
- 2 Processes and measures output
- 3 Compares output with the desired value
- 4 Adjusts the input to reduce errors
- 5 Repeats to keep the system stable

♦ Easy Example: Thermostat (Room Heater) 🔥 ❄️

Room too cold? → Heater turns ON to increase temperature.

Room too hot? → Heater turns OFF to reduce temperature.

✓ The thermostat keeps adjusting the heater to maintain the right temperature.

✓ This is negative feedback because it controls and stabilizes the system. 🎯

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Quiz-3


1. What does a SISO system have?

- a) Multiple inputs and one output
- b) One input and one output
- c) No inputs, only outputs
- d) No outputs, only inputs

2. Which of the following is an example of a SISO system?

- a) A mobile network handling multiple calls
- b) A traffic signal controlling many roads
- c) A room heater adjusting temperature
- d) A factory with many machines working together

3. In a SISO system, what does the controller do?

- a) Ignores the error in output
 - b) Measures the output and makes adjustments
 - c) Increases the number of inputs
 - d) Always keeps the system ON
- 


4. What does a MIMO system have?

- a) One input and one output
- b) Multiple inputs and multiple outputs
- c) No inputs, only feedback
- d) Only one input and many outputs

5. Which of these is an example of a MIMO system?

- a) A heater turning on and off
- b) A traffic light system controlling a single road
- c) A mobile network handling multiple users
- d) A single bulb controlled by a switch

6. Why is a MIMO system more complex than a SISO system?

- a) Because it uses multiple inputs and outputs
 - b) Because it does not use feedback
 - c) Because it only works manually
 - d) Because it does not process signals
- 

7. What is a feedback system?

- a) A system that always keeps running
- b) A system that adjusts itself based on its output
- c) A system that does not measure its output
- d) A system that works without sensors

8. Which of the following is NOT a type of feedback system?

- a) Positive feedback
- b) Negative feedback
- c) Neutral feedback
- d) None of the above

9. What does a positive feedback system do?

- a) Reduces the output to maintain stability
- b) Increases and amplifies the output
- c) Stops the system from working
- d) Always turns the system OFF


10. Which of these is an example of a positive feedback system?

- a) A microphone near a speaker causing a loud noise
- b) A thermostat controlling room temperature
- c) A car's cruise control system
- d) A washing machine turning off automatically

11. What does a negative feedback system do?

- a) Keeps increasing the output without control
- b) Maintains stability by reducing errors
- c) Stops the system from adjusting itself
- d) Increases errors in the system

12. Which of these is an example of a negative feedback system?

- a) A microphone amplifying sound continuously
 - b) A heater turning on and off based on temperature
 - c) A person shouting louder when near a speaker
 - d) A car engine running without speed control
- 

13. What happens in a thermostat-based heating system?

- a) It keeps heating without stopping
- b) It turns ON and OFF based on room temperature
- c) It does not measure temperature
- d) It always runs at full power

14. Why are negative feedback systems useful?

- a) They make systems unstable
- b) They help in maintaining a steady output
- c) They always increase the system's power
- d) They do not make any corrections

15. Which feedback system is used in a thermostat-controlled heater?

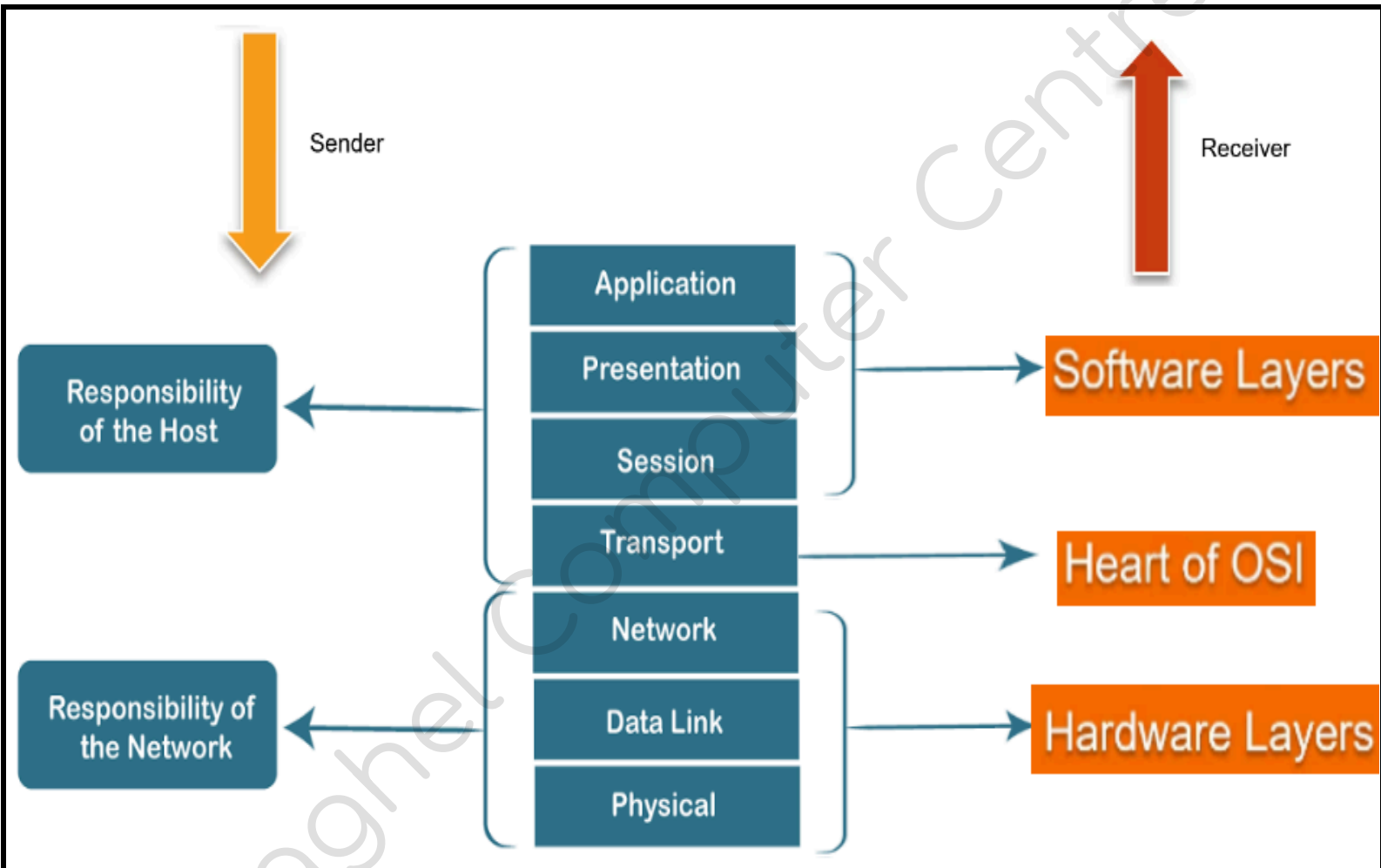
- a) Positive feedback
- b) Negative feedback
- c) No feedback
- d) Random feedback

Q.No	Answer
1	b
2	c
3	b
4	b
5	c
6	a
7	b
8	c
9	b
10	a

11	b
12	b
13	b
14	b
15	b

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OSI Model (Open Systems Interconnection Model)



-
- ✓ OSI Model is a framework that explains how data moves from one computer to another over a network.
 - ✓ It divides the communication process into 7 layers, making it easier to understand.
 - ✓ Developed by ISO (International Organization for Standardization) in 1984.
 - ✓ 7 Layers, each with a specific role.
 - ✓ Data Flow in Networking (Relation between Bit, Frame, Packet, and Segment)

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Data flow in networking

Data (Application Layer)

Normal information typed by the user, it may be message, text, photo, files, etc.



Segment (Transport layer)

Data is divided into small parts.



Packet (Network layer)

Segment + IP address

So the pieces knows where to go.



Frame (Data link layer)

Packet + MAC address + Error check

To travel safely inside LAN.



Bits (Physical layer)

It is 0 and 1 signals

Actual electric / light / wireless signals used
to travel on cables.


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Seven Layers of OSI Model

The OSI Model has seven layers.
It explains how data moves from one computer to another computer in a network.

OSI Layers List

Layer No.	Layer Name	Data Unit
Layer 7	Application Layer	Data
Layer 6	Presentation Layer	Data
Layer 5	Session Layer	Data
Layer 4	Transport Layer	Segment
Layer 3	Network Layer	Packet
Layer 2	Data Link Layer	Frame
Layer 1	Physical Layer	Bits



1. Application Layer

- Data unit: Data
- It provides services to the user.
- It is also called the User Interface Layer.
- It is also called the Topmost Layer.
- It allows browsing, chatting, and emailing.
- It helps users send and receive messages.
- It displays data to the user.
- It supports applications like Chrome, WhatsApp, Gmail, etc.

Protocol Examples

- HTTP
 - FTP
 - SMTP
 - DNS
-

2. Presentation Layer

- Data unit: Data
 - It converts data into a readable format.
 - It encrypts data for security.
 - It decrypts data to make it normal again.
 - It compresses data to reduce size.
 - It makes sure the receiver understands the data.
 - Presentation Layer works like a translator.
 - If data is encrypted before sending, this layer can decrypt it at the receiver side.
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3. Session Layer

- Data unit: Data
 - The Session Layer starts, maintains, and ends communication between devices.
 - It starts communication between devices.
 - It maintains communication.
 - It ends communication properly.
 - It controls the timing of communication.
 - It manages login and logout sessions.
 - Overall, it controls the conversation between devices.
-

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4. Transport Layer

- Data unit: Segment
- The Transport Layer is responsible for sending data safely from sender to receiver.
- It breaks data into small parts called segments.
- It reassembles segments at the receiver side.
- It ensures complete and correct delivery of data.
- It uses TCP for safe communication.
- It uses UDP for fast communication.
- It ensures safe delivery of data.

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5. Network Layer

- Data unit: Packet
- Device: Router
- It selects the best path to send data.
- It uses IP addresses to identify devices.
- It performs routing-Network Layer works like a route finder.
- It handles packet forwarding.
- It manages network addressing.

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6. Data Link Layer

- Data unit: Frame
 - Device: Switch
 - It uses MAC addresses to identify devices.
 - It sends data within the same network.
 - It detects errors in data frames.
 - It controls how devices share the network.
 - It manages local network communication.
-

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7. Physical Layer

- Data unit: Bits
 - Bits means: 0 and 1
 - Devices: Cables, Wi-Fi, connectors, etc.
 - It sends data as electrical or radio signals.
 - It defines cables and connectors.
 - It defines voltage and frequency.
 - It converts bits into signals.
 - It provides physical connection.
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Communication Types in OSI Model

Communication Type	OSI Layer
Node to Node	Data Link Layer
Host to Host	Network Layer
Process to Process	Transport Layer
End to End	Transport Layer

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1. Node to Node Communication

Node to Node means data transfer from one network device to another network device.

Example

Data moves from a switch to a router.

2. Host to Host Communication

Host to Host means sending data from one computer to another computer.

Example

A laptop sends a file to another PC.

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3. Process to Process Communication

Process to Process means one program communicates with another program.

Example

Your chat application communicates with a server program.

4. End to End Communication

End to End means data goes from the sender to the receiver.

Example

Your phone message reaches your friend's phone.


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Advantages of OSI Model

- It helps us understand how data moves in a network.
- It makes problem-solving easier by dividing work into layers.
- It allows different computers and devices to work together.
- It is a common standard used around the world.
- It is useful for teaching beginners about networking.
- It keeps network communication organized.

Disadvantages of OSI Model

- It is only a reference model.
 - It is not used exactly in real networks.
 - Some layers do almost the same work.
 - It has more layers than needed in real life.
 - Real networks do not always follow OSI rules.
 - It becomes heavy and complex if applied fully.
- 


Protocol Stacks

- Protocol Stacks organizes communication in layers as per the OSI model.
 - Each layer has specific tasks and rules for handling data.
 - It allows different protocols to work together smoothly.
-

Structure of Protocol Stacks

- It is layered group of protocol.
 - Each layer uses its own protocol.
 - Data moves top to bottom (sender side)
 - Data moves bottom to top (receiver side)
-

Layer operation


- Each layers provide services to the layer above.
 - Each layers uses services from the layer below.
- 

-
- Both devices must use the same protocol Stacks
 - Same layers on both devices communicate logically.
-

Note:-

1. Physical communication: Only physical layer sends real signals
 2. Encapsulation: Headers are add when data moves down.
 3. Decapsulation: Headers are remove when data moves up.
-

Header management

- Each layers add own header when spending data (encapsulation).
 - On the receiver side each layers removes its own header (Decapsulation).
 - Header contains control information
-
- 

Subtasks & Protocols

- OSI model divides communication into small task (subtasks)
- Each layer handles one specific task
- all protocol together form a complete protocol Stacks
- Popular protocol stack (TCP/IP)

Popular Protocol Stack (TCP/IP)

- It is the most commonly used protocol stack.
- It is used on the Internet.
- It was developed for reliable data communication
- It is widely used in UNIX, windows, LINUX and network system

Quiz-4


1. What does the OSI model explain?

- a) How computers store data
- b) How data moves from one computer to another over a network
- c) How software is installed on a computer
- d) How a computer processes information

2. How many layers does the OSI model have?

- a) 5
- b) 6
- c) 7
- d) 8

3. Which organization developed the OSI model?

- a) IEEE
 - b) ISO
 - c) IETF
 - d) W3C
- 

4. Which layer of the OSI model is responsible for user interaction with applications?

- a) Transport Layer
- b) Network Layer
- c) Application Layer
- d) Data Link Layer

5. Which layer is also called the "Translation Layer"?

- a) Session Layer
- b) Presentation Layer
- c) Physical Layer
- d) Transport Layer

6. What does the Session Layer do?

- a) Manages communication sessions between devices
- b) Translates data into a readable format
- c) Controls the flow of electricity in the network
- d) Finds the best path for data transmission

7. Which layer is responsible for reliable data transfer?

- a) Data Link Layer
- b) Network Layer
- c) Physical Layer
- d) Transport Layer

8. What is the main function of the Network Layer?

- a) Encrypts and compresses data
- b) Finds the best path for data transmission
- c) Controls communication sessions
- d) Deals with physical hardware

9. What does the Data Link Layer use for device identification?

- a) IP Address
- b) MAC Address
- c) Port Number
- d) HTTP Protocol

10. Which layer is also known as the "Hardware Layer"?

- a) Data Link Layer
- b) Physical Layer
- c) Transport Layer
- d) Application Layer

11. What is the correct order of data flow in networking?

- a) Frame → Segment → Packet → Bits
- b) Bits → Frame → Packet → Segment
- c) Segment → Bits → Packet → Frame
- d) Packet → Bits → Frame → Segment

12. What is the data unit at the Transport Layer?

- a) Frame
- b) Packet
- c) Segment
- d) Bits

13. What is an example of a protocol used in the Application Layer?

- a) HTTP
- b) IP
- c) TCP
- d) UDP

14. Which layer deals with encryption and compression?

- a) Presentation Layer
- b) Session Layer
- c) Physical Layer
- d) Network Layer

15. Why is the OSI model important?

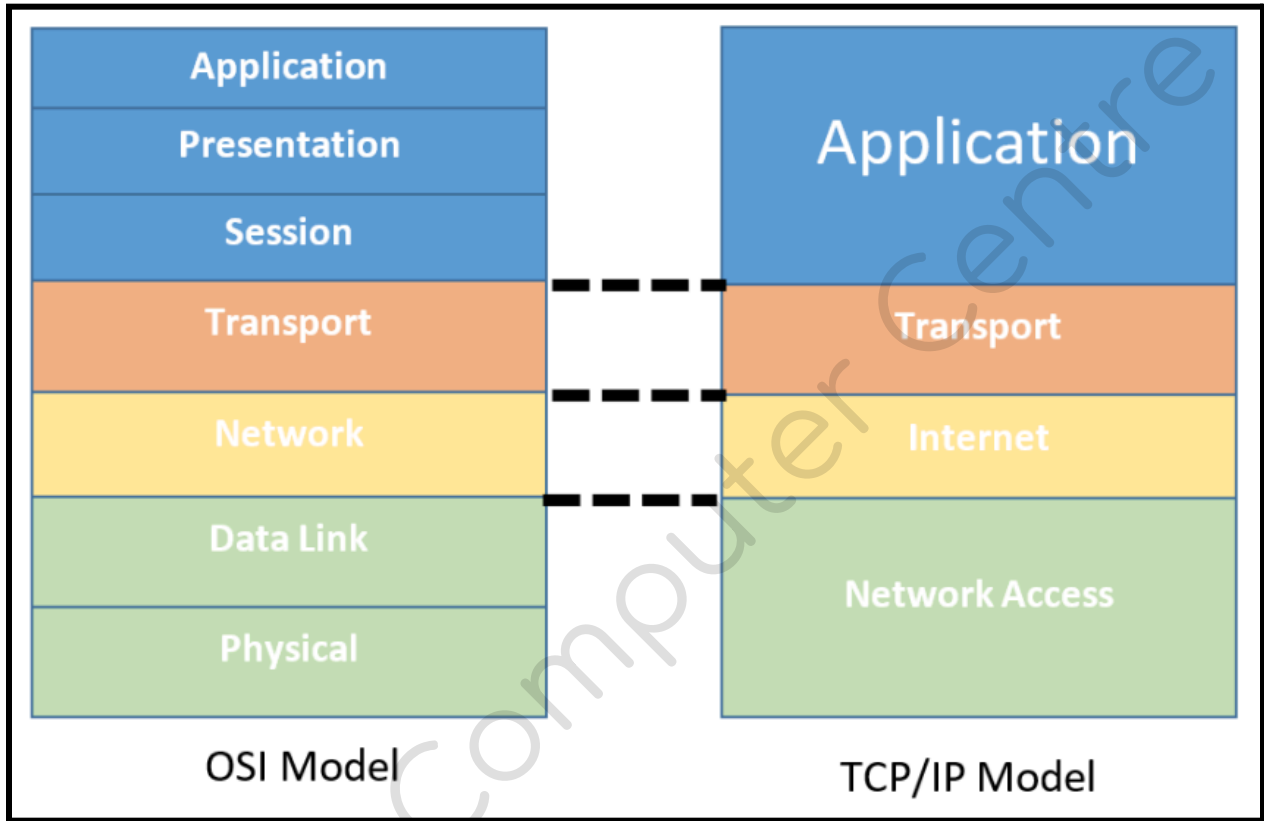
- a) It helps understand networking in a structured way
- b) It makes computers faster
- c) It only works with old technology
- d) It is used only for programming

Q.No	Answer
1	b
2	c
3	b
4	c
5	b
6	a
7	d
8	b
9	b
10	b

11	b
12	c
13	a
14	a
15	a

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TCP/IP Model



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-
- It is a 4-layer protocol stack used for network communication, including the Internet.
 - Developed in the 1970s by the U.S. Department of Defense for ARPANET.
 - Explains how data travels across different types of networks.
 - It is the base of modern networking, used in IoT, LAN, WAN, and the Internet.
 - Ensures reliable, flexible, and scalable communication between devices.
 - Powers real-world networks and supports protocols like TCP, UDP, HTTP, FTP, etc.

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TCP/IP Model Layers

TCP/IP Layers Table

Layer No.	Layer Name	Similar OSI Layer	Data Unit
Layer 4	Application Layer	Application + Presentation + Session	Data
Layer 3	Transport Layer	Transport Layer	Segment
Layer 2	Internet Layer	Network Layer	Packet
Layer 1	Network Access Layer	Data Link + Physical Layer	Frame + Bits

1. Application Layer

- It is equal to Application + Presentation + Session layer.
- Data unit: Data
- It sends data to the user.
- It prepares data before sending.
- It handles login and logout.
- It can encrypt data.
- It can compress data.
- It helps applications to communicate on the network.

Protocol Examples

Protocol	Full Form	Work
HTTP	HyperText Transfer Protocol	It is used to open websites and web pages.
FTP	File Transfer Protocol	It is used to send and receive files.
SMTP	Simple Mail Transfer Protocol	It is used to send emails.

DNS	Domain Name System	It converts website names into IP addresses.
CoAP	Constrained Application Protocol	It is used in small IoT devices for communication.
MQTT	Message Queuing Telemetry Transport	It is used for lightweight IoT messaging.
Telnet	Telecommunication Network	It is used for remote login to another computer.

Application Examples

- Gmail
 - WhatsApp
-

2. Transport Layer

- Data unit: Segment
- It breaks data into small parts.
- It joins segments again at the receiver side.
- It makes sure data reaches correctly using TCP.
- It sends data fast without checking using UDP.
- It uses port numbers for apps.
- It manages:
 - Multiplexing
 - Segmentation
 - Sequencing

Protocol Examples

Proto col	Full Form	Work
TCP	Transmission Control Protocol	It sends data safely and checks delivery.
UDP	User Datagram Protocol	It sends data fast but does not check delivery properly.

Important Terms

Term	Meaning
Multiplexing	It allows many applications to send data at the same time.
Segmentation	It breaks large data into small segments.
Sequencing	It gives numbers to segments so they can be joined in correct order.

Handshake

- Handshake is a process where two devices agree to communicate before sending data.
 - UDP does not use handshake.
 - UDP sends data directly.
 - UDP is faster but less reliable.
-

3. Internet Layer

- It is equal to Network Layer.
- Data unit: Packet
- It adds IP address to data.
- It finds the best path for data.
- It sends data between different networks.
- It uses router to forward packets.
- It handles IPv4 and IPv6 addresses.
- It supports connectionless communication.

Protocol Examples

Protocol	Full Form	Work
IP	Internet Protocol	It gives address to data and sends it to the correct device.
IPv4	Internet Protocol version 4	It is an older IP address system.
IPv6	Internet Protocol version 6	It is a newer IP address system with more addresses.

ARP	Address Resolution Protocol	It finds MAC address using IP address.
ICMP	Internet Control Message Protocol	It sends error and control messages in a network.
IGMP	Internet Group Management Protocol	It manages group communication in a network.

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4. Network Access Layer

- It is equal to Data Link + Physical Layer.
- It is also called Network Interface Layer.
- Data unit: Frame + Bits
- It adds MAC address for local network.
- It sends data inside the same network.
- It changes data into signals.
- It detects errors.
- It uses cable, Wi-Fi, and switches.
- It works with NICs.

Full Forms and Examples

Term	Full Form	Work
NIC	Network Interface Card	It helps a computer connect to a network.
MAC Address	Media Access Control Address	It identifies a device inside a local network.
ATM	Asynchronous Transfer Mode	It is used for high-speed data transfer.

ISDN	Integrated Services Digital Network	It sends voice and data over digital telephone lines.
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Quiz-5


1. What does TCP/IP stand for?

- a) Transmission Control Protocol / Internet Protocol
- b) Transfer Communication Protocol / Internet Process
- c) Transport Control Process / Internal Protocol
- d) Transfer Control Pathway / Internet Program

2. How many layers does the TCP/IP model have?

- a) 4
- b) 5
- c) 6
- d) 7

3. Who developed the TCP/IP model?

- a) ISO
 - b) IEEE
 - c) U.S. Department of Defense (DoD)
 - d) W3C
- 

4. Which layer of the TCP/IP model is responsible for web browsing and email?

- a) Transport Layer
- b) Network Access Layer
- c) Internet Layer
- d) Application Layer

5. Which layer ensures reliable communication between devices?

- a) Application Layer
- b) Transport Layer
- c) Internet Layer
- d) Network Access Layer

6. What is the equivalent of the TCP/IP Internet Layer in the OSI model?

- a) Transport Layer
- b) Network Layer
- c) Data Link Layer
- d) Physical Layer

7. What protocol is used at the Transport Layer for reliable data transfer?

- a) UDP
- b) HTTP
- c) TCP
- d) FTP

8. Which layer is responsible for IP addressing and routing?

- a) Application Layer
- b) Internet Layer
- c) Transport Layer
- d) Network Access Layer

9. What is the main function of the Network Access Layer?

- a) To manage end-to-end communication
- b) To find the best route for data
- c) To handle physical transmission of data
- d) To encrypt and compress data

10. Which of the following protocols is NOT part of the TCP/IP model?

- a) FTP
- b) ICMP
- c) HTTP
- d) OSI

11. What type of data unit is used in the Internet Layer?

- a) Bits
- b) Frames
- c) Packets
- d) Segments

12. What layer is responsible for managing MAC addresses and physical hardware?

- a) Transport Layer
- b) Internet Layer
- c) Network Access Layer
- d) Application Layer

13. What protocol is commonly used for sending emails?

- a) HTTP
- b) SMTP
- c) IP
- d) UDP

14. Why is the TCP/IP model important?

- a) It makes the internet work
- b) It only works with small networks
- c) It replaces the OSI model completely
- d) It is used only for Wi-Fi networks

15. What is a key feature of the TCP/IP model?

- a) It is complex and hard to use
- b) It is not used in real-world applications
- c) It has only 4 layers, making it simple and practical
- d) It is slower than the OSI model

Q.No	Answer
1	a
2	a
3	c
4	d
5	b
6	b
7	c
8	b
9	c
10	d

11	c
12	c
13	b
14	a
15	c

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Modes of Data Transmission

1 Simplex Mode (One-Way Communication)



- Definition: Data flows in only one direction.
- Characteristics:
 - One device sends, and the other only receives.
 - No return communication is possible.
- Examples:
 - TV Broadcast
 - Keyboard to computer
 - Factory data collection terminals
- Limitations:
 - No feedback or acknowledgment.
 - Errors cannot be corrected.

② Half-Duplex Mode (Two-Way, But One at a Time)



Definition: Data flows in both directions, but only one direction at a time.

Characteristics:

- Communication alternates between sending and receiving.
- Requires two wires (two separate channels for sending and receiving data).

Examples:

- Walkie-Talkie

Limitations:

- Turn-around time (delay when switching between transmitting and receiving).
- Slower than full-duplex for high-speed applications.

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③ Full-Duplex Mode (Two-Way, Same Time)




- Definition: Data flows simultaneously in both directions.
- Characteristics:
 - Both devices send and receive data at the same time.
 - Requires four wires (four channels, two for sending and two for receiving).
 - Eliminates the need for "turn-around" time (no delay between sending and receiving).
 - Significantly improves communication efficiency.
- Examples:
 - Mobile calls
 - High-speed data applications
 - Computer-to-computer communication

-
- Advantages:
 - Ideal for applications needing high efficiency.
 - Reduces communication delays.
 - Limitations:
 - Costly and complex – needs advanced hardware.
 - Interference – signals may clash.

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Communication in IoT: Wired and Wireless Connectivity

Wired Networks

- **Definition:** Uses physical cables like Ethernet for transferring data.
 - **Characteristics:**
 - Reliable and secure communication.
 - Less interference compared to wireless networks.
 - Supports high-speed communication at lower costs.
 - Equipment is less affected by external interference.
- 

- Cables Used:

- Copper wires/Coaxial cable.
- Twisted pairs.
- Fiber-optic cables.

- Applications:

- Factory machines.
- Corporate office networks.
- Hybrid systems where wireless devices connect to wired networks.

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Wireless Networks

- Definition: Uses electromagnetic waves or infrared waves for communication, no physical wires.
- Characteristics:
 - Devices use antennas or sensors for signal reception.
 - Uses radio frequency waves for voice and data transmission.
- Examples of Wireless Devices:
 - Mobile phones.
 - Wireless sensors.
 - TV remotes.
 - Laptops with WLAN cards.
- Technologies Used:
 - RFID ,Bluetooth.,BLE ,WiFi,ZigBee etc

Key Differences Between Wired and Wireless Media

Aspect	Wired Media	Wireless Media
Type	Bounded (uses cables, fiber-optic)	Unbounded (uses radio, electromagnetic waves)
Interference	Less likely to experience interference	More prone to interference (e.g., from walls, other devices)
Cost	Generally lower for data transfer	Higher due to advanced infrastructure (e.g., towers, satellites)
Mobility	Fixed connectivity (tied to physical location)	High mobility and flexibility (devices can move freely)

Quiz- 6

1. Which mode allows data to flow in only one direction?
 - A. Full-Duplex
 - B. Half-Duplex
 - C. Simplex
 - D. Wireless
 2. Which of the following is an example of Full-Duplex communication?
 - A. TV Broadcast
 - B. Walkie-Talkie
 - C. Mobile Phone Call
 - D. Keyboard to Computer
 3. What is the main limitation of Simplex communication?
 - A. Expensive
 - B. No return communication
 - C. Too slow
 - D. Needs 4 wires
- 

4. Which mode allows data flow in both directions but not at the same time?

- A. Simplex
- B. Full-Duplex
- C. Half-Duplex
- D. Multiplex

5. Which type of network uses physical cables for data transmission?

- A. Wireless Network
- B. Cloud Network
- C. Fiber Network
- D. Wired Network

6. Which of the following is a wireless communication technology?

- A. Coaxial Cable
- B. Fiber-optic Cable
- C. Bluetooth
- D. Twisted Pair

7. What is the main advantage of Full-Duplex over Half-Duplex?

- A. Lower cost
- B. Slower speed
- C. Communication happens at same time
- D. Uses fewer wires

8. Which cable type is commonly used in wired networks?

- A. Infrared
- B. Fiber-optic
- C. Microwave
- D. Satellite

9. Which one is more prone to signal interference?

- A. Wired Media
- B. Wireless Media
- C. Copper Cable
- D. Fiber-optic Cable

10. Why is wireless media considered more mobile than wired media?

- A. It uses fiber cables
- B. It is slower
- C. Devices can move freely
- D. It is always connected

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Answers

Q.No.	Answer
1	C
2	C
3	B
4	C
5	D
6	C
7	C
8	B
9	B
10	C

Transmission Media

Meaning of Transmission Media

Transmission media is the path through which data travels from one device to another device.

Transmission media is divided into two types:


1. Guided Media — Wired transmission
 2. Unguided Media — Wireless transmission
-

1. Guided Media

Wired Transmission

Guided media uses physical cables to transfer data between devices.

Characteristics

- It is more reliable than wireless media.
 - It is more secure.
 - It gives high-speed data transfer.
 - It has less interference.
 - It is not affected by weather.
- 

-
- It needs physical cable setup.
 - Mobility is limited because cables are used.
-

Types of Guided Media

1. Twisted Pair Cable
 2. Coaxial Cable
 3. Fiber Optic Cable
-

1. Twisted Pair Cable

Twisted pair cable has two copper wires twisted together.

The wires are twisted to reduce interference.

Examples

- Landline telephone cable
 - Ethernet cable
 - LAN cable
-

Types of Twisted Pair Cable

1. UTP

Unshielded Twisted Pair

- It does not have extra shielding.
- It is mostly used in homes and offices.
- It is cheaper and easy to install.
- It is used for internet and LAN connection.

2. STP

Shielded Twisted Pair

- It has extra shielding.
- It protects data from noise and interference.
- It is used in noisy places.
- It is used in factories and data centers.

Applications of Twisted Pair Cable

- Local telephone communication
 - Digital data transmission over short distance
 - LAN connection
 - Internet connection in homes and offices
-

Advantages of Twisted Pair Cable

- It is low cost.
 - It is easily available.
 - It is easy to install.
 - It can send analog and digital signals.
 - If one part has a problem, the whole network does not stop.
-

Disadvantages of Twisted Pair Cable

- It has limited bandwidth.
 - Speed is low compared to other cables.
 - Signal quality becomes weak over long distance.
 - It is affected by noise and interference.
-

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Important Terms

Interference

Interference means signal problem caused by nearby wires, machines, or electrical devices.

Resistance to Interference

Resistance to interference means how well a cable can stop signal problems.

2. Coaxial Cable

Coaxial cable has a copper core covered with insulation and metal shielding.

It reduces signal loss and protects data from interference.

Example

- Cable TV connection
-

Structure of Coaxial Cable

1. Inner Copper Core
It carries the signal.
 2. Insulating Material
It separates the inner core from the outer conductor.
 3. Outer Metal Mesh Conductor
It protects the signal from noise.
 4. Plastic Protective Layer
It protects the cable from outside damage.
-

Types of Coaxial Cable

1. 50 Ohm Cable
 - It is used for digital data.
 - It is used in computer networks.
 2. 75 Ohm Cable
 - It is used for analog signals.
 - It is used in cable TV.
-

Types of Coaxial Transmission

1. Baseband Coaxial Cable

- It sends a single signal at a time.
- It is used for digital signaling.
- It is used in LANs.
- Frequency is up to 4 kHz.
- It sends one data channel at a time.

2. Broadband Coaxial Cable

- It sends multiple signals at the same time.
- It uses different frequencies.
- Frequency is above 4 kHz.
- It is used for analog signals.
- It requires a modem.

Applications of Coaxial Cable

- Cable TV networks
 - Old Ethernet LANs
 - Telephone networks
 - Analog and digital communication
-

3. Fiber Optic Cable

Fiber optic cable uses light signals to send data.

It uses glass or plastic fiber instead of copper wire.

Examples

- JioFiber
 - Airtel Xstream
 - High-speed internet fiber connection
-

Structure of Fiber Optic Cable

1. Jacket / Sheath

- It is the outer protective cover of the cable.
- It protects the fiber from damage.

2. Cladding

- It surrounds the fiber core.
- It helps light stay inside the cable.

3. Fiber Core

- It is the central part of the cable.
 - Light travels through this part.
- 

Important Units in Fiber Optic Cable

Micron

- Micron is used to measure fiber thickness.
- Symbol of micron is μm .
- 1 micron is a very small size.
- Fiber core is usually 8–10 microns.

Easy Meaning

Micron means the size of the fiber pipe.

Example:

Human hair is around 70 microns thick, but fiber core is only 8–10 microns.

Nanometer

- Nanometer is used to measure light wavelength.
- Symbol of nanometer is nm.
- 1 micron = 1000 nanometers.
- It is used for light signals inside fiber.

Easy Meaning

Nanometer means the size of light wave.



Wavelength

Wavelength means the size of a light wave.

Fiber optic cable uses light to send data.
Different wavelengths are used for better transmission.

Simple Trick

- Micron = size of fiber pipe
 - Nanometer = size of light wave
 - Wavelength = type or size of light wave
-

Types of Fiber Optic Cable


1. Single Mode Fiber

SMF — Single Mode Fiber

Single Mode Fiber is also called Monomode Fiber.

In this fiber, light travels in one straight path.

Core Size

- 8–10 microns
 - Very thin core
- 

Wavelength

- 1310 nm
- 1550 nm

Use

- Long-distance communication
- High-speed networks

Simple Logic

The core is very thin, so light travels straight.
That is why it is used for long distance and high speed.

2. Multimode Fiber

MMF — Multimode Fiber

In Multimode Fiber, light travels in many paths.

Light bounces inside the cable.

Wavelength

- 850 nm
- 1300 nm

Use

- Short-distance communication
- 

-
- Networking systems
 - LANs

Simple Logic

The core is thicker, so light travels in many paths.
That is why it is mainly used for short distance.

Types of Multimode Fiber

1. Step Index Fiber

In Step Index Fiber, the core and cladding have a sudden change.

Working

- Light travels in a zig-zag path.
- Light bounces sharply inside the cable.
- Signal becomes weak.
- Speed is slow.
- Performance is low.

Easy Example

Imagine throwing a ball inside a box.
The ball hits the walls again and again.

In the same way, light bounces sharply in Step Index Fiber.

2. Graded Index Fiber

In Graded Index Fiber, the core has multiple layers.

Working

- Light travels in a smooth curved path.
- Light does not bounce sharply.
- Signal remains strong.
- Speed is fast.
- Performance is better.
- It has less signal loss.

Easy Example

Imagine driving on a smooth curved road.

There are no sharp turns, so speed remains good.

In the same way, light moves smoothly in Graded Index Fiber.

Applications of Fiber Optic Cable


- High-speed internet
 - High-speed networking devices
- 

-
- High-speed servers
 - Workstations
 - Long-distance communication
-

Advantages of Fiber Optic Cable

- It sends data very fast.
 - It supports long-distance communication.
 - It has very low signal loss.
 - It is not affected by electrical noise.
 - It gives high bandwidth.
-

Disadvantages of Fiber Optic Cable

- It is expensive.
 - It is fragile.
 - It can break easily.
 - It is difficult to install.
 - It needs special tools and skilled workers.
-
- 

Cable Media Comparison

EMI

Electromagnetic Interference

EMI means noise or disturbance in signal caused by electrical devices.

1. Cost

- UTP is the cheapest cable.
 - STP and Coaxial Cable cost more than UTP.
 - Fiber Optic Cable is the most expensive cable.
-

2. Installation

- UTP is very easy to install.
 - STP and Coaxial Cable are also easy, but not as easy as UTP.
 - Fiber Optic Cable is difficult to install.
-




3. Bandwidth / Speed Capacity

- UTP supports 1 to 155 Mbps, usually 10 Mbps.
 - STP supports 1 to 155 Mbps, usually 100 Mbps.
 - Coaxial Cable usually supports 100 Mbps.
 - Fiber Optic Cable supports 2 Gbps, so it has the highest speed.
-

4. Attenuation / Signal Loss

- UTP has high signal loss and works for only a few hundred meters.
 - STP also has high signal loss and works for a few hundred meters.
 - Coaxial Cable has lower signal loss and can work for a few kilometers.
 - Fiber Optic Cable has the lowest signal loss and can work for tens of kilometers.
-

5. Noise / EMI

- UTP is affected by EMI the most.
 - STP is less affected than UTP because it has shielding.
- 

-
- Coaxial Cable is also less affected than UTP because it has better shielding.
 - Fiber Optic Cable is not affected by EMI because it uses light instead of electricity.
-

2. Unguided Media

Wireless Transmission

Unguided media uses electromagnetic waves to transfer data without cables.

It uses radio waves, microwaves, and infrared waves.

Characteristics

- No cables are needed.
 - Installation is easy.
 - It is portable and flexible.
 - Devices can move easily.
 - It has more interference than wired media.
 - It is used in IoT, mobile networks, and remote communication.
-



Advantages of Wireless Media

- It supports high bandwidth.
 - It has low attenuation.
 - It is lightweight.
 - It is useful where cables are difficult to install.
 - It is useful for mobile communication.
 - It supports remote communication.
-

Disadvantages of Wireless Media

- Installation and equipment can be expensive.
 - It requires skilled workers.
 - It is affected by interference.
 - Security can be a problem if not managed properly.
-

Types of Unguided Media

1. Radio Waves
 2. Microwaves
 3. Infrared Waves
-



Frequency Range of Unguided Media

Type	Frequency Range
Radio Waves	10 kHz to 1 GHz
Microwaves	1 GHz to 300 GHz
Infrared Waves	300 GHz to 400 THz

1. Radio Waves

Radio waves are electromagnetic waves used for long-distance communication.

Frequency Range

- 10 kHz to 1 GHz

Direction

- Omnidirectional
- 

Meaning of Omnidirectional

Omnidirectional means signals spread in all directions.

Radio Wave Bands

Band	Full Form
VLF	Very Low Frequency
LF	Low Frequency
MF	Medium Frequency
VHF	Very High Frequency

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VHF Data

VHF

Very High Frequency

- Range: 30 MHz to 300 MHz
 - Wavelength: 1 m to 10 m
-

Characteristics of Radio Waves

- They are easy to generate.
 - They can travel long distances.
 - They can pass through buildings.
 - They spread in all directions.
 - Some bands have low bandwidth.
-

Uses of Radio Waves

- FM Radio
 - Television
 - Paging
 - Cordless phones
 - Marine communication
-



2. Microwaves

Microwaves are high-frequency electromagnetic waves.

Frequency Range

- 1 GHz to 300 GHz

Direction

- Line of Sight


Meaning of Line of Sight

Line of Sight means signal travels in a straight line. Both antennas should face each other clearly.

Important Data

- Repeater distance: 25 to 30 km
 - Data speed: up to 16 Gbps
 - Voice channels: up to 250,000 channels
-

Characteristics of Microwaves

- They travel in a straight line.
 - They need proper antenna alignment.
- 

-
- They have high speed.
 - They are affected by weather.
 - They are useful for long-distance communication.
-

Uses of Microwaves

- Cellular communication
 - Satellite communication
 - Television distribution
 - Wireless LAN
 - Long-distance phone calls
-

Repeater Data

- Repeaters are used after 25–30 km.
 - Repeaters help in long-distance transmission.
 - They receive weak signals and send them again.
-

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Types of Microwave Communication Systems

There are two types of microwave communication systems:

1. Terrestrial Microwave System
2. Satellite Microwave System


1. Terrestrial Microwave System

Terrestrial Microwave System is a ground-based communication system.

Main Points

- It uses parabolic antennas.
- It works in low GHz range.
- It needs line of sight.
- It is used when cable installation is difficult.
- It is used for tower-to-tower communication.

Examples

- Hilly areas
 - River crossing areas
 - Long-distance communication
- 

2. Satellite Microwave System

Satellite Microwave System uses satellites in space.

Main Points

- It uses a satellite in space.
- It works in low GHz range.
- It needs line of sight.
- Satellite is placed about 36,000 km above the earth.
- Satellite remains fixed relative to earth.
- It is used for very long-distance communication.

Simple Meaning

Data goes from earth to satellite and then satellite sends it back to earth.

Quick Revision

Type	Simple Meaning
Terrestrial Microwave	Tower to tower communication
Satellite Microwave	Earth to satellite to earth communication

3. Infrared Waves

Infrared waves are short-range wireless waves.

Frequency Range

- 300 GHz to 400 THz

Range

- Short distance

Direction

- Line of Sight

Penetration



-
- It cannot pass through walls.
-

Characteristics of Infrared Waves

- It is used for short-distance communication.
 - It is directional.
 - It cannot pass through solid objects.
 - It is secure for short-range communication.
 - It does not require a license.
-


Uses of Infrared Waves

- TV remote
 - Wireless mouse
 - Wireless keyboard
 - Short-range communication devices
 - Laptops
 - Wireless LANs
-


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Factors Affecting Network Selection

- ✓ **Network Range** – How far devices need to communicate.
 - ✓ **Bandwidth** – How fast data needs to be transferred.
 - ✓ **Power Usage** – How much energy the network consumes.
 - ✓ **Interoperability** – How well it works with other devices.
 - ✓ **Intermittent Connectivity** – If it can handle unstable connections.
 - ✓ **Security** – How much protection is needed for data.
- 

Quiz-8

1. Which of the following is an example of unguided transmission media?
 - A. Twisted Pair
 - B. Coaxial Cable
 - C. Infrared Waves
 - D. Fiber-Optic Cable
 2. Which wireless wave type is used in TV remotes and short-range communication?
 - A. Radio Waves
 - B. Microwaves
 - C. Infrared Waves
 - D. Bluetooth
 3. Which waves are omnidirectional and can pass through buildings?
 - A. Microwaves
 - B. Infrared Waves
 - C. Laser Beams
 - D. Radio Waves
- 

4. What is a disadvantage of microwave transmission?

- A. Cannot be directed
- B. Easily passes through walls
- C. Affected by weather
- D. Used for only short-range

5. Which of the following waves requires precise alignment between antennas?

- A. Radio Waves
- B. Microwaves
- C. Infrared Waves
- D. Gamma Rays

6. Which wireless communication type is most affected by weather conditions?

- A. Infrared
- B. Fiber-Optic
- C. Radio
- D. Microwaves

7. Which of the following cannot pass through solid objects?

- A. Radio Waves
- B. Microwaves
- C. Infrared Waves
- D. VHF Waves

8. Which of these has the shortest range?

- A. Microwaves
- B. Infrared Waves
- C. Radio Waves
- D. Satellite

9. Which type of communication is used in marine VHF systems and FM radio?

- A. Infrared
- B. Microwave
- C. Radio Waves
- D. Optical Fiber

10. Which is a key advantage of wireless media?

- A. No interference
- B. High cost
- C. No cables required
- D. Needs special installation

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Answers

Q.No.	Answer
1	C
2	C
3	D
4	C
5	B
6	D
7	C
8	B
9	C
10	C

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