📘 Internet of Things (IoT) – Unit 03

🔥 RGPV Topper-Level Notes (One Night Exam Preparation)

---

1. Basics of IoT Networking

Definition

IoT Networking is the process of connecting IoT devices, sensors, gateways and cloud systems for data communication.

Easy Introduction

IoT networking devices ko internet ya local network ke through connect karta hai taaki devices ek dusre se data exchange kar sakein.

Simple language me:

```
Device ↔ Network ↔ Cloud ↔ User
```

Why This Topic is Important

Without networking:

❌ Devices communicate nahi kar sakte
❌ Cloud monitoring possible nahi hoti

❌ Smart systems work nahi karenge

Detailed Explanation

IoT networking me different communication technologies use hoti hain:

Technology	Use
Wi-Fi	Internet connection
Bluetooth	Short range
ZigBee	Low power IoT
RFID	Identification
NFC	Very short range communication
6LoWPAN	IPv6 for low power devices

Working / Steps

1. Sensor data collect karta hai
2. Node network se connect hota hai
3. Data gateway/cloud ko bheja jata hai
4. User mobile/app me data dekhta hai

Diagram

```
Sensor → Node → Gateway → Internet → Cloud → User
```

Advantages

✅ Device connectivity

✅ Real-time communication

✅ Remote monitoring

✅ Automation support

Disadvantages

❌ Security risk

❌ Network congestion

❌ Power consumption

Applications

- Smart homes
- Smart agriculture
- Smart city
- Industrial IoT

Important Keywords

Connectivity, Communication Protocol, Gateway, Wireless Communication

---

Conclusion

IoT networking smart communication ka base hai jo devices ko internet aur cloud se connect karta hai.

---

2. IoT Components

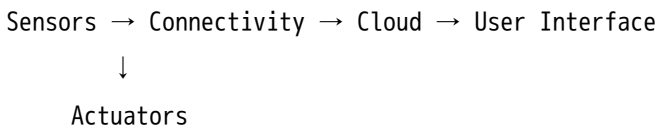
Definition

IoT Components are the basic parts required to build an IoT system.

Main Components of IoT

Component	Function
Sensors	Data collection
Actuators	Perform action
Connectivity	Data transfer
Processing Unit	Data processing
Cloud	Data storage
User Interface	User interaction

Diagram



Easy Explanation

Sensor data collect karta hai → network send karta hai → cloud process karta hai → user result dekhta hai.

Applications

- Healthcare
- Smart traffic
- Smart factory

Important Keywords

Sensors, Connectivity, Cloud, Actuators, User Interface

Conclusion

IoT components milkar smart automated system banate hain.

---

3. Functional Components of IoT

Definition

Functional components are modules that perform different IoT operations.

Components

Functional Component	Work
Device	Sensing
Communication	Data transfer
Services	Data processing
Management	Monitoring
Security	Protection
Application	User interaction

Diagram

```
Device → Communication → Service → Management → Application
```

Advantages

✅ Organized architecture

✅ Better security

✅ Efficient communication

Important Keywords

Functional Blocks, Security, Device Management, Communication

---

4. IoT Service Oriented Architecture (SOA)

Definition

IoT SOA is an architecture where IoT services are provided as reusable independent services.

Easy Introduction

SOA me different services separately available hoti hain and applications unhe use karti hain.

Layers of SOA

Layer	Work
Sensing Layer	Data collection
Network Layer	Data transfer
Service Layer	Service management
Interface Layer	User interaction

Diagram

```
Application Layer
        ↑
Service Layer
        ↑
Network Layer
        ↑
Sensing Layer
```

Advantages

✅ Reusable services
✅ Scalability
✅ Easy integration

Disadvantages

❌ Complex management
❌ Security challenges

Applications

- Smart city
- Cloud IoT platforms
- Industrial IoT

Important Keywords

SOA, Reusable Services, Service Layer, Scalability

---

5. IoT Challenges

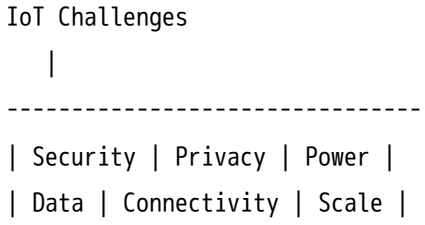
Definition

IoT challenges are problems faced during development and deployment of IoT systems.

Main Challenges

Challenge	Meaning
Security	Hacking risk
Privacy	Personal data leakage
Scalability	Large devices management
Interoperability	Different devices compatibility
Power Consumption	Battery issue
Connectivity	Network issues
Data Management	Huge data handling

Diagram



Advantages of Solving Challenges

✅ Reliable system

✅ Better security

✅ Efficient communication

Important Keywords

Security, Privacy, Scalability, Interoperability

Conclusion

IoT challenges ko solve karna reliable and secure IoT systems ke liye important hai.

---

6. 6LoWPAN

Definition

6LoWPAN means IPv6 over Low Power Wireless Personal Area Network.

Easy Introduction

Ye low-power IoT devices ko IPv6 network se connect karta hai.

Why Needed?

IoT devices small aur low power hote hain. Direct IPv6 use karna difficult hota hai. 6LoWPAN lightweight solution deta hai.

Working

1. Sensor data generate karta hai
2. 6LoWPAN protocol packet compress karta hai
3. Wireless network se send hota hai
4. IPv6 internet me communicate karta hai

Diagram

```
IoT Device → 6LoWPAN → IPv6 Network → Internet
```

Advantages

✅ Low power consumption
✅ IPv6 support
✅ Efficient communication

Disadvantages

❌ Limited bandwidth
❌ Complex routing

Applications

- Smart homes
- Smart metering
- WSN systems

Important Keywords

IPv6, Low Power, Packet Compression, WPAN

---

7. IEEE 802.15.4

Definition

IEEE 802.15.4 is a standard for low-rate wireless personal area networks.

Features

Feature	Description
Low power	Battery saving
Low cost	Cheap implementation
Short range	Small area communication
Low data rate	Suitable for sensors

Diagram

```
Sensor Nodes ↔ IEEE 802.15.4 ↔ Gateway
```

Applications

- ZigBee
- Smart sensors
- Home automation

Important Keywords

LR-WPAN, Low Power, Wireless Communication

---

8. ZigBee and Its Types

Definition

ZigBee is a low-power wireless communication protocol used in IoT networks.

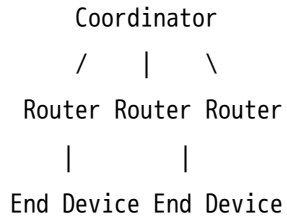
ZigBee Device Types

Type	Work
Coordinator	Controls network
Router	Data forwarding
End Device	Final sensing device

ZigBee Network Types

Type	Structure
Star	Central coordinator
Mesh	Multi-path communication
Tree	Hierarchical structure

Diagram



Advantages

✅ Low power

✅ Cheap

✅ Reliable mesh network

Disadvantages

❌ Low data rate

❌ Limited range

Applications

- Smart homes
- Industrial automation
- Sensor networks

Important Keywords

Coordinator, Router, End Device, Mesh Topology

---

9. RFID Features

Definition

RFID (Radio Frequency Identification) is a wireless technology used for object identification using radio waves.

RFID Features

Feature	Meaning
Wireless	No physical contact

Feature	Meaning
Fast scanning	Quick identification
Automatic tracking	Real-time monitoring
Unique ID	Every tag unique

Diagram

```
RFID Tag ↔ RFID Reader ↔ Database
```

Applications

- Inventory tracking
- Smart toll systems
- Library systems

Important Keywords

RFID Tag, RFID Reader, Wireless Identification

---

10. RFID Working Principle

Working Steps

1. RFID reader emits radio signal
2. RFID tag receives signal
3. Tag sends unique ID
4. Reader receives data
5. Database verifies object

Diagram

```
Reader → Radio Signal → RFID Tag
Tag → ID Data → Reader → Database
```

Advantages

✅ Fast identification

✅ No line-of-sight needed

✅ Automatic tracking

Disadvantages

❌ Security risk

❌ Costly compared to barcode

Applications

- Supply chain
- Smart cards
- Attendance system

---

11. NFC (Near Field Communication)

Definition

NFC is a short-range wireless communication technology.

Range

Usually less than 10 cm.

Working

Two NFC devices nearby aate hain and data exchange karte hain.

Diagram

```
Phone ↔ NFC Tag
```

Applications

- Google Pay
- Smart cards
- Contactless payment

Advantages

✅ Fast
✅ Secure
✅ Easy to use

Disadvantages

❌ Very short range
❌ Low data transfer rate

Important Keywords

Short Range, Contactless Communication, Secure Payment

---

12. Bluetooth

Definition

Bluetooth is a short-range wireless communication technology.

Features

Feature	Meaning
Low power	Battery efficient
Short range	Nearby communication
Wireless	No cables

Applications

- Wireless headphones
- Smartwatch
- Smart home devices

Diagram

```
Phone ↔ Bluetooth Device
```

Advantages

✅ Easy connectivity

✅ Cheap

✅ Low power

Disadvantages

❌ Limited range

❌ Speed lower than Wi-Fi

Important Keywords

Wireless Communication, Pairing, Low Power

---

13. Wireless Sensor Networks (WSN)

Definition

WSN is a network of sensor nodes that communicate wirelessly.

Components

Component	Work
Sensor Node	Data collection
Gateway	Data transfer
Base Station	Data processing

Diagram

```
Sensor Nodes → Gateway → Base Station
```

Applications

- Forest fire detection
- Military monitoring
- Smart farming
- Healthcare

Advantages

✅ Remote monitoring
✅ Easy deployment
✅ Real-time sensing

Disadvantages

❌ Battery limitation
❌ Security issues

Important Keywords

Wireless Sensor Network, Sensor Node, Gateway, Base Station

🔥 MOST IMPORTANT TOPICS

⭐ ZigBee
⭐ RFID

⭐ 6LoWPAN

⭐ WSN

⭐ IoT Challenges

⭐ IEEE 802.15.4

⭐ MOST IMPORTANT 7-MARK QUESTIONS

1. Explain 6LoWPAN in detail.
2. Explain IEEE 802.15.4 protocol.
3. Explain ZigBee architecture and types.
4. Explain RFID features and working principle.
5. Explain NFC technology.
6. Explain Bluetooth technology.
7. Explain Wireless Sensor Networks and applications.
8. Explain IoT challenges.

⭐ MOST IMPORTANT 14-MARK QUESTIONS

1. Explain ZigBee architecture and network types with neat diagram.
2. Explain RFID working principle and applications in detail.
3. Explain WSN architecture and applications.
4. Explain IoT networking technologies in detail.
5. Explain IoT service-oriented architecture with diagram.

🎯 PYQ-BASED EXPECTED QUESTIONS

⭐ Very High Probability

✅ ZigBee
✅ RFID
✅ MQTT/CoAP related networking
✅ WSN
✅ IEEE 802.15.4

⭐ High Probability

✅ NFC
✅ Bluetooth
✅ IoT Challenges
✅ 6LoWPAN

⭐ Medium Probability

✅ SOA
✅ Functional Components
✅ IoT Networking Basics

⚡ ONE-NIGHT REVISION NOTES

Topic	Quick Revision
ZigBee	Low-power mesh protocol
RFID	Radio-based identification
NFC	Very short-range communication
Bluetooth	Short-range wireless
WSN	Wireless sensor network
6LoWPAN	IPv6 for low power devices

Topic	Quick Revision
IEEE 802.15.4	Low-rate wireless standard

🧠 MEMORY TRICKS

ZigBee Devices

👉 “CRE”

- C = Coordinator
- R = Router
- E = End Device

IoT Challenges

👉 “SPCID”

- S = Security
- P = Privacy
- C = Connectivity
- I = Interoperability
- D = Data Management

RFID Components

👉 “TRD”

- T = Tag
- R = Reader
- D = Database

📌 SMART STUDY PLAN

2-Hour Revision Strategy

Time	Topic
20 min	ZigBee
20 min	RFID
20 min	WSN
20 min	6LoWPAN
20 min	IEEE 802.15.4
20 min	NFC + Bluetooth

🚀 TOPPER ANSWER WRITING TIPS

✅ Draw diagrams in every networking question
✅ Make comparison tables
✅ Underline keywords
✅ Write protocol full forms
✅ Mention applications separately

🎯 FINAL EXAM PREDICTION

MOST EXPECTED LONG QUESTION

⭐ “Explain ZigBee architecture and types.”

MOST EXPECTED THEORY QUESTION

⭐ “Explain RFID working principle and applications.”

MOST EXPECTED SHORT NOTE

⭐ “NFC”

⭐ “Bluetooth”

⭐ “6LoWPAN”