

Internet of Things – Unit 1

RGPV Topper-Level Exam Notes

1. IoT Definition

Definition

Internet of Things is a network of physical objects connected to the internet that can collect, exchange and process data using sensors, software and communication technologies.

Easy Introduction

IoT ka simple meaning hai:

Things + Internet = Smart Things

Example: smart watch, smart TV, smart bulb, smart home, smart car.

Why This Topic is Important

IoT modern technology ka base hai. Iska use health, agriculture, home automation, industry, transport, smart city etc. me hota hai.

Detailed Explanation

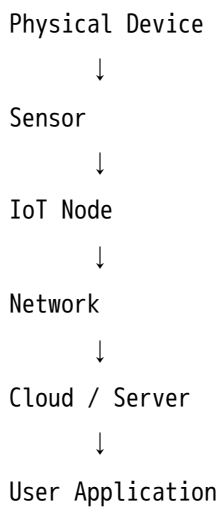
IoT me normal physical devices ko internet se connect kiya jata hai. Ye devices sensors se data collect karte hain, network se data bhejte hain, aur system decision leta hai.

Working / Steps

1. Sensor data collect karta hai.

2. Data IoT device ya node me process hota hai.
3. Data network ke through cloud/server tak jata hai.
4. Cloud data analyze karta hai.
5. Output user app/dashboard par show hota hai.
6. Actuator action perform kar sakta hai.

Diagram / Flowchart



Example

Smart AC room temperature sense karta hai. Temperature high ho to AC automatically cooling start kar deta hai.

Advantages

- Automation
- Remote monitoring
- Time saving
- Better decision making
- Cost reduction

Disadvantages

- Security risk
- Privacy issue
- Internet dependency
- High setup cost

Applications

- Smart home
- Smart city
- Healthcare
- Agriculture
- Industry automation
- Transport

Important Keywords for Exam

Sensors, Actuators, Connectivity, Cloud, Automation, Smart Devices, Data Exchange

Conclusion

IoT physical world ko digital world se connect karta hai and devices ko smart banata hai.

2. Characteristics of IoT

Definition

Characteristics of IoT are the important features that define how IoT systems work and behave.

Easy Introduction

IoT devices normal devices se different hote hain because they can sense, connect, communicate and act automatically.

Important Characteristics

Characteristic	Easy Meaning
Connectivity	Devices internet se connected
Sensing	Sensors data collect karte hain
Intelligence	System smart decision leta hai
Dynamic Nature	Environment ke according change
Scalability	Many devices add ho sakte hain
Security	Data protection required
Heterogeneity	Different devices work together
Automation	Manual work kam hota hai

Detailed Explanation

1. Connectivity

IoT devices internet, Wi-Fi, Bluetooth, Zigbee, 4G/5G se connect hote hain.

2. Sensing

Sensor temperature, motion, light, pressure etc. measure karta hai.

3. Intelligence

IoT system data analyze karke decision leta hai.

4. Heterogeneity

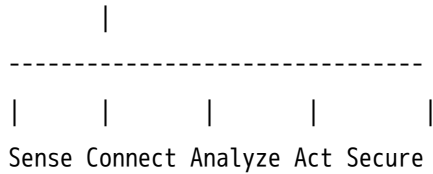
Different types ke devices ek system me kaam kar sakte hain.

5. Scalability

System me thousands devices connect ho sakte hain.

Diagram

IoT Characteristics



Example

Smart agriculture system soil moisture sense karta hai, cloud data analyze karta hai, aur motor automatically start karta hai.

Advantages

- Better automation
- Smart decision
- Easy monitoring
- Large-scale connectivity

Important Keywords

Connectivity, Sensing, Intelligence, Scalability, Heterogeneity, Security

Conclusion

IoT characteristics devices ko smart, connected and automated banate hain.

3. IoT Conceptual and Architectural Framework

Definition

IoT conceptual framework explains the basic idea and components of IoT, while architectural framework explains the layered structure of an IoT system.

Easy Introduction

IoT system ek single device nahi hota. Isme sensors, network, cloud, application and user interface sab involved hote hain.

Detailed Explanation

IoT framework batata hai ki IoT system me data ka flow kaise hota hai.

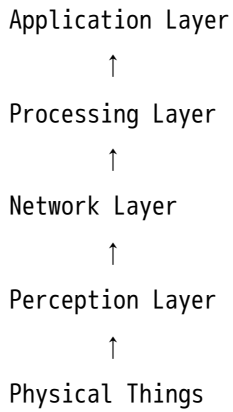
Basic IoT Framework

Things → Connectivity → Data Processing → Application

IoT Architecture Layers

Layer	Work
Perception Layer	Sensors data collect karte hain
Network Layer	Data transfer hota hai
Processing Layer	Cloud/data processing
Application Layer	User ko service milti hai
Business Layer	Business decision and management

Diagram



Example

Smart parking system:

- sensor detects parking space
- data goes through network
- cloud processes availability
- app shows free parking

Advantages

- Clear system design
- Easy implementation
- Better management
- Layer-wise problem solving

Important Keywords

Perception Layer, Network Layer, Processing Layer, Application Layer, Data Flow

Conclusion

IoT architectural framework gives a clear layered structure for designing IoT systems.

4. Physical Design of IoT

Definition

Physical design of IoT refers to actual physical components used in an IoT system such as sensors, actuators, devices, gateways and communication hardware.

Easy Introduction

Physical design means hardware part of IoT.

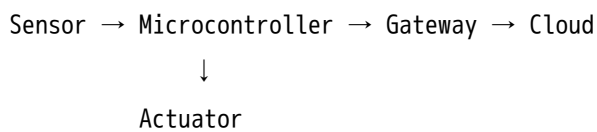
Main Physical Components

Component	Work
Sensors	Data collect
Actuators	Action perform
IoT Devices	Data process
Gateway	Devices ko internet se connect
Communication Module	Wi-Fi/Bluetooth etc.
Power Supply	Energy provide

Working

1. Sensor environment data collect karta hai.
2. Microcontroller data process karta hai.
3. Gateway internet se connect karta hai.
4. Actuator action leta hai.

Diagram



Example

Smart irrigation:

- soil moisture sensor
- Arduino/NodeMCU
- relay
- water pump

Advantages

- Real-world data collection
- Automation possible
- Remote control possible

Important Keywords

Sensor, Actuator, Microcontroller, Gateway, Communication Module

Conclusion

Physical design IoT system ka hardware structure define karta hai.

5. Logical Design of IoT

Definition

Logical design of IoT describes the functional blocks, communication models and data flow of an IoT system.

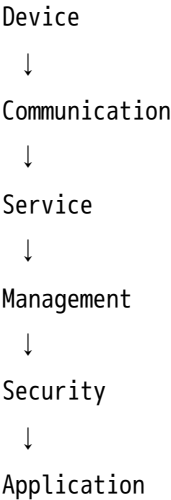
Easy Introduction

Logical design hardware nahi, system ka working logic batata hai.

Main Elements

Element	Meaning
IoT Functional Blocks	Device, communication, service
Communication Models	Request-response, publish-subscribe
APIs	Software interaction
Data Flow	Data movement

IoT Functional Blocks



Communication Models

Model	Meaning
Request-Response	Client request, server response
Publish-Subscribe	Publisher sends data, subscriber receives
Push-Pull	Producer pushes, consumer pulls
Exclusive Pair	One-to-one connection

Example

Smart weather app sensor publishes temperature data. User app subscribes and receives updates.

Advantages

- Clear software structure
- Easy data flow understanding
- Better communication design

Important Keywords

Functional Blocks, API, Communication Model, Data Flow, Publish-Subscribe

Conclusion

Logical design explains how IoT system works internally and communicates.

6. IoT Enablers

Definition

IoT enablers are technologies that make IoT possible and useful.

Easy Introduction

IoT needs many technologies to work. These supporting technologies are called IoT enablers.

Important IoT Enablers

Enabler	Use
Sensors	Data collection
Cloud Computing	Data storage and processing
Big Data	Large data analysis
AI/ML	Smart decision
IPv6	Large address space
Wireless Network	Device connectivity
Embedded Systems	Smart device control
RFID	Object identification

Diagram

IoT Enablers

|

| Sensors | Cloud | AI | IPv6 | Wireless |

Example

Smart city needs sensors, cloud, AI, internet, GPS and mobile apps.

Advantages

- Smart automation
- Better connectivity
- Large scale IoT possible
- Intelligent decision making

Important Keywords

Sensors, Cloud, Big Data, AI, IPv6, RFID, Wireless Communication

Conclusion

IoT enablers provide the basic technologies required to build smart IoT applications.

7. Modern Day IoT Applications

Definition

IoT applications are real-world uses of IoT technology to make systems smart, connected and automated.

Important Applications

Area	Example
Smart Home	Smart lights, smart AC
Healthcare	Health monitoring wearable
Agriculture	Smart irrigation
Industry	Machine monitoring
Transport	Connected vehicles
Smart City	Smart parking, smart lights
Retail	Inventory tracking
Energy	Smart meter

Diagram

Example

Smart health band measures heart rate and sends data to mobile app.

Advantages

- Remote monitoring
- Automation
- Better safety
- Cost reduction
- Efficient resource use

Disadvantages

- Data privacy risk
- Security attacks
- Internet dependency
- Device cost

Important Keywords

Smart Home, Healthcare, Smart City, Smart Agriculture, Industrial IoT

Conclusion

IoT applications are transforming daily life, industries and cities by connecting physical devices to digital systems.

8. M2M Communication

Definition

Machine-to-Machine communication is direct communication between devices without human involvement.

Easy Introduction

M2M means machines talk to each other automatically.

Detailed Explanation

In M2M, devices exchange data using wired or wireless networks.

Working

Machine 1 → Network → Machine 2

Example

Vending machine automatically sends stock information to company server.

Advantages

- Automatic communication
- Less human effort
- Faster response
- Useful in industries

Disadvantages

- Limited intelligence
- Less flexible than IoT
- Mostly closed system

Applications

- Industrial automation
- Smart meters
- Vehicle tracking
- ATM monitoring

Important Keywords

Machine Communication, Automation, Device-to-Device, Remote Monitoring

Conclusion

M2M enables automatic communication between machines and forms the base of IoT.

9. IoT vs M2M

Basis	IoT	M2M
Full Form	Internet of Things	Machine to Machine
Connectivity	Internet-based	Direct/wired/wireless
Scope	Broad	Limited
Intelligence	More intelligent	Less intelligent
Cloud Use	Mostly uses cloud	May not use cloud
Human Interaction	User apps involved	Mostly machine-only
Example	Smart home	ATM status monitoring

Conclusion

M2M is device-to-device communication, while IoT is broader and internet/cloud-based smart ecosystem.

10. IoT vs WoT

Definition of WoT

Web of Things means using web standards and technologies to connect and access IoT devices.

Easy Introduction

IoT connects things to internet. WoT makes those things accessible using web technologies like HTTP, REST APIs and URLs.

Comparison Table

Basis	IoT	WoT
Meaning	Connects physical things to internet	Connects things using web standards
Focus	Device connectivity	Web-based access
Technologies	Sensors, networks, cloud	HTTP, REST, APIs
Scope	Broader	Part of IoT
Example	Smart bulb connected to internet	Smart bulb controlled using web API

Important Keywords

Web Standards, REST API, HTTP, Device Access, Web Integration

Conclusion

WoT is an extension of IoT that uses web technologies to make IoT devices easier to access and integrate.

11. IoT Reference Architecture

Definition

IoT reference architecture is a standard layered model that explains how different components of IoT interact with each other.

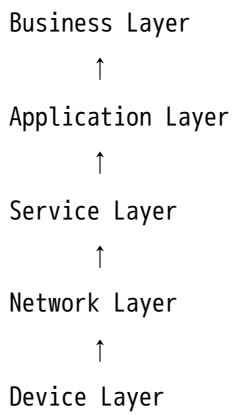
Layers

- Business Layer
- Application Layer
- Service Layer
- Network Layer
- Device Layer

Explanation

Layer	Work
Device Layer	Sensors and actuators
Network Layer	Communication
Service Layer	Data processing services
Application Layer	User applications
Business Layer	Business rules and decisions

Diagram



Advantages

- Standard design
- Easy understanding
- Better system development
- Layer-wise security possible

Important Keywords

Device Layer, Network Layer, Service Layer, Application Layer, Business Layer

Conclusion

IoT reference architecture provides a standard structure for designing scalable IoT systems.

12. IoT Network Configurations

Definition

IoT network configuration defines how IoT devices, gateways, servers and users are connected.

Types

Configuration	Meaning
Device-to-Device	Direct device communication
Device-to-Gateway	Device sends data to gateway
Device-to-Cloud	Device directly connects cloud
Back-End Data Sharing	Data shared among systems

Diagram

Device → Gateway → Cloud → Application

Example

Home sensors send data to smart hub, then hub sends data to cloud.

Advantages

- Flexible design
- Better connectivity
- Easy device management

Important Keywords

Device-to-Device, Device-to-Gateway, Device-to-Cloud, Back-End Sharing

Conclusion

IoT network configuration decides how devices communicate and exchange data.

13. IoT LAN

Definition

IoT LAN is a local area network used to connect IoT devices within a small area like home, office or building.

Example

Smart home devices connected through Wi-Fi.

Technologies

- Wi-Fi
- Bluetooth
- Zigbee
- Ethernet

Diagram

Smart Bulb

Smart Fan → Home Router → Mobile App

Smart AC

Advantages

- Fast local communication
- Low cost
- Easy setup

Disadvantages

- Limited range
- Local area only

Important Keywords

Local Network, Wi-Fi, Bluetooth, Zigbee, Home Automation

Conclusion

IoT LAN connects IoT devices in small local areas.

14. IoT WAN

Definition

IoT WAN is a wide area network used to connect IoT devices over large geographical areas.

Example

Smart city sensors connected across the whole city.

Technologies

- Cellular network
- LoRaWAN
- NB-IoT
- Satellite

Diagram

City Sensors → Cellular/LoRaWAN → Cloud → Control Center

Advantages

- Long-distance connectivity
- Useful for smart cities
- Large-scale monitoring

Disadvantages

- Higher cost
- Network dependency
- More delay than LAN

Important Keywords

Wide Area Network, LoRaWAN, NB-IoT, Cellular, Smart City

Conclusion

IoT WAN connects IoT devices spread over large areas.

15. IoT Node

Definition

IoT Node is a basic IoT device that collects data from sensors and communicates with other devices or cloud.

Components

- Sensor
- Microcontroller
- Communication module
- Power supply

Diagram

Sensor → Microcontroller → Communication Module

Example

Temperature sensor node in smart agriculture.

Important Keywords

Sensor Node, Data Collection, Microcontroller, Communication Module

Conclusion

IoT node is the basic building block of an IoT system.

16. IoT Gateway

Definition

IoT Gateway is a device that connects IoT nodes to cloud or internet and helps in data forwarding, filtering and protocol conversion.

Easy Introduction

Gateway acts like a bridge between local IoT devices and cloud.

Working

IoT Nodes → Gateway → Internet/Cloud

Functions

- Data collection
- Protocol conversion
- Security
- Filtering
- Cloud connectivity

Example

Smart home hub connects Zigbee devices to internet.

Advantages

- Connects multiple devices
- Reduces cloud load
- Improves security
- Supports protocol conversion

Important Keywords

Gateway, Protocol Conversion, Data Filtering, Cloud Connectivity, Edge Processing

Conclusion

IoT gateway connects local IoT devices with cloud and internet services.

17. IoT Proxy

Definition

IoT Proxy is an intermediate component that represents IoT devices and manages communication between devices and applications.

Easy Introduction

Proxy acts as a middleman. Application directly device se baat nahi karti; proxy ke through communicate karti hai.

Working

Application → IoT Proxy → IoT Device

Uses

- Security
- Device abstraction
- Request handling
- Data filtering

Example

A web app requests smart meter data through IoT proxy instead of directly accessing meter.

Advantages

- Better security
- Easy device management
- Hides device complexity

Important Keywords

Proxy, Middleware, Device Abstraction, Request Handling, Security

Conclusion

IoT proxy simplifies and secures communication between applications and IoT devices.

18. IPv4 vs IPv6

Definition

IPv4 and IPv6 are internet protocol versions used to assign addresses to devices connected to a network.

Easy Introduction

Every internet-connected device needs an address. IPv4 has limited addresses, while IPv6 provides a very large address space.

Comparison Table

Basis	IPv4	IPv6
Address Size	32-bit	128-bit
Address Format	Decimal	Hexadecimal
Example	192.168.1.1	2001:0db8::1
Address Space	Limited	Very large
Security	Optional	Better support

Basis	IPv4	IPv6
Header	More complex	Simplified
IoT Suitability	Limited	Highly suitable

Why IPv6 is Important for IoT

IoT has billions of devices. IPv4 cannot provide enough unique addresses. IPv6 solves this problem.

Diagram

IoT Devices → Need Unique IP → IPv6 Provides Huge Addresses

Advantages of IPv6

- Huge address space
- Better routing
- Better security support
- Suitable for IoT

Disadvantages

- Migration from IPv4 difficult
- Compatibility issues
- Requires updated devices

Important Keywords

IPv4, IPv6, 32-bit, 128-bit, Address Space, IoT Addressing

Conclusion

IPv6 is more suitable for IoT because it provides a huge number of unique IP addresses.



MOST IMPORTANT TOPICS

1. IoT Definition and Characteristics ★★★★★
 2. IoT Architecture / Reference Architecture ★★★★★
 3. Physical and Logical Design ★★★★★
 4. IoT vs M2M ★★★★★
 5. IoT vs WoT ★★★★★
 6. IoT Gateway / Node / Proxy ★★★★★
 7. IoT LAN and WAN ★★★★★
 8. IPv4 vs IPv6 ★★★★★
 9. Modern IoT Applications ★★★★★
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MOST IMPORTANT 7-MARK

QUESTIONS

1. Define IoT and explain its characteristics.
 2. Explain physical and logical design of IoT.
 3. Explain IoT architecture with diagram.
 4. Explain IoT enablers.
 5. Explain modern IoT applications.
 6. Explain M2M communication.
 7. Differentiate between IoT and M2M.
 8. Differentiate between IoT and WoT.
 9. Explain IoT gateway and IoT node.
 10. Differentiate between IPv4 and IPv6.
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★ MOST IMPORTANT 14-MARK QUESTIONS

1. Explain IoT conceptual and architectural framework with diagram.
 2. Explain physical and logical design of IoT in detail.
 3. Explain IoT reference architecture and network configurations.
 4. Explain IoT vs M2M and IoT vs WoT with comparison tables.
 5. Explain IoT LAN, WAN, Node, Gateway and Proxy.
 6. Explain IPv4 vs IPv6 and importance of IPv6 in IoT.
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PYQ-BASED EXPECTED QUESTIONS

Very High Probability

- ✓ IoT definition and characteristics
- ✓ IoT architecture / reference architecture
- ✓ IoT vs M2M
- ✓ IPv4 vs IPv6

High Probability

- ✓ Physical and logical design of IoT
- ✓ IoT gateway, node and proxy
- ✓ IoT enablers
- ✓ Modern IoT applications

Medium Probability

- ✓ IoT LAN and WAN
- ✓ IoT vs WoT

✓ IoT network configurations

✓ M2M communication

ONE-NIGHT REVISION NOTES

Topic	One-Line Revision
IoT	Things connected to internet
Sensor	Collects data
Actuator	Performs action
Gateway	Connects IoT devices to cloud
Node	Basic IoT device
Proxy	Middleman between app and device
LAN	Small area network
WAN	Large area network
M2M	Machine-to-machine communication
WoT	Web-based IoT access
IPv6	Best for billions of IoT devices

SMART STUDY PLAN

2-Hour Revision Strategy

Time	Topic
25 min	IoT definition + characteristics
25 min	IoT architecture
20 min	Physical + logical design
20 min	IoT vs M2M + IoT vs WoT
20 min	Gateway, Node, Proxy
10 min	IPv4 vs IPv6

5-Hour Preparation Strategy

Time	Topic
1 hour	IoT basics + characteristics
1 hour	Architecture + reference model
1 hour	Physical/logical design + enablers
1 hour	M2M, WoT, network configuration
1 hour	LAN/WAN/Node/Gateway/Proxy/IPv6

One-Night Priority Order

1. IoT definition and characteristics
2. IoT architecture
3. IoT reference architecture
4. Physical and logical design
5. IoT vs M2M
6. IPv4 vs IPv6
7. Gateway, Node, Proxy
8. IoT applications
9. LAN/WAN
10. IoT vs WoT



MEMORY TRICKS

IoT Basic Flow

SNCUA

- S = Sensor
- N = Network
- C = Cloud
- U = User

- A = Actuator

IoT Characteristics

CSISHAS

- C = Connectivity
- S = Sensing
- I = Intelligence
- S = Scalability
- H = Heterogeneity
- A = Automation
- S = Security

IoT Architecture

PNPAB

- P = Perception
- N = Network
- P = Processing
- A = Application
- B = Business



TOPPER ANSWER WRITING TIPS

For 7 Marks

Definition



Easy explanation



Diagram

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Example

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Advantages

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Conclusion

For 14 Marks

Introduction

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Definition

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Architecture / Components

↓

Detailed explanation

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Diagram

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Example

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Comparison table

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Applications

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Conclusion

Keywords to Underline

IoT, Sensors, Actuators, Gateway, Cloud, M2M, WoT, IPv6, LAN, WAN, Node, Proxy,

Reference Architecture

Final Tip

Agar time bahut kam hai, to sabse pehle **IoT definition + characteristics + architecture + IoT vs M2M + IPv4 vs IPv6** prepare karo. Ye Unit-1 ke sabse scoring topics hain