



Academic Year 2024 - 2025

Question Bank

Year/Semester:
III/ IV

Department: EEE

Subject Code/Title : OCS352/ IOT
CONCEPTS AND APPLICATIONS

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Unit: I/II/III/IV/V

Section: Part A/B/C

UNIT-I

INTRODUCTION TO INTERNET OF THINGS

PART A

1. Define IoT?

The internet of things, or IoT , is a network of interrelated devices that connects and exchange data with other IoT devices and the cloud.

2. What are the three IoT architecture layers?

- The client side (IoT device layer)
- Operators on the server side(IoT gateway layer)
- A pathway for connecting clients and operators(IoT platform layer)

3. List the main stages in the IoT architecture?

- Sensors and actuators
- Internet gateway and data acquisition system
- Edge IT
- Data center and cloud

4. Mention the IoT enabling technologies?

- Wireless sensor networks
- Cloud computing
- BigData Analytics
- Communication protocols
- Embedded systems

5. List the examples of WSN based of IoT system?

- Weather monitoring systems
- Indoor air quality monitoring systems
- Soil moisture monitoring systems
- Smart grids
- Surveillance systems

6. Define IoT enabling cloud computing?

Cloud computing is a computing model in which applications and services are delivered over internet. The resources provisioned by cloud can be compute, networking or storage. Cloud allows the users to access resources based on utility model.

7. What are the services provided by cloud computing?

Cloud computing offers three basic service models using which users can subscribe to cloud resource. These service models are:

- Infrastructure-As-A-Service(IAAS)
- Platform-As-A-Service(PAAS)
- Software-As-A-Service(SAAS)

8. List the four phases in architecture of IoT?

- Networked devices
- Data aggregation
- Final analysis
- Cloud analysis

9. What are the advantages of IoT?

- Cost reduction
- Efficiency and productivity
- Business opportunities
- Customer experience
- Mobility and agility

10. What are the disadvantages of IoT?

The disadvantages of IoT are as follow

- Security
- Compatibility
- Complexity
- Safety
- Policies

11. List the types of communication model in IoT?

- Request & response model
- Publisher-subscriber model
- Push-pull
- Exclusive

12. What is M2M?

Machine-to-Machine (M2M) communication, also called M2M/IoT, is a more advanced form of the internet where many devices connect with each other. Imagine a world where devices communicate without human intervention it's like they are sharing secrets.

13. What is API?

An API (Application programming interface) is a set of rules that govern how software components interact with each other.

API is typically used to allow a cloud application to access data from an IoT device or

perform remote actions.

14. List the different levels in the IoT technology stack?

- Device API's to support protocols in the communication layer such as MQTTS, HTTPS, and CoAP.
- Gateway API's to connect different devices the cloud platform.
- Server side API's often made available as REST APIs.

15. Define fog computing?

Fog computing is a decentralized computing infrastructure in which data, compute, storage and application are located somewhere between the data source and the cloud.

16. Define edge computing?

Edge computing is a distributed information technology (IT) architecture in which client data is processed at the periphery of the network, as close to the originating source as possible.

PART B

1. Enumerate the characteristics of IoT.
2. Compare and contrast fog, edge, and cloud computing in IoT.
3. Explain with an example of edge computing.
4. Discuss the fog computing with neat diagram
5. Explain in detail about the evolution of internet of things.
6. Describe the different Core IoT functional stack.
7. With neat diagram explain IoT architectures.
8. Write short notes on
 1. one m2m
 2. IoT World Forum (IoTWF)
9. Explain the following
 - 1.Simplified IoT Architecture
 - 2.Alternative IoT Models

PART C

1. Explain fog, edge, and cloud computing in IoT.
2. Discuss the IoT world forum (IoTWF) standardized Architecture.
3. Explain the architecture of one M2M
4. Illustrate the flow where IoT devices sense environmental changes, transmit the data to central hubs and use analytics tools for actionable results.

UNIT-II

COMPONENTS IN INTERNET OF THINGS

PART A

1. What are the IoT functional blocks?

- Sensor/Actuator block
- Connectivity Block
- Data Processing Block
- Application Block
- Security Block

2. Mention the uses of sensors in IoT?

- Sensors are used for sensing things and devices etc.
- A device that provides a usable output in response to a specified measurement.
- The sensor attains a physical parameter and converts it into a signal suitable for processing (e.g. electrical, mechanical, optical) the characteristics of any device or material to detect the presence of a particular physical quantity.
- The output of the sensor is a signal which is converted to a human-readable form like changes in characteristics, changes in resistance, capacitance, impedance, etc.

3. What are the Characteristics of sensor?

- Static Characteristics
- Dynamic Characteristics

4. List the types of sensors used in IoT.

- Electrical sensor
- Light sensor
- Touch sensor
- Range sensing
- Mechanical sensor

5. Define actuators

An actuator is a machine component or system that moves or controls the mechanism of the system

6. List the types of Actuators.

- Hydraulic Actuators
- Pneumatic Actuators
- Electrical Actuators
- Thermal/Magnetic Actuators
- Mechanical Actuators

7. What are the actuators function in IoT?

- Data Processing: An IoT gateway or cloud-based platform processes the data acquired

by sensors.

- **Decision Making:** Based on the desired consequence or action, the processed data is assessed and decisions are made.
- **Action:** Based on the decisions made in step 3, the IoT system sends signals to the actuators to conduct particular actions.
- **Feedback:** The actuators may provide feedback to the IoT system, such as confirmation that an operation was successfully done or an error message indicating that an action could not be completed

8. Give the limitations of Actuators in IoT.

- **Compatibility:** Actuators may not be interoperable with all IoT devices and systems, limiting their efficacy in some applications.
- **Power Consumption:** Actuators can consume a substantial amount of power, which can be a problem in IoT systems that rely on battery power or have restricted power supplies.
- **Maintenance:** Actuators require routine maintenance to guarantee good operation, which can be time-consuming and costly.

9. Give some examples of Actuators in Internet of Things.

- Smart Home Systems
- Industrial Automation
- Agriculture

10. Explain about smart objects in IoT.

Smart Object is an object that enhances interplay with not solely humans however also with different smart objects. Also recognized as smart connected products or smart connected things (SCoT), they are products, assets, and different matters embedded with processors, sensors, software program and connectivity that helps in permitting information to be exchanged between the product and its environment, and different products and systems.

11. Mention the Functionalities of Smart Objects in IoT.

- Real-time Data Acquisition within the Operational Processes
- Decentralized Information Processing and Decision Making
- Independent execution of complete business processes

12. What are the Advantages in designing IoT systems based on smart objects ?

- Energy saving is one of them. Smart objects are usually powered by battery.
- The second advantage is automation. IoT smart objects are autonomous and self-governed.
- They operate independently and can collaborate with other objects globally.

13. List the Challenges of Using Smart Objects.

- Smart objects are often constrained devices and are usually powered by battery.
- Frequently they are working in real-time mode. These are the main causes of the challenges.
- Other challenge is connectivity. Currently a large number of networking technologies

are being employed in connecting physical devices together and to the Internet.

- Security and privacy is of big concern for smart object based IoT systems.

14. What are the Examples of Smart Object in ?

- (a) connected watch
- (b) connected thermostat
- (c) connected light bulbs
- (d) smart refrigerator
- (e) voice assistant

15. List the Classification of Smart objects.

- Mobile or Static
- Low or Excessive Reporting Frequency
- Battery-Powered or Power-Connected
- Simple or Rich Data

16. What are the key applications of Control Units in IoT devices?

- Embedded Systems:
- Network Communication:
- Energy Efficiency:
- Real-Time Applications:

17. What is IoT Communication modules?

IoT communication module supports data transmission and communication, and provides operation and maintenance services for customers through the IoT platform.

PART – B

1. Discuss about the following (i) SoC (ii) Microcontrollers
2. Discuss in detail the building blocks of IoT and its functionalities with suitable illustration.
3. Explain the usage of Sensors in IoT with example.
4. Describe the types of sensors and Characteristics of sensors.
5. With neat diagram explain the working principle of actuators?
6. What is meant by Smart objects? Explain how it is used in IoT?
7. Illustrate the control units in IoT.
8. Explain the Communication modules in Internet of Things.
9. Write short notes on
 - (i) Bluetooth
 - (ii) Zigbee

PART – C

1. Explain the WiFi module used in IoT.
2. Discuss about the following in detail a) Sensors and Actuators. b) Connecting Smart Objects.
3. Explain the various functional blocks of IoT eco systems.
4. Describe principle behind the following IoT communication Module
 - (i) GPS
 - (ii) GSM

UNIT-III

PROTOCOLS AND TECHNOLOGIES BEHIND IOT

PART A

1. What is IoT Protocols?

The Internet of Things (IoT) is about the network of sensor devices to the web in real-time. IoT devices communicate with each other over the network, so certain standards and rules need to be set to determine how data is exchanged. These rules are called IoT Network Protocols.

2. List the Importance of IoT protocols.

- The ability to interact with each other and resolve common problems is what separates IoT devices from traditional computers.
- These interactions are only possible if there is a medium or means of communication in the IoT ecosystem.
- The IoT protocols are thus a common "language" that allows devices to interact with other IoT devices.
- The IoT protocols lay down standards that are adopted in every IoT ecosystem for proper functioning and to avoid security threats.

3. What are the Classification of IoT Protocols?

- IoT data protocol
- IoT Network Protocols

4. What is Wireless Body Area Network?

This network has other names such as Body Area Network(BAN), Medical Body Area Network (MBAN) or Body Sensor Network(BSN). They work within the 10 centimetre to 1 metre range. The common ones include Bluetooth, NFC, Zigbee, RFID(Radio Frequency) and various other proprietary technologies.

5. What is WPAN?

A wireless personal area network (WPAN) is a group of devices connected without the use of wires or cables. Today, most PANs for everyday use are wireless. WPANs use close-range wireless connectivity protocols such as Bluetooth.

6. What is IPV6?

- IoT refers to the network of interconnected physical devices, sensors, vehicles, appliances, and more, all embedded with technology to collect and exchange data.
- This technology revolution has transformed various industries, including healthcare, agriculture, manufacturing, and smart cities.
- As IoT devices proliferate, they require unique IP addresses to communicate over the internet.

7. What are the benefits of IPv6 Addressing in IoT

IPv6 addressing offers a range of benefits that are particularly advantageous in the context of IoT:

1. Scalability
2. Simplified Connectivity
3. Security Improvements
4. Efficient Address Auto configuration
5. Enhanced Quality of Service

8. Mention the methods of IPv6 addressing.

- Unicast Address
- Multicast Address
- Anycast Address

9. State 6LoWPAN.

6LoWPAN is an IPv6 protocol, and It's extended from is IPv6 over Low Power Personal Area Network. As the name itself explains the meaning of this protocol is that this protocol works on Wireless Personal Area Network i.e., WPAN.

10. Write the disadvantages of 6LoWPAN.

- It is comparatively less secure than Zigbee.
- It has lesser immunity to interference than that Wi-Fi and Bluetooth.
- Without the mesh topology, it supports a short range.

11. Give the Applications of 6LoWPAN.

- It is a wireless sensor network.
- It is used in home-automation,
- It is used in smart agricultural techniques, and industrial monitoring.

12. Define MQTT protocol.

MQTT stands for Message Queuing Telemetry Transport. MQTT is a machine to machine internet of things connectivity protocol.

These characteristics make it useful in various situations, including constant environment such as for communication machine to machine and internet of things contexts.

13. List the Characteristics of MQTT.

- It is a machine to machine protocol, i.e., it provides communication between the devices.
- It is designed as a simple and lightweight messaging protocol that uses a publish/subscribe system to exchange the information between the client and the server.
- It does not require that both the client and the server establish a connection at the same time.

14. What is IoT data analytics?

IoT data analytics aims to transform enormous amounts of from numerous heterogeneous devices and sensors in the Internet of Things ecosystem into insights.

15. What is Big data?

Big data has been an evolving concept since the start of the digital age. It is a huge data set that is defined by three characteristics, known as the three Vs: volume, velocity, and variety - big data differs from other data sets by the size (volume), rate of growth/change (velocity) and the variety of structures unstructured, and semi structured data within the set.

16. State Cloud Computing?

Cloud computing delivers computing services, such as servers, storage databases, networking, software, and more, over the Internet ('the cloud').

17. Give the Real Time Examples of Cloud Internet of Things.

- Amazon Web Services (AWS)
- Google Cloud
- Microsoft Azure
- Oracle Cloud

PART – B

1. Describe Physical and MAC layers Topology and Security of IEEE 802.15.4 IEEE 802.15.4 and tabulate the protocol stacks utilizing IEEE 802.15.4.
2. Analyze in detail Lora WAN technology, illustrating the layers, MAC forms and Architecture.
3. Discuss the following:
(a) IEEE 802.11ah (b) IP versions
4. Briefly discuss about Constrained nodes and Networks
5. Explain the following.
(a) 6LoWPAN (b) SCADA
6. Describe about Application Layer Protocols:
(a) CoAP (b) MQTT
7. Explain the Usage of RFID in IoT.
8. Describe the following in IoT
(a) WSN (b) Big data Analytics
9. Explain the following in IoT
(a) Cloud Computing (b) Embedded Systems

PART – C

1. Explain the common uses of RFID and how the technology is utilized
2. Analyze in detail Lora WAN technology, illustrating the layers, MAC forms and Architecture.
3. Describe how businesses use remote servers hosted online for data management and application deployment.
4. Explain the Zigbee architecture, characteristics, physical and MAC layer

UNIT-IV

OPEN PLATFORMS AND PROGRAMMING

PART- A

1. Mention some IoT Tools.

- Arduino
- Flutter
- Kinoma
- Tessel 2
- M2MLabs Mainspring

2. Which is better for IoT Arduino or Raspberry pi?

- Arduino is a single-board microcontroller created in the early 2000s in Italy. It aims for prototyping and device connectivity. Also, it is still available as open- source hardware and software.
- Later, the Raspberry Pi was released as a tool for teaching basic computer science. It's a full-featured computer, albeit a small one. Its componentry varies from model to model. But, it has its own processor, memory, and graphics processing unit.

3. What is Arduino?

Arduino is an open-source electronics platform. It uses simple hardware and software to make it easy to use. Inputs can be read by Arduino boards. They can detect light on a sensor, a finger on a button, or a Twitter message, among other things.

4. What is Raspberry Pi?

The Raspberry Pi is a small, low-cost computer. It is the size of a credit card that connects to a computer or television and uses a standard keyboard and mouse. It's a capable little device. It allows people of all ages to learn about computers and programming languages like Scratch and Python. It can do everything a desktop computer can. Also, It can browse the internet and play high-definition video. It can also use spreadsheets, word processing, and gaming.

5. Compare Arduino and Raspberry Pi

- Raspberry Pi Vs Arduino
- Raspberry Pi
- Microcomputer
- Needs an operating system
- Complicated

6. What type of PIN numbering in Raspberry Pi?

Raspberry Pi has two ways of defining pin number which are as follows:

- GPIO Numbering
- Physical Numbering

In GPIO Numbering, pin number refers to number on Broadcom Soc (System on Chip). So, we should always consider the pin mapping for using GPIO pin.

7. Write a Python Program for Raspberry Pi to control LED using Push Button.

```
import RPi.GPIO as GPIO
LED=32
Switch_input = 29
GPIO.setmode(GPIO.BOARD)
GPIO.setup(LED, GPIO.OUT)
GPIO.setup(Switch_input, GPIO.IN, pull_up_down=GPIO.PUD_UP)
while True:
    if(GPIO.input(Switch_input)):
        GPIO.output(LED,GPIO.LOW)
    else: GPIO.output(LED,GPIO.HIGH)
```

8. Give the example of GPIO as input and Output in Raspberry Pi.

- GPIO as Output
- GPIO.setup(channel, GPIO.OUT)
- GPIO as Input
- GPIO.setup(channel, GPIO.IN)

9. How will you configure the digital pin in Arduino?

Arduino (ATmega) digital pins can be configured as output to drive output devices. We have to configure these pins to use as output.

To configure these pins, pinMode() function is used which set direction of pin as input or output.

pinMode(pin no, Mode)

This function is used to configure GPIO pin as input or output.

pin no number of pin whose mode we want to set.

Mode INPUT, OUTPUT or INPUT_PULLUP

E.g. pinMode (3, OUTPUT) //set pin 3 as output

10. What are the methods available to read and Store sensor data in cloud?

The following methods to use cloud services to store/read/graph the sensor data which are received from may have ESP32, ESP8266, RASPBERRY PI etc:

Firebase Realtime Database and Firebase storage

Deta Base: Free and Unlimited Database

Thing speak Channels

Google sheets

MySQL on a Cloud Server

11. What is ThingSpeak in IoT platform?

ThingSpeak is an IoT platform in which you can create channels to store data. It provides visualization tools and different widgets to display your data like charts, gauges, or numeric displays. The submitted data is also associated with a timestamp, which is useful if you want to display it on charts to see how it behaves over time.

PART- B

1. Describe the following steps involved in IoT system design methodology:
(i) Information model Specification (ii) Service Specifications
2. Explain the characteristics of Python programming language
3. Explain Benefits of python programming language
4. Write a short on various service types used in service specifications step of lot system design methodology.
5. Justify how Raspberry Pi is different from a desktop computer.
6. Describe various features of a Raspberry Pi device.
7. List out various versions of raspberry pi devices till date
8. Design an automatic lightening system with LDR, Light and raspberry pi and write a python program to support the working of that design.
9. With the help of neat diagram explain the basic building blocks of IoT device

PART – C

1. What is a module in python? Explain with an example
2. Write a short note on various raspberry pi interfaces used for data transfer
3. What is the use of SPI and I2C interfaces on raspberry pi?.
4. Illustrate how to interface a switch to raspberry pi.
5. Illustrate how to interface a Light sensor (LDR) with raspberry pi

UNIT-V **IOT APPLICATIONS**

PART A

1. What are the classification of IoT Business model?

IoT business models can be classified into different classes based on their characteristics and revenue generation strategies. While there is no universally agreed upon classification, commonly recognized classes include: Product- oriented Models, Service-oriented Models, Data-oriented Models, Platform- oriented Models.

2. What is Business Intelligence?

Business Intelligence (BI) is a process that enables a business service to extract new facts and knowledge and then undertake better decisions.

3. Define Industry 4.0.

Industry 4.0 can be defined in several ways as

- Several contemporary automation, data exchange and manufacturing technologies.
- Vision of tomorrow's manufacturing deploying intelligent factories, machines, raw materials and products in which the Internet plays a vital role.
- Use of Cyber Physical Production System (CPPS), which is a merger of virtual and real world.
- Intelligent solution for connected manufacturing.

4. What is the business model scenario for IoT?

- ❖ Sensors M2M, sensor networks data and the data using web APIs for multiple information sources data, open data, mobile services network information data, corporate database and knowledge database are at the input stages.
- ❖ The data from multiple sources and services are part of the key resources in business model scenarios for IoT.

5. What is IoT based Smart city?

Implementing IoT-based smart city solutions is making urban life more convenient and safer. It is while helping cities improve infrastructure & public utility services.

6. List the need for Smart cities.

- ❖ Better Resource Management
- ❖ Improved Quality of Life
- ❖ Increased Sustainability
- ❖ Economic Development:

7. Mention the real world applications of IoT in Smart cities.

- ❖ Smart Traffic Management
- ❖ Smart Parking
- ❖ Public Transport
- ❖ Public Safety
- ❖ Environmental well-being
- ❖ Applications of IoT in Smart Cities
- ❖ Waste Management
- ❖ Remote Monitoring
- ❖ Utility Management

8. What is the Need and Importance of Smart Mobility?

- ❖ Smart mobility enables inhabitants to navigate and move freely within the smart city surroundings.
- ❖ Improved traffic management, the availability of alternative routes (in case of traffic or emergencies), and dedicated routes and navigation for essential services (such as ambulances, government vehicles, official movements) can be facilitated by smart mobility. Such mobility services are needed to provide congestion free, environment friendly and sustainable alternatives for the inhabitants and administrations alike.
- ❖ With smart mobility solutions we can have two-fold advantages both for citizens as well as administrations.

9. Compare IoT and IIoT.

| S.No. | IIOT | IOT |
|-------|--|--|
| 1. | It focuses on industrial applications such as manufacturing, power plants, oil & gas, etc. | It focuses on general applications ranging from wearables to robots & machines. |
| 2. | It uses critical equipment & devices connected over a network which will cause a life-threatening or other emergency situations on failure | Its implementation starts with small scale level so there is no need to worry about life-threatening situations. |

therefore uses more sensitive and precise sensors.

- | | | |
|----|--|--------------------------------------|
| 3. | It deals with large scale networks. | It deals with small scale networks. |
| 4. | It can be programmed remotely i.e., offers remote on-site programming. | It offers easy off-site programming. |
| 5. | It handles data ranging from medium to high. | It handles very high volume of data. |
| 6. | It requires robust security to protect the data. | It requires identity and privacy. |
| 7. | It needs stringent requirements. | It needs moderate requirements. |
| 8. | It having very long life cycle. | It having short product life cycle. |
| 9. | It has high- reliability. | It is less reliable. |

10. Define Smart health

A healthcare system that enables patients and doctors to communicate with each other and remotely exchange information monitored, collected, and analyzed from patients' daily activities via the IoT.

11. Mention the advantages of Industrial Internet of Things

- ❖ Improved accuracy
- ❖ Product and process optimization
- ❖ Predictive maintenance and analysis
- ❖ Higher efficiency
- ❖ Remote accessibility and monitoring
- ❖ Enhanced security
- ❖ Scalability of network
- ❖ Reduced down time for machines and process
- ❖ Power savings
- ❖ Cost effectiveness

12. What are the Key Benefits of IoT in Agriculture?

- ❖ Manual Process Automation
- ❖ Intelligent Data Collection.
- ❖ Waste reduction.
- ❖ Less Energy Consumption.
- ❖ Remote Farm Monitoring.
- ❖ Improved Production Control.
- ❖ Lower Production Risk.
- ❖ Reduction in Operation Costs.

PART-B

1. Implement the air pollution monitoring system using the Web Socket approach
2. Implementation of smart irrigation system
3. Design a smart home automation system using IoT With mode REST service

4. Explain service specification for home automation system in state service
5. Implement the analytics component for the forest fire detection system.
6. Design a weather monitoring IoT system using REST based?
7. Define process specification & domain model for smart parking IoT system
8. Implement the analytics component for the forest fire detection system.
9. Explain the Business models for the internet of things

PART – C

1. Explain with diagram
 - (i) Smart city
 - (ii) Smart mobility
 - (iii) Transport
2. Explain the concept of Industrial IoT.
3. Implement Smart health system using IoT
4. Explain the IoT Process in
 - (i) Environment monitoring
 - (ii) surveillance