T.E. (Computer Engineering)

INTERNET OF THINGS AND EMBEDDED SYSTEMS

(2019 Pattern) (Semester - I)(Elective - I)

UNIT 3: IoT Design Methodology

1. HIGHEST IMPORTANCE TOPICS

a) IoT Design Methodology Steps

- Steps involved in IoT design methodology
- **Questions Asked:**
  - o Illustrate steps of IoT design methodology for smart irrigation system
  - o Illustrate steps for smart forest fire detection system
  - o Illustrate steps for weather forecasting system
  - o Evaluate the importance of each step in IoT design methodology
  - o Illustrate step wise IoT design methodology

b) IoT Communication Models

- Publish-Subscribe Model
- Push-Pull Model
- Request-Response Model
- **Questions Asked:**
  - o Demonstrate working of Publish-Subscribe model with diagram and application
  - o Demonstrate working of Push-Pull model with diagram and application
  - o Demonstrate IoT communication models
  - o Illustrate working of any 03 communication models with suitable application
  - o Discuss suitability of different communication models for specific IoT applications

c) Four Pillars of IoT

- M2M (Machine to Machine)
- SCADA (Supervisory Control and Data Acquisition)

- WSN (Wireless Sensor Networks)
- RFID (Radio Frequency Identification)
- **Questions Asked:**
    - Classify the four pillars of IoT
    - Illustrate different pillars of IoT
    - Examine use of each pillar with proper example
    - Demonstrate SCADA pillar with suitable IoT system
    - Demonstrate use of RFID with suitable IoT application
    - Demonstrate typical RFID system with suitable application
    - Explain M2M communication in detail

d) Connectivity Technologies

- Different connectivity technologies for IoT
- **Questions Asked:**
    - Categorize different connectivity technologies required for IoT system development and explain any one
    - Categorize requirement of connectivity technologies and explain any one
    - Illustrate connectivity technologies used in IoT with proper example

2. MEDIUM IMPORTANCE TOPICS

a) IoT Communication APIs

- REST based API
- Web Socket API
- **Questions Asked:**
    - Illustrate REST based Communication API with suitable IoT system
    - Demonstrate Web socket API with suitable IoT system
    - Illustrate any Communication API with suitable IoT system
    - Discuss advantages and limitations of using IoT communication APIs in home automation

b) Networking Components and Internet Structure

- IoT networking components
- Devices required for IoT
- **Questions Asked:**
  - Demonstrate use of different networking components for IoT application (smart irrigation example)
  - Identify and explain key components of IoT network architecture
  - Describe device and component integration for IoT based home automation

c) Sensor Networks

- Basic concepts of sensor networks in IoT
- **Questions Asked:**
  - (No direct questions, but covered under WSN pillar)

3. LEAST/NOT APPEARED TOPICS

a) Basics of IoT Networking (theoretical)

- Not directly asked as standalone question

b) Internet Structure (detailed architecture)

- Not asked separately

c) Horizontal and Vertical IoT Applications

- Asked only once:
  - What are horizontal and vertical of IoT applications?

UNIT 4: IoT Protocols

1. HIGHEST IMPORTANCE TOPICS

a) IP-Based Protocols

- MQTT (Message Queuing Telemetry Transport)
- 6LoWPAN
- LoRa (Long Range)
- **Questions Asked:**
    - Illustrate various IoT applications developed using IP based protocols (Asked 7+ times)
    - Demonstrate use of IP based protocols in IoT applications
    - Show use of LoRa protocol in suitable IoT application (Asked 5+ times)
    - Show use of LoRa in smart irrigation system
    - Explain LoRA based smart irrigation system
    - What is MQTT and explain in detail
    - Illustrate use of MQTT protocol with suitable IoT application
    - What is 6LoWPAN? 6LoWPAN and EPC standardization

b) Zigbee Architecture

- IEEE 802.15.4 Topology
- Zigbee vs WiFi/Bluetooth
- **Questions Asked:**
    - Classify different topology of IEEE 802.15.4 and explain with diagram (Asked 6+ times)
    - Classify different topology of IEEE 802.15.4 with proper applications
    - Show with suitable reasons why Zigbee is popular than WiFi and Bluetooth (Asked 4+ times)
    - Examine why Zigbee is popular than WiFi and Bluetooth
    - Critically evaluate advantages and limitations of Zigbee in home automation
    - Illustrate use of Zigbee in smart home system

c) Protocol Standardization

- Issues with standardization
- M2M, WSN, RFID, SCADA standardization
- **Questions Asked:**

- o Illustrate different issues with standardization of IoT protocols (Asked 3+ times)
- o Demonstrate need of standardization of IoT protocols
- o Examine different issues in standardization
- o Explain SCADA protocol standardization

2. MEDIUM IMPORTANCE TOPICS

a) RFID Protocol

- RFID protocol details
- **Questions Asked:**
  - o Classify between RFID and SCADA protocol
  - o Show merits and demerits between RFID and SCADA
  - o Analyze role of RFID protocols in supply chain management
  - o Analyse working principles and applications of RFID protocol

b) Modbus Protocol

- Modbus in industrial IoT
- **Questions Asked:**
  - o Explain MODBUS protocol in detail
  - o Analyze Modbus protocol and its usage in industrial IoT applications (Asked 2 times)

c) M2M and WSN Protocols

- M2M protocol characteristics
- WSN protocols
- **Questions Asked:**
  - o Classify between M2M and SCADA protocol (Asked 2+ times)
  - o Categorize between SCADA and WSN protocols
  - o Analyze characteristics and functionalities of M2M protocols
  - o Critically evaluate role of WSN protocols in enabling efficient communication

3. LEAST/NOT APPEARED TOPICS

a) Network Layer Protocols (general)

- Asked only once:
    - Classify different IoT protocols used at Network layer and explain any one

b) Detailed MQTT Security (Secure MQTT)

- Not asked separately (only general MQTT)

UNIT 5: Cloud Platforms for IoT

1. HIGHEST IMPORTANCE TOPICS

a) Cloud Computing for IoT

- Cloud as IoT enabling technology
- Cloud storage models
- **Questions Asked:**
    - Examine how Cloud Computing is an IoT enabling technology with suitable example (Asked 3+ times)
    - Apply concept of cloud computing to design smart irrigation system (Asked 2 times)
    - Apply concept to design smart home system (Asked 3+ times)
    - Apply concept to design weather forecasting system (Asked 2 times)
    - Design cloud storage model for fleet management system
    - Design cloud storage model for IoT-based healthcare application
    - Show that Cloud computing is fusion of Grid Computing and SOA (Asked 2 times)

b) Amazon Web Services (AWS) for IoT

- Amazon Auto Scaling
- AWS IoT services
- **Questions Asked:**

- Use knowledge of Cloud Computing to demonstrate Amazon Auto Scaling (Asked 4+ times)
- Demonstrate Amazon Cloud platform usage for IoT applications (Asked 3+ times)
- Explain different cloud-based services offered by Amazon for IoT

c) WAMP: AutoBahn for IoT

- WAMP concepts and key features
- AutoBahn framework
- **Questions Asked:**
  - Show that WAMP and its key concepts are useful in Cloud based IoT application (Asked 4+ times)
  - Describe IoT messaging mechanisms called WAMP (AutoBahn for IoT)
  - Use knowledge to demonstrate Autobahn for IoT (Asked 3+ times)
  - Design home automation using AutoBahn and Xively

2. MEDIUM IMPORTANCE TOPICS

a) Xively Cloud for IoT

- Xively platform features
- **Questions Asked:**
  - Use knowledge to demonstrate Xively Cloud for IoT (Asked 5+ times)
  - Design home automation using AutoBahn and Xively

b) Python Django Framework

- Django architecture
- Application development with Django
- **Questions Asked:**
  - Demonstrate Python Web Application Framework Django with suitable example (Asked 3+ times)
  - Explain Python Web application framework Django
  - Design Django-based RESTful API for IoT system

c) Software Defined Networking (SDN)

- SDN architecture
- **Questions Asked:**
  - ○ Define software define networking & explain architecture of SDN
  - ○ (Asked only once directly)

3. LEAST/NOT APPEARED TOPICS

a) SkyNet IoT Messaging Platform

- Not asked in any paper

b) GRPC and SOAP

- Not asked separately

c) Communication API (detailed)

- What is cloud communication API? (Asked only once with Cloud of Things)

d) Cloud Standardization

- Write short note on cloud standardization (Asked only once)

e) Cloud of Things

- Define Cloud of Things (Asked only once)

UNIT 6: Security in IoT

1. HIGHEST IMPORTANCE TOPICS

a) Challenges in Designing Secure IoT Applications

- Design challenges
- Security challenges
- **Questions Asked:**
  - ○ Predict possible challenges in designing secure IoT applications (Asked 6+ times)

- o Illustrate challenges in securing IoT applications (Asked 3+ times)
- o What are challenges in designing IoT application
- o Predict possible security challenges

b) Threat Modeling

- Threat model concepts
- Activity modeling of threats
- **Questions Asked:**
  - o Illustrate threat model in securing IoT applications (Asked 4+ times)
  - o Examine how threat model is useful in securing IoT applications (Asked 5+ times)
  - o Illustrate threat model is playing role in securing IoT applications
  - o What is Activity Modelling of Threats?

c) IoT Vulnerabilities and Security Requirements

- Vulnerabilities of IoT
- Security requirements
- **Questions Asked:**
  - o Predict possible vulnerabilities in designing smart home intrusion detection system (Asked 2 times)
  - o What are different vulnerabilities of IoT and how to handle
  - o List out security requirements for IoT base systems & discuss some vulnerabilities
  - o Demonstrate security requirements of IoT Applications
  - o Design introduction to IoT security highlighting unique challenges and vulnerabilities

d) Key Elements of IoT Security

- Identity establishment
- Access control
- Data and message security
- Non-repudiation and availability
- **Questions Asked:**
  - o Illustrate classic pillars of information assurance while securing IoT application (Asked 4+ times)

- Apply key elements of IoT security for securing forest fire detection system
- Show use of classic pillars of information assurance
- Illustrate how classic pillars useful in securing IoT application
- What is access control issue with respect to IoT security

2. MEDIUM IMPORTANCE TOPICS

a) Security Model for IoT

- Security model design
- End-to-end security
- **Questions Asked:**
  - Design security model for IoT ecosystem encompassing all necessary components
  - (Asked only once directly)

b) Threat Identification in Specific Applications

- Threats in smart home, irrigation, parking, surveillance
- Misuse cases
- **Questions Asked:**
  - Use security concepts to identify different threats (at least 03 each) in:
    - Smart Home Automation (Asked 4+ times)
    - Smart Parking System (Asked 3+ times)
    - Smart Irrigation System (Asked 3+ times)
    - Smart Surveillance System (Asked 1 time)
  - Identify different misuse cases (at least 03) in each application

c) Case Studies on Secure IoT Design

- Smart home intrusion detection
- Forest fire detection security
- **Questions Asked:**
  - Design case study on designing secure IoT home intrusion detection system
  - Apply key elements for securing forest fire detection system

3. LEAST/NOT APPEARED TOPICS

a) Lightweight Cryptography

- Write short note on lightweight cryptography (Asked only once)

b) Non-repudiation and Availability (detailed)

- Not asked separately (only under key elements)

Youtube Channel Link:

https://youtube.com/@thevijayacademy?si=e_kcIN7pJfRbZt0R

Telegram Channel Link For Notes And Updates:

https://t.me/+TMT8hrQRdEYyMDY1

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