**Course Objectives**

1. Understand IoT Network Architectures.
2. Explore Communication Protocols.
3. Implement Network Security Measures:
4. Ensure Interoperability and Integration
5. **The expected Course Outcomes are:**

|  |  |
| --- | --- |
| CO 1 | Explore the fundamental principles and concepts of IoT network architecture. |
| CO 2 | Understand various communication protocols and wireless protocols in IoT and effectively select and utilize the appropriate protocols for different IoT applications. |
| CO 3 | Demonstrate proficiency in configuring and managing IoT networks, including network monitoring, diagnostics. |
| CO 4 | Evaluate and implement appropriate security measures and protocols to safeguard IoT networks from potential threats and vulnerabilities. |
| CO 5 | Explore IoT integration and interoperability concepts enabling seamless data exchange and interoperability between diverse IoT devices and systems |

CO-PO Mapping

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Program**  **Outcomes**  **Course Outcomes** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PSO1** | **PSO2** | **PSO3** |
| **CO 1** | 2 | 2 | 2 | 2 |  |  |  |  |  |  |  | 2 | 2 | 1 |
| **CO 2** | 3 | 2 | 3 | 3 | 2 |  |  |  |  |  |  | 2 | 2 | 2 |
| **CO 3** | 1 | 1 | 2 | 2 | 1 | 1 | 1 |  |  |  |  | 2 | 2 | 3 |
| **CO 4** |  |  | 1 | 1 | 2 | 2 | 2 |  |  |  |  |  |  | 2 |
| **CO 5** |  |  | 1 | 1 | 2 | 2 | 2 |  |  |  |  |  | 2 | 1 |
| **Average** | **2** | **1.6** | **1.8** | **1.8** | **1.7** | **1.6** | **1.6** |  |  |  |  | **2** | **2** | **1.8** |

1 – Weakly Mapped (Low) 2 – Moderately Mapped (Medium)

3 – Strongly Mapped (High) “\_” means there is no correlation

**Syllabus**

**Unit I: Introduction to IoT Network Architecture 12 Lecture Hours**

1. Overview of Computer Network
2. OSI Model Brief
3. IoT Reference Model by IoT World Forum
4. Serial vs Parallel communication
5. SPI, I2C, USB, CAN, RS232 Interfaces
6. Concepts and fundamentals of IoT network architecture
7. IoT network topologies and architectures
8. Edge computing and fog computing in IoT
9. IoT network scalability and manageability
10. Security considerations in IoT network architecture

**Unit II: IoT Communication Protocols 12 Lecture Hours**

1. IoT Data Protocols and Formats
   1. JSON (JavaScript Object Notation) for IoT data exchange
   2. XML (eXtensible Markup Language) for IoT data representation
   3. CBOR (Concise Binary Object Representation) for efficient IoT data encoding
2. MQTT (Message Queuing Telemetry Transport) protocol
3. CoAP (Constrained Application Protocol) for IoT
4. AMQP (Advanced Message Queuing Protocol)
5. HTTP and RESTful APIs in IoT
6. WebSocket protocol for real-time communication
7. Modbus protocol for industrial IoT communication

**Unit III: Wireless Communication Protocols 12 Lecture Hours**

1. Physical Layer, Modulation and demodulation
2. Radio Frequency Spectrum
3. RF Spectrum for communication
4. Transmitting data with radio waves
5. Signal distortion and noise
6. Bluetooth and Bluetooth Low Energy (BLE) in IoT
7. Zigbee protocol for low-power wireless networks
8. LoRaWAN (Long Range Wide Area Network) for IoT
9. Medium Access Control layer
10. IEEE 802.15.4 Protocol

**Unit IV: IoT Security and Privacy Protocols 12 Lecture Hours**

1. Authentication and access control in IoT
2. Encryption and secure communication protocols
3. DTLS (Datagram Transport Layer Security) for IoT
4. IPSec (Internet Protocol Security) for secure IoT communication

**Unit V: IoT Network Management and Monitoring 12 Lecture Hours**

1. SNMP (Simple Network Management Protocol) in IoT
2. IoT device provisioning and management
3. Over-the-Air (OTA) updates for IoT devices

**Total lecture Hours 60**

**Textbooks**

1. MIsha Dohler, "Internet of Things: Architectures, Protocols, and Standards".
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Press, 2017.

**Reference Books**

1. Yan Zhang, Laurence T. Yang, and Huansheng Ning, "Wireless Communications and Networks for the Internet of Things", Auerbach Publications, 2019.

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

**Examination Scheme**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Components** | **IA** | **MID SEM** | **End Sem** | **Total** |
| Weightage (%) | 50 | 20 | 30 | 100 |

Detailed breakup of Internal Assessment

|  |  |
| --- | --- |
| **Internal Assessment Component** | **Weightage in calculation of Internal Assessment (100 marks)** |
| Quiz 1 | 15% |
| Quiz 2 | 15% |
| Class Test 1 | 15% |
| Class Test 2 | 15% |
| Assignment 1/Project | 20% |
| Assignment 2/Project | 20% |