

RAMAKRISHNA MISSION VIDYAMANDIRA

NEP Syllabus B.Sc. Computer Science Major

Semester-VII

Course Code: 7CMSMJC1

Course Type: Major Course

Course Outcome:

- i) Explain IoT architecture, components, and enabling technologies.
- ii) Develop simple IoT systems using sensors, actuators, and embedded platforms.
- iii) Analyze and implement IoT communication protocols and networking technologies.
- iv) Design cloud-enabled IoT applications for data collection and processing.
- v) Evaluate security, privacy, and ethical challenges in IoT systems.
- vi) Apply IoT concepts to solve real-world problems in different application domains.

7CMSMJC1: Internet of Things

Credit: 3

Marks: 50

Introduction: Evolution of IoT; Definition and Characteristics of IoT; IoT Ecosystem; IoT Architecture: Three-layer Architecture, Five-layer Architecture; IoT Design Principles; IoT Enabling Technologies: Embedded Systems, Wireless Communication, Cloud Computing, AI and Data Analytics; IoT Applications and case studies. [3 L]

Sensors, Actuators and Embedded Platforms: Introduction to Sensors and Actuators; Sensor Classification; Common IoT Sensors: Temperature, Humidity, Light, Motion, Gas; Actuators and Control Systems; Microcontrollers and Single Board Computers; Overview of: Arduino, ESP8266/ESP32, Raspberry Pi, Interfacing Sensors with IoT Devices, Data Acquisition Concepts. [8 L]

IoT Communication and Networking: IoT Communication Models; Network Layers in IoT; IPv4 and IPv6 Basics; Wireless Communication Technologies: Wi-Fi, Bluetooth/BLE, ZigBee, LoRaWAN, Cellular IoT (NB-IoT); IoT Protocols: MQTT, CoAP, HTTP/HTTPS; Message Brokers; Device Discovery and Addressing; QoS in IoT Networks. [13 L]

IoT Data Processing, Cloud and Edge Computing: IoT Data Lifecycle; Data Collection and Storage; Cloud Computing for IoT; Edge and Fog Computing; IoT Middleware; Cloud Platforms: AWS IoT, Azure IoT, Google Cloud IoT (conceptual); Real-time Data Processing; Dashboard and Visualization Concepts [8 L]

IoT Security and Privacy: Security Challenges in IoT; Threats and Vulnerabilities; Authentication and Authorization; Encryption Fundamentals; Secure Communication; Privacy Issues in IoT; Security Best Practices; Case Studies of IoT Attacks. [6 L]

Advanced Topics and Applications: Industrial IoT (IIoT); Smart Cities; Smart Agriculture; Healthcare IoT; Smart Homes AI and Machine Learning in IoT; Digital Twins; Emerging Trends and Future Directions. [7 L]

7CMSMJC1 (P): Internet of Things Laboratory

Credit: 1

Marks: 25

- IoT application development using Arduino-based embedded platforms.
- Interfacing and programming of various sensors and actuators.
- Acquisition, processing, and monitoring of sensor data.
- Design and implementation of real-time IoT monitoring and control systems.
- Communication between IoT devices and cloud platforms.
- Deployment of IoT solutions to cloud services for data storage and visualization.
- Remote monitoring and device management through cloud-based IoT applications.
- Mini-project involving the development and deployment of an end-to-end IoT solution.

[30 L]

Recommended Books and web resources:

1. Bahga, A., and Madiseti, V. K., *Internet of Things: A Hands-On Approach*, Universities Press.
2. Buyya, R., and Dastjerdi, A. V., *Internet of Things: Principles and Paradigms*, Morgan Kaufmann.
3. McEwen, A., and Cassimally, H., *Designing the Internet of Things*, Wiley.
4. Kranz, M., *Building the Internet of Things*, Wiley.
5. Raj, P., and Raman, A., *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*, CRC Press.
6. <https://docs.arduino.cc/arduino-cloud/>
7. <https://docs.arduino.cc/tutorials/uno-wifi-rev2/uno-wifi-r2-mqtt-device-to-device/>
8. <https://cloud.arduino.cc/>