## NIRMA UNIVERSITY

| Institute: | Institute of Technology |
|---|---|
| Name of Programme: | Integrated BTech (CSE)-MBA |
| Course Code: | 3CS208ME24 |
| Course Title: | Internet of Things |
| Course Type: | Department Elective-IV |
| Year of Introduction: | 2024-25 |

| L | T | Practical Component | | | | C |
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### Course Learning Outcomes (CLO):

At the end of the course, the students will be able to –

1. summarise the architectural components and platforms of the IoT ecosystem (BL2)
2. apply appropriate access technology and protocols as per the application requirement (BL3)
3. appraise the role of big data, cloud computing, and data analytics in a typical IoT system (BL5)
4. design applications with suitable lightweight data processing and communication Methodologies. (BL6)

| Unit | Contents | Teaching Hours (Total 45) |
|---|---|---|
| Unit-I | Introduction, applications, need and scope of IoT, IoT reference model and Various IoT architectures, functional stack, Processors, and Operating Systems for resource-constrained devices | 07 |
| Unit-II | M2M Communication, Sensors and actuators, smart objects, Connecting objects, protocols, and access technologies like IEEE802.15.4, LoRaWAN, LTE-M, BLE, NB-IoT, Sigfox | 12 |
| Unit-III | IoT network layer, 6LoWPAN, IPv6: IPv6 structure, addressing, routing, interconnecting issues, 6LoWPAN: forwarding, addressing, header compression, neighbor discovery, Routing in LLN, RPL | 07 |
| Unit-IV | Application layer protocols, CoAP, MQTT, AMQP, XMPP, Integrating Internet Services with Interoperable data encoding with XML, JSON, and CBOR, Sensor data models and representation, lightweight web services for IoT | 09 |
| Unit-V | Data analytics for IoT, machine learning, Big Data Analytics tools like NoSQL, and Hadoop, Securing IoT, Challenges in IoT security, provisions for securing IoT network | 07 |
| Unit-VI | Case studies on IoT applications: Connected Vehicles and Autonomous Vehicles, Industrial IoT, IoMT (Internet of Medical Things), Smart Grid | 03 |

### Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents

**Suggested Readings/ References:**
1. David Hanes, G. Salgueiro, IoT Fundamentals - Networking Technologies, Protocols, and Use Cases for Internet of Things, Cisco Press
2. Jean-Philippe Vasseur, Adam Dunkels, Interconnecting Smart Objects with IP: The Next Internet, Morgan Kaufmann
3. Pethuru Raj, Anupama Raman, The Internet of Things - Enabling Technologies, Platforms and Use Cases, CRC Press
4. Robert Stackowiak, Art Licht, VenuMantha and Louis Nagode, Big Data and The Internet of Things, Apress
5. Peter Waher, Learning Internet of Things, Packt Publishing Ltd
6. Daniel Kellmereit, Daniel Obodovski, The Silent Intelligence: The Internet of Things, DND Ventures
7. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley

**Suggested List of Experiments:**

| Sr. No. | Title | Hours |
|---|---|---|
| 1 | Building basic electronic circuits using various components and exploring ESP8266, ESP32, and Arduino IDE. | 02 |
| 2 | Programming the boards – ESP, Arduino | 02 |
| 3 | Access sensors and control actuator using HTTP protocol | 02 |
| 4 | Interfacing temperature and ultrasonic sensor with micro-controller | 04 |
| 5 | Integrating Bluetooth, RFID, and LoRa transceivers with different IoT platforms | 04 |
| 6 | Upload sensor data to a cloud platform | 02 |
| 7 | Publish and Subscribe with MQTT | 04 |
| 8 | Application development using COAP | 04 |
| 9 | Interfacing IoT boards with platforms like IFTTT | 02 |
| 10 | Simulate IoT network on Cooja Simulator focusing on 6LowPAN | 04 |