

**NIRMA UNIVERSITY**  
**School of Technology, Institute of Technology**  
**B.Tech. Electronics & Communication Engineering**  
**Semester - VII**  
**Department Elective V**

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<b>Course Code</b>	2ECDE65
<b>Course Title</b>	Internet of Things

**Course Outcomes (COs):**

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

1. design an Internet of Things framework for a given application using a suitable sensor, microcontroller unit, communication protocol, and cloud architecture.
2. comprehend sensor types, power management, IP-based and non-IP-based WLAN, WPAN and WWAN communication protocols, and cloud messaging protocols related to IoT.
3. evaluate the performance of cloud service models for the given application.
4. analyse the performance of Zigbee, Bluetooth, and WiFi 6LoPAN for a given Internet of Things application for reliability, congestion control, and control packet overhead parameters.

**Syllabus**

**Teaching Hours: 45**

**UNIT I: Introduction and Overview of Internet of Things** **04**

Evolution, Challenges in Internet of Things, Characteristics, Applications of IoT in Science, Engineering and Societal Domain

**UNIT II: IoT-node Architecture** **06**

Sensors, Actuators, Microcontrollers, Energy management of IoT nodes, Examples of sensor nodes

**UNIT III: Wireless Personal Area Network Standards** **08**

IEEE 802. 15. 1 Bluetooth, Bluetooth low energy (BLE) 4.0, Bluetooth beacon, Bluetooth Mesh, Bluetooth Smart 5.0, IEEE 802.15.4 Zigbee, Z-wave, IEEE 802.11 WiFi, 6LoPAN, WPAN with IP-thread

**UNIT IV: Long Range Communication Standards** **06**

Long-range communication – LTE, LoRA, LoRaWAN, Sigfox

**UNIT V: Edge to Cloud protocols** **06**

MQTT- Publish-subscribe, packet structure, MQTT-SN, Case study, CoAP – Architecture

**UNIT VI: Cloud Computing** **05**

NaaS, SaaS, PaaS, IaaS; Public, private and hybrid cloud, OpenStack cloud architecture, Case study

**UNIT VII: Fog Computing** **05**

Introduction, Comparison with edge computing, OpenFog reference architecture, topologies

**UNIT VIII: Case Study** **05**

IoT based Societal Applications- Smart City, Healthcare domain, Security aspects of IoT

**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.

**Laboratory Work:**

Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated.

**Suggested Reading:**

1. Perry Lea, Internet of Things for Architects, Packt Publisher
2. Abhishek S Nagarajan, RMD Sundaram Shriram K Vasudevan, Internet of Things, Wiley

3. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, Wiley
4. Rajkumar Buyya and Amir Vahid Dastjerdi, Internet of Things -Principles and Paradigms, Elsevier

L = Lecture, T = Tutorial, P = Practical, C = Credit