Nirma University

Institute:	**Institute of Technology**
Name of Programme:	**B. Tech. in Electrical Engineering**
Semester:	**V**
Course Code:	**3EE405ME26**
Course Title:	**IoT in Electrical Engineering**
Course Type:	**Department Elective-I**
Year of Introduction:	**2021 – 22**

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Course Learning Outcomes (CLOs):

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

1. comprehend about the basics and architectural components of IoT (BL2)
2. apply appropriate access technology and protocols as per the application requirement (BL3)
3. appreciate the role of big data, cloud computing and security in a IoT system (BL2)
4. design IoT applications in different domains with performance analysis. (BL6)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	**Introduction to Internet of Things (IoT)** Introduction to OSI model, TCP-IP protocol suite, concept, importance, challenges, structure of IoT, major players, types- consumer IoT and industrial IoT (IIoT)	**5**
Unit-II	**IoT Node Architecture** Sensors - working and types, sensitivity, error, actuators – working & types; transducers, overview of micro-controllers and real time simulator	**10**
Unit-III	**Connectivity and Communication Technologies** Architecture design: hardware layer / perception, networking - wireless sensor networking (WSN), low power wide area networks (LPWAN), information & communication technology (ICTs) - wifi, Zigbee, RFID, Wireless HART, NFC, Bluetooth, LoRa, communication criteria, IoT access technologies – IEEE 802.15.4, Communication technologies: MQTT, CoAP, and REST, IPv6, 6LoWPAN	**12**
Unit-IV	**Cloud computing and Data Analytics for IoT** Cloud computing- Introduction, models, implementation, Cloud systems-storage, data management and data processing, Introduction to big data analytics	**08**
Unit-V	**Applications of IoT in Electrical Smart Systems** Home automation and building energy management, SCADA using IoT, smart metering, Smart grid-structure, challenges, wide area monitoring, electric transportation, and relevant case studies of electrical systems	**10**

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:

- Peter Waher, *Learning Internet of Things*, Packt Publishing.
- Sudip Misra, Anandarup Mukherjee and Arijit Roy, *Introduction To IoT*, Cambridge University Press.
- Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-on Approach*, Orient Blackswan Private Limited - New Delhi.
- Pethuru Raj and Anupama C. Raman, *The Internet of Things: Enabling Technologies*, Platforms, and Use Cases, CRC Press.
- David Hanes, G. Salgueiro, *IoT Fundamentals - Networking Technologies, Protocols, and Use Cases for Internet of Things*, Cisco Press.
- Olivier Hersent, David Boswarthick and Omar Elloumi, *The Internet of Things key applications and protocols*, Wiley.
- Michael Miller, *The Internet of Things*, Pearson.
- Zach Shelby and Carsten Bormann, *6LoWPAN: The Wireless Embedded Internet*, Wiley.
- Kostas Siozios, Dimitrios Anagnostos, Dimitrios Soudris and Elias Kosmatopoulos, *IoT for Smart Grids: Design Challenges and Paradigms*, Springer.
- Relevant application notes, standards, and recent publications from referred journals.

Suggested List of Experiments: Laboratory work will be based on the above syllabus with a minimum 10 experiments to be incorporated. The students in a suitable group size will design and perform one experiment as a part of laboratory work.

Sr. No.	Name of Experiment	Hours
1.	Introduction to Python for IoT applications.	2
2.	Program NodeMCU using Arduino IDE and interface the serial monitor of NodeMCU.	2
3.	Program the Digital Input and Output pins of NodeMCU and perform related activities.	2
4.	Program the Analog Input and Output pins of NodeMCU and perform related activities.	4
5.	Program NodeMCU to scan I^2C devices connected to NodeMCU.	2
6.	Program NodeMCU to get its MAC address.	4
7.	Program NodeMCU to control devices based on commands received from mobile application.	2
8.	Introduction to programming on Raspberry Pi.	2
9.	Programming on Raspberry Pi for various IoT applications.	2
10.	Introduction to programming on SparkFun.	2
11.	Programming on SparkFun for various IoT applications.	2