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| **Course Code** | **IoT Design and Applications** | **L** | **T** | **P** | **C** |
|  |  | **2** | **0** | **2** | **3** |
| **Pre Requisite:** | NIL |  | | | |

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| **Course Objectives** |
| * Introduction to fundamentals of IoT * Application of IoT in various domain * Hardware and software that enable IoT * Upload data on cloud for further analysis and visualisation * Access the IoT data from cloud using mobile computing devices. * Design product for automation various domain such as for |
| **Course Outcomes** |
| After successfully completing the course the student should be able to   1. Describe the technology that enables IoT. 2. Describe Hardware and software required to design and build IoT 3. Interface with sensors and actuators and other IoT devices 4. Set up the servers to upload IoT data to cloud for further analysis 5. Design and Develop program mobile computing device to access IoT data from cloud and to interact with devices. |
| **Student Learning Outcomes: 2,5,9** |
| 2. Having a clear understanding of the subject related concepts and of contemporary issues 5. Having design thinking capability 9. Having problem solving ability – social issues and engineering problems |

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| **Module 1** | **Introduction to IoT** | **6 Hours** | **SLO : 2** |
| Things in IoT, IoT protocols, IoT communication model, IoT communication APIs, IoT enabling Technologies. | | | |
| **Module 2** | **Application of IoT** | **6 Hours** | **SLO: 2,5** |
| Applications of IoT in various Sectors - M2M – Machine to Machine, Difference between IoT and M2M – Industry 4.0 standards | | | |
| **Module 3** | **IoT Supported hardware** | **6 Hours** | **SLO: 5,9** |
| Introduction to wireless sensor network, RFID, Sensors, Overview of IoT supported Hardware platforms - Raspberry pi, Arduino and Zoul/Zolertia Motes . | | | |
| **Module 4** | **Communication in IoT** | **6 hours** | **SLO: 2,9** |
| Protocols like Serial, I2C, 6LoWPAN, 802.11wifi, 802.15 Bluetooth, 802.15.4 Zigbee, GPS, CoAp – Constrained application protocol, RPL – routing protocol for lossy networks. | | | |
| **Module 5** | **IoT Software development** | **6 hours** | **SLO: 5,9** |
| Operating Systems for IoT – Pros and cons - Contiki OS – Protothreads – Border Routers – Gateways – Applications like broadcast – Ping Pong – Addition of new Sensors – Event programming – IPv6 – 6LoWPAN - in Contiki OS. | | | |
| **Total Lecture Hours: 30 hours (15 hours of Laboratory)** | | | |
| **Teaching Pedagogy**  Online Learning Materials, Video Lectures and Case Studies  Evaluation Criteria : Online Quiz, Practical Exercises, Term End Examination. | | | |
| **Reference Books:**   1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A hands-on Approach”, University Press, 2015 (1 st edition) 2. Adrian McEwen & Hakim Cassimally, “Designing the Internet of Things”, Wiley,Nov 2013, (1 st edition) | | | |
| List of Experiments in Contiki OS   1. Installation and configuration of Contiki OS 2. LED Application 3. Button Sensor Configuration 4. Implementation of RPL Border Router 5. Broadcast application using Contiki OS. 6. Addition of New Sensor within an Emulator using Contiki OS 7. Collect View application in Contiki OS 8. Power and Energy Management in IoT 9. CoAP Protocol Implementation using Contiki OS 10. MQTT application using Contiki OS. | | | |