

Devi Ahilya University, Indore, India Institute of Engineering & Technology			III Year B.E. (Computer Engg.) (Full Time)				
Subject Code & Name	Instructions Hours per Week			Credits			
CER6E2	L	T	P	L	T	P	Total
Recent Trend in Computer Engineering(Internet of Things)	3	1	2	3	1	1	5
Duration of Theory Paper: 3 Hours							

### Learning Objectives:

1. To understand new trend of computer Engineering.
2. To understand Smart Objects and IoT Architectures.
3. To learn about various IOT-related protocols.
4. To build simple IoT Systems using Arduino and Raspberry Pi.
5. To understand data analytics and cloud in the context of IoT.
6. To develop IoT infrastructure for popular applications.

### Pre requisites:

Some basic knowledge of the python will help in doing the backend design for IoT server and a lot in designing IoT gateway. A good knowledge of C and C++ for embedded device programming and also should have the patience to work with hardware.

## COURSE OF CONTENTS

### UNIT I

**FUNDAMENTALS OF IoT :** Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -- Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects .

### UNIT II

**IoT PROTOCOLS:** IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

### UNIT III

**DESIGN AND DEVELOPMENT :** Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

### UNIT IV

**DATA ANALYTICS AND SUPPORTING SERVICES :** Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache

Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG.

## **UNIT V**

**CASE STUDIES/INDUSTRIAL APPLICATIONS :** Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control.

### **Learning Outcomes:**

**Upon completion of the course, the student should be able to:**

1. Explain the concept of IoT.
2. Analyze various protocols for IoT.
3. Design a PoC of an IoT system using Rasperry Pi/Arduino
4. Apply data analytics and use cloud offerings related to IoT.
5. Analyze applications of IoT in real time scenario

### **TEXTBOOK:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.

### **REFERENCES:**

1. ArshdeepBahga, Vijay Madiseti, —Internet of Things – A hands-on approach, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2).
3. Jan Hoeller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.