

## CS449: INTERNET OF THINGS

### Credits and Hours:

Teaching Scheme	Theory	Practical	Tutorial	Total	Credit
Hours/week	3	2	-	5	4
Marks	100	50	-	150	

### Pre-requisite courses:

- Computer Network
- Wireless Communication
- Embedded system

### Outline of the course:

Sr. No.	Title of the unit	Minimum number of hours
1	Introduction and evolution of IoT	04
2	Organization and primary components of IoT systems	08
3	A reference IoT architecture	10
4	Design issues for the IoT edge	12
5	Security, trust, and privacy issues in IoT	08
6	IoT case studies	03

**Total hours (Theory): 45**

**Total hours (Lab): 30**

**Total hours: 75**

## Detailed Syllabus:

<b>1</b>	<b>Introduction and evolution of IoT</b>	<b>04 Hours</b>	<b>09%</b>	
1.1	Internet of Things Definition Evolution Origin, Definition, Characteristics, applications, need and scope of IoT, functional stack, Cisco IoT Architecture, Processors and Operating Systems for resource constrained devices, Sensors and actuators, smart objects, IoT vs M2M, IoT vs WoT, IoE.			
<b>2</b>	<b>Organisation and primary components of IoT systems</b>	<b>08 Hours</b>	<b>18%</b>	
2.1	Structure of IoT systems			
2.2	IoT backend modules			
2.3	IoT gateways, IoT Cloud platforms : AWS IoT Platform, Azure IoT Platform, IBM Bluemix Platform, Sensor-Cloud			
2.4	Edge Computing, Fog Computing			
<b>3</b>	<b>A reference IoT architecture</b>	<b>10 Hours</b>	<b>22%</b>	
3.1	Design principles and design requirements for the reference architecture			
3.2	Real-world constraints			
<b>4</b>	<b>Design issues for the IoT edge</b>	<b>12 Hours</b>	<b>27%</b>	
4.1	Sensors and actuators for IoT systems			
4.2	Interoperability and reliability issues			
4.3	Communication protocols and protocol stacks for the edge			

	devices (HTTP, CoAP, MQTT, AMQP, XMPP)		
4.4	Hardware security for edge devices		
<b>5</b>	<b>Security, trust, and privacy issues in IoT</b>	<b>08 Hours</b>	<b>18%</b>
5.1	Identity management of IoT edge devices		
<b>6</b>	<b>IoT case studies</b>	<b>03 Hours</b>	<b>06%</b>
6.1	Smart grid		
6.2	Home automation		
6.3	Industrial IoT		

### **Instructional Method and Pedagogy:**

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.

### **Course Outcome (COs):**

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

CO1	Analyze and utilization of IoT for latest trend in IT sector.
CO2	Provide an understanding of the technologies and the standards relating to the Internet of Things.
CO3	Integration of Existing technology for development of IoT Applications
CO4	Student will be able to make program which works on Sensors
CO5	Addressing security, privacy and standardisation issues in implementation of IoT.

### Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	-	2	-	-	-	-	-	-	-	1	-	-	-
CO2	-	3	2	-	3	-	-	3	-	3	-	-	2	-
CO3	-	2	-	3	2	1	-	-	1	-	-	-	-	-
CO4	-		-	2	2	-	3	-	-	2	-	-	-	2
CO5	1	-	-	-	3	2	-	-	3	-	-	3	-	-

Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put “-”

### Recommended Study Material:

#### Text book:

1. Internet of Things: Architectures, Protocols and Standards 1st Edition , Simone Cirani, Gianluigi Ferrari, Marco Picone, and Luca Veltri.
2. Internet of Things: principles and paradigms, Buyya, Rajkumar and Amir Vahid Dasterdji (eds.), Morgan Kaufmann, 2016.
3. From Machine-to-Machine to the Internet of Things: introduction to a new age of intelligence, Holler, Jan et al, Academic Press, 2014.

#### Reference book:

1. The Internet of Things Enabling Technologies, Platforms, and Use Cases, Pethuru Raj Anupama C. Raman, 2017
2. Building Internet of Things with the Arduino, Doukas, Charalampos, Create Space Independent Publishing Platform, 2012.
3. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.

#### Web material:

1. <http://web.mit.edu/professional/digital-programs/courses/IoT/phone/index.html>
2. [https://swayam.gov.in/nd1\\_noc19\\_cs65/preview](https://swayam.gov.in/nd1_noc19_cs65/preview)
3. <https://www.edureka.co/blog/iot-tutorial/>
4. <http://www.steves-internet-guide.com/internet-of-things/>

#### Software:

1. Contiki OS
2. Node-Red
3. Proteus
4. Thinker Cad