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:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **1** | **Introduction and evolution of IoT** | **04 Hours** | **09%** | |  |
| 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. | |  | |  |
| **2** | **Organisation and primary components of IoT systems** | **08 Hours** | **18%** | |  |
| 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 | |  |
| **3** | **A reference IoT architecture** | **10 Hours** | **22%** | |  |
| 3.1 | Design principles and design requirements for the reference architecture | |  | |  |
| 3.2 | Real-world constraints | |  |
| **4** | **Design issues for the IoT edge** | **12 Hours** | **27%** | |  |
| 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 | |  |
| **5** | **Security, trust, and privacy issues in IoT** | **08 Hours** | **18%** | |  |
| 5.1 | Identity management of IoT edge devices | |  | |  |
| **6** | **IoT case studies** | **03 Hours** | | **06%** | |
| 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:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **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
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