16-01-2021

Course Number : **EEE F411**

Course Title : **Internet of Things**

Instructor-In-Charge : **Sandeep Kumar**

1. Scope and Objective:

This module is designed to provide students with solid technical knowledge and skills to build Internet of Things (IoT) systems. Internet of things has evolved due to convergence of multiple technologies - embedded systems, sensor technology, real-time data analytics, machine learning etc. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the IoT. This course comprehensively covers various technologies and tools used for enabling IoT solutions. Knowledge of various topics required for building IoT prototypes like sensors and actuators/ Communications and networking and data management is also imparted in this course. This course would also help the students understand the various IoT security challenges and solution to address them. The course will also give the students exposure to how various real world problems are being solved by IoT based solutions (like in applications for smart city, smart farming etc.). There would also be some hands on sessions where students would learn how to build and program IoT systems and make end-to-end solutions for different applications. Furthermore, assignments and projects in this course would help students build IoT prototypes and apply what they have learnt in the course to solve real world problems.

2. Text Book:

(T1) *Internet of Things: Principles and paradigms*. R. Buyya, and A.V Dastjerdi (Elsevier), 2016.

3. Reference Books:

(R1) "Precision - Internet Of Things", by Timothy Chou (Mc Graw Hill), 2017.
(R2) "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press), 2017.

(R3) "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press), 2014.
(R4) “Internet of Things” by Raj Kamal (Mc Graw Hill), 2017.
(R5) IEEE and ACM Transactions.

4. Course Plan

Lectures

Module	Topics covered	Lectures	Chapter in the Text Book
Module 1: Introduction to IoT	Introduction to IoT & Cyber-Physical Systems, IoT applications - an overview, Different Levels of IoT Applications : Level 1 - 6 with examples, IoT Design Methodology & Life Cycle, Introduction to IoT Physical End Points & Platforms, IoT System Design Examples (for applications like fitness tracker, smart parking etc.).	Lecture 1- Lecture 8	Class slides and notes. (T1: Ch-1, 12, R3: Ch-1, R4: Ch-1)
Module 2: Sensors and Actuators for IoT	Introduction to sensors for IoT application development, Data Acquisition, Signal Conditioning and Processing, Multi Sensor fusion for IoT, Advanced sensing techniques (e.g. BCI/HCI), Actuators and Controllers for IoT	Lecture 9 - Lecture 14	Class slides and notes. (T1: Ch-15, R4: Ch-7)
Module 3: Programming IoT end points	Introduction to Arduino microcontroller for IoT applications, Programming with Arduino and prototype development (e.g. for smart farming, smart city applications etc.), Introduction to Raspberry Pi, Programming Raspberry Pi (Python), Introduction to Android platform and services, Android App development for IoT Applications	Lecture 15- Lecture 24	Class slides and notes + Internet resources.
Module 4: Communications and networking in IoT	Introduction to IoT Network, Communication & Networking Requirements in IoT, Network Models & Architecture (Client-server, P2P etc.), Wireless sensor networks, Other Ad Hoc networks (MANET, VANET), Common network standards (Bluetooth, NFC, LORA) etc.	Lecture 25 - Lecture 31	Class slides and notes. (Ch-3, R3: Ch-4, R4: Ch-4)
Module 5:	Data Management for IoT, Advanced optimization for	Lecture	Class slides and

Data management in IoT	processing sensor data, Machine learning for IoT data analytics, Introduction to IoT Cloud Services, Case studies of Cloud services for IoT and learning how to use them.	32-Lecture 36	notes. (Ch-8,9, R3: Ch-10, R4: Ch-5,6)
Module 6: Security issues in IoT	Cyber-attacks on IoT- Case study, Security solutions for IoT: hardware/software	Lecture 37 - Lecture 38	Class slides and notes. (Ch-10, R4: Ch-10)
Module 7: Emerging topics in the IoT	Smart-grid, Industrial IoT etc.	Lecture 39 - Lecture 41	Class slides and notes. (T1: Ch-16)

Labs:

Lab for the course would be once in a week for ~ 2 hour of duration. It would consist of the demo sessions where the students will learn how to work with microcontrollers and raspberry pi and learn building IoT applications starting from the scratch. The list of experiments to be conducted along with the schedule and evaluation scheme is as follows:

S.No.	Name of Experiment	Week	Evaluation Method
1	Introduction to Raspberry-pi 3 and Python Programming.	1st	Lab record and assignment.
2	Interfacing Raspberry-pi with the smart phone for enabling home automation.	2nd	
3	Home Security System using Raspberry-pi and PIR Sensor.	3rd	
4	Remote Data Logging with Raspberry-pi using	4th	

	socket programming.		
5	Design of a temperature dependent auto-cooling system using Raspberry-pi.	5th	
6	LED Control and Pi-Camera interfacing with Raspberry-pi.	6th	
7	Introduction to BOLT IoT module and it's interfacing with smart phone.	7th	
8	Home automation using the BOLT IoT module.	8th	
9	Introduction to Arduino microcontroller and its programming.	9th	
10	Interfacing of the sensors and actuators with Arduino.	10th	

Overall Evaluation Scheme:

S. No	Evaluation Component	Weightage	Marks (out of 300)	Duration	Date and Time	Nature
1	Mid-Semester Test	30 %	90	90 minutes	02/03 3.30 - 5.00PM	Open book
2	Quizzes (Best 1 out of 2)	5 %	15	15 minutes	To be announced	Open book

3	Lab Sessions	10 %	30	Each of 2 hours	As per time table	Open book
4	Lab Quiz	10 %	30	30 minutes	To be announced	Open book
5	Assignment	5 %	15	-	To be announced	Open book
6	Comprehensive Exam	40 %	120	120 minutes	05/05 AN	Open book
	Total	100 %	300			

Chamber Consultation Hour: To be announced in Class.

Notices: All notices regarding the course will be put up on CMS.

Make-up Policy: No make-up will be provided without prior permission from the Instructor-Incharge (IC).

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge