COURSE TITLE	**SENSOR AND IOT**
COURSE CODE	**01CT1618**
COURSE CREDITS	**4**

Objective:

1 The objective of the course is to introduce to fundamentals of IoT and understand applications of IoT in various domains. Explore hardware, software, communication and data management enablers for IoT and learn to use them along with fulfilling security requirements of IoT.

Course Outcomes: After completion of this course, student will be able to:

1 Understand IoT architecture, hardware and software components, protocols and applications.

2 Apply proper access technologies and protocols to build IoTNodes.

3 Implement algorithms related to various layers in protocol stack of IoTframework.

4 Distinguish between various IoT architectural components, hardware modules, communication techniques, security technologies and relate them with IoT applications.

5 Construct an IoT solution for existing applicationdomains.

Pre-requisite of course: Introduction to Single Board Computer Programming, Computer Networks, Internet and Web Technology

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Introduction to Internet of Things** Definitions, Core Concepts, Related Concepts, Challenges, IoT framework, IoT Reference Models, IoT Architecture: IoTWF architecture, architecture for adequate design for required security, architecture of edge computing, OPC unified architecture, oneM2M	8
2	**IoT Devices** Classification of Things in IoT, Sensors and its classification, Actuators and its classification, Working principles of various sensors, MEMS, Smart Objects, Case study – Sensor tag energy harvesting, batteries and super capacitors,interfacing of sensors with microcontroller	6

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Contents : Unit	Topics	Contact Hours
3	**IoT Protocols** Communication Criteria, Access technologies and communication protocols, Bluetooth, BLE, LoRaWAN, WirelessHART, Zwave,LTE-M, NB-IoT, Sigfox, 6LowPAN, 6TiSCH, LLN, RPL, MQTT, Publish-Subscribe Operation, Packet Structure, Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS), Session Layer-HTTP, XMPP, AMQP	14
4	**Security in IoT** Protocols and technologies, Lightweight formats for crypto security, CoAP, DTLS, Object security for constrained RESTful environments, OAUTH based authorization, Denial of Service attacks, selective jamming in wireless networks, Intrusion detection systems and firewalls	8
5	**Recent trends in IoT** IoT application domains: Smart Cities, Smart Manufacturing, Smart Grid, Smart Buildings, Intelligent Transportation Systems, Healthcare	6
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment-1** Demonstrate the working of raspberry pi	2
2	**Experiment-2** Hands-on experimentation on connecting Raspberry Pi with existing system components.	2
3	**Experiment-3** To sense temperature and humidity using sensors interfaced with IoT hardwareboard.	2
4	**Experiment-4** To detect presence using proximity sensor interfaced with IoT hardwareboard.	2
5	**Experiment-5** To detect distance of object using ultrasonic sensor interfaced with IoT hardware board.	2
6	**Experiment-6** To interface pressure sensor with IoT hardware board and read sensed data.	2
7	**Experiment-7** To read RFID tag using RFID reader interfaced with IoT hardware board.	2
8	**Experiment-8** To control LED on IoT hardware board using Bluetooth module interfaced with it.	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
9	**Experiment-9** To get location data using GPS module interfaced with IoT hardware module on webpage.	2
10	**Experiment-10** To understand implementation of MQTT using ContikiOS.	2
11	**Experiment-11** To understand implementation of CoAP using ContikiOS.	2
12	**Experiment-12** To create IPv6 network and configure network stack using Cooja simulator.	2
13	**Experiment-13** Demonstrate a smart object API gateway service reference implementation in IoT toolkit.	2
14	**Experiment-14** Sketch the architecture of IoT Tool kit and explain each entity in brief.	2
15	**Experiment-15** Write and explain working of an HTTP- to-CoAP semantic mapping proxy in IoT toolkit.	2
16	**Experiment-16** Describe gateway-as-a-service deployment in IoT tool kit.	2
17	**Experiment-17** Explain application framework and embedded software agents for IoT tool kit.	2
18	**Experiment-18** Define and Explain Eclipse IoTProject.	2
19	**Experiment-19** List and summarize few Eclipse IoTProjects.	2
20	**Experiment-20** Give overview of Zetta.	2
Total Hours		**40**

Textbook :

1 Internet of Things A to Z: Technologies and Applications, Q. F. Hassan, IEEE Press,Wiley, 2018

2 IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, D. Hanes, G. Salguerio, P. Grossetete, R. Barton, J. Henry, CISCOPress, 2017

3 From Machine to Machine to Internet of Things, J. Holler, V. Tsiatsis, C. Mulligan, S. Karnouskos, S. Avesand, D. Boyle, Academic Press,ELSEVIER, 2014

References:

1 The Internet of Things Enabling Technologies, Platforms, and Use Cases, The Internet of Things Enabling Technologies, Platforms, and Use Cases, P. Raj, A. Raman, CRCPress, 2017

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
15.00	30.00	20.00	15.00	10.00	10.00

Instructional Method:

1 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

2 Practical examination will be conducted at the end of the semester for evaluation of performance of students in laboratory.

3 Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.

4 The course delivery method will depend upon the requirement of content and need of the students. The teacher in addition to conventional teaching method (Chalk and Talk) may use any of the tools such as demonstration, role play, Quiz, brainstorming, Flipped class, Project based learning, Collaborative learning, MOOCs etc. for effective teaching.

Supplementary Resources:

1 https://www.coursera.org/specializations/iot

2 https://www.coursera.org/specializations/internet-of-things

3 https://nptel.ac.in/courses/106/105/106105166

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