COURSE TITLE	**INTERNET OF THINGS AND APPLICATIONS**
COURSE CODE	**01CE0620**
COURSE CREDITS	**3**

Objective:

1 Students will build working IoT applications by connecting basic microcontrollers with various physical sensors and actuators. They will illustrate the purpose of different IoT protocols by mapping the data flow across their connected devices. Furthermore, students will apply essential security principles to identify potential risks within their applied hardware configurations.

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

1 Apply the fundamental concepts, characteristics, and architectural levels of IoT.
2 Apply sensor and actuator principles to sensing and control tasks.
3 Analyze microcontroller features for hardware interfacing.
4 Analyze IoT protocols for efficient data communication.
5 Analyze IoT security concepts and demonstrate IoT application use cases.

Pre-requisite of course:NA

Teaching and Examination Scheme

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

Contents : Unit	Topics	Contact Hours
1	**Introduction to Internet of Things** Introduction and Definition of Internet of Things, need and scope of IoT, Application Areas of IoT, Characteristics of IoT, Things in IoT, IoT Stack, Enabling Technologies,, IoT Challenges, IoT Levels, IoT and Cyber Physical System IoT and WSN	6
2	**Sensor and Actuators** Definition, features, classification, characteristics, physics of few basic and important sensors and actuators	5
3	**Microcontroller, Microprocessor and their Interfacing** Basics of a controller, popular microcontrollers, Overview of different peripherals, ADC, DAC, Memory, GPIO, Timers, Interfacing of Sensors and Actuators to microcontrollers and microprocessors, Introduction to: Arduino, Raspberry Pi, ESP32, Orange Pi	6
4	**Protocols for IoT** Messaging protocols: CoAP, MQTT, XMPP, AMQP, Transport protocols: BLE, LiFi	5

Contents : Unit	Topics	Contact Hours
5	**IoT Security and Applications of IoT** IoT Security: Various security issues and needs, Requirements, security architecture, Challenges and algorithms., Applications of IoT: Smart Home, Smart cITY, Smart Perishable Tracking with IoT and Sensors, Smart Healthcare – Elderly Fall Detection with IoT and Sensors, Smart Inflight Lavatory Maintenance with IoT, IoT–Based Application to Monitor Water Quality, Smart Warehouse Monitoring, Smart Retail – IoT Possibilities in the Retail Sector, IoT-Based Smart Driver Assistance Systems, System to Measure Collision Impact in an Accident with IoT, Case studies on IoT applications: Connected Vehicles and Autonomous Vehicles, Industrial IoT, IoMT (Internet of Medical Things)	6
Total Hours		**28**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Practical 1** Analysis of Microcontroller and Mincroprocessor based IoT devices.	2
2	**Practical 2** Hardware Interfacing: Basic I/O Operations	2
3	**Practical 3** Environmental Data Acquisition	2
4	**Practical 4** Actuator Control via Pulse Width Modulation (PWM)	2
5	**Practical 5** Local Connectivity using Bluetooth/BLE	2
6	**Practical 6** Introduction to Web Servers	2
7	**Practical 7** MQTT Protocol Implementation	2
8	**Practical 8** Cloud Integration and Data Visualization	2
9	**Practical 9** Automated Threshold Control System	2
10	**Practical 10** Capstone Application: Small-Scale Industry Use Case	2
Total Hours		**20**

Textbook :

1 Internet of Things, Vasudevan, Nagrajan and Sundaram, Wiley India, 2022

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References:

1 Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security, Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security, Perry Lea, Packt Publishing, 2018

2 IoT Fundamentals - Networking Technologies, Protocols, and Use Cases for Internet of Things, IoT Fundamentals - Networking Technologies, Protocols, and Use Cases for Internet of Things, David Hanes, G. Salgueiro, Cisco Press, 2017

3 Interconnecting Smart Objects with IP: The Next Internet, Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kaufmann, 2010

4 Learning Internet of Things, Learning Internet of Things, Peter Waher, Packt Publishing Ltd, 2015

5 The Internet of Things: Key Applications and Protocols, The Internet of Things: Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, Wiley Publications, 2012

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**
0.00	10.00	50.00	20.00	20.00	0.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc

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

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

4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

1 https://www.tutorialspoint.com/internet_of_things/index.html

2 https://www.iotworldtoday.com/

3 https://www.arduino.cc/en/IoT/

4 https://www.raspberrypi.com

5 https://www.iotforall.com/

6 https://www.hackster.io/

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Supplementary Resources:

7 https://www.tinkercad.com/