COURSE CODE	COURSE TITLE	L	T	P	C
1152EC229	INTERNET OF THINGS	1	0	4	3

a. Course Category:

Program Elective

b. Preamble:

Internet of Things (IoT) is presently a hot technology worldwide. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions.

c. Prerequisite Courses:

Data Communication Networks

d. Related Courses:

Software Defined Radio

e. Course Outcomes :

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Skill Level (Based on Dave's Taxonomy)
CO1	Explain about the IoT Architecture, Protocols, IoT6 and the hardware/software used to design an IoT device	K2
CO2	Program MSP430 wireless microcontroller unit for various IoT applications	S4
CO3	Program Raspberry PI wireless microcontroller unit for various IoT applications	S4

f. Correlation of CO's with PO's

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	M	-	-	-	-	-	-	-	-	L	-	-
CO2	M	M	H	L	L	L	L	L	-	-	-	L	-	-
CO3	M	-	-	-	L	-	-	-	M	L	L	-	M	M

g. Examination scheme

Examination Scheme for practical dominated course										
Internal evaluation (40M)							**Semester end evaluation (60M)**			
Laboratory experiment (15M)				**Model laboratory test (25M)**			**Part-A (20M)**	**Part-B (40M)**		
Performance in conducting experiment (5)	Result and analysis (3)	Viva Voce (3)	Record (4)	Performance in conducting experiment (15)	Result and analysis (5)	Viva Voce (5)	Theory questions to evaluate the knowledge and understanding (20)	Performance in conducting experiment (25)	Result and analysis (10)	Viva-Voce (5)

h. Course Content :

Theory **15 Hours**

Internet of Things – Introduction and Applications

Internet of Things Vision – IoT Applications and Use Case Scenarios – IoT Functional View – IoT Smart-X Applications: Smart Cities, Smart Energy and Smart Grid, Smart Mobility and Transport, Smart Home, Buildings and Infrastructure, Smart Factory and Manufacturing, Smart Health, Smart Logistics and Retail

IoT Protocols Convergence

Message Queue Telemetry Transport (MQTT) – Constrained Applications Protocol (CoAP) – Advanced Message Queuing Protocol (AMQP) – Java Message Service API (JMS) –Data Distribution Service (DDS) – Representational State Transfer (REST) – Extensible Messaging and Presence Protocol (XMPP)

Scalable Integration Framework for Heterogeneous Smart Objects, Applications and Services

Introduction - IPv6 Potential – IoT6 – IPv6 for IoT – Adapting IPv6 to IoT Requirements – IoT6 Architecture – DigCovery – IoT6 Integration with the Cloud and EPICS – Enabling Heterogeneous Integration – IoT6 Smart Office Use-Case – Scalability Perspective

Hardware and Software

Introduction to Raspberry Pi, MSP430 – Raspbian OS – Code Composer Studio - Python Programming

i. List of experiments

S. No	CO Mapping	Practical Exercises (60 Hours)
1.	CO1	Study of various connection policies for Wi-Fi connectivity
2.	CO2	Programming Wireless MCU to blink LED using GPIO
3.	CO2	Program to Interface Temperature Sensor using I2C Communication Interface
4.	CO2	Program to Interface accelerometer sensor using SPI communication Interface
5.	CO2	Experimenting with Wireless MCU in WLAN AP mode
6.	CO2	Experimenting with Wireless MCU in WLAN station mode
7.	CO2	Program Wireless MCU to connect to a website
8.	CO2	Program Wireless MCU to upload sensor Data to cloud(BLYNK)
9.	CO2	Program Wireless MCU for File download Application
10.	CO2	Program Wireless MCU for Email Sending Application
11.	CO2	Program Wireless MCU to behave as a HTTP Web server
12.	CO2	Program Wireless MCU for Wi-Fi Direct Application
13.	CO3	Setting up a Raspberry Pi
14.	CO3	Using Python, PHP, and MySQL
15.	CO3	Interfacing various sensors with Raspberry PI
16.	CO3	Setting up and working with a web server to store data and run other applications
17.	CO3	Using Google Cloud Messaging (GCM) service to send sensor data notification to an Android app when the situation arises and to display stored data
18.	CO3	Configure IPv6 on Raspberry PI
19.	CO3	Hosting a Website on Raspberry PI

20.	CO3	Wireless Sensor Network using Raspberry PI

Total 75 hrs

j. Suggested Learning Resources

List of textbooks

1. OvidiuVermesan& Peter Friess, Internet of Things Applications - From Research and Innovation to Market Deployment, River Publishers Series in Communications, 2014
2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (AHands-on-Approach)",1st Edition, VPT, 2014
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach toConnecting Everything", 1st Edition, Apress Publications,2013
4. CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1

List of Major Equipment/ Instrument/Software with Broad Specifications

- MSP430G2xx Launch-Pad Development Board
- MSP430F5529 Launch Pad
- TM4C129X IOT Connected Development Kit
- TIVA Launchpad EK-TM4C123Gx2
- MSP432P401R Launch pad
- CC3200 Simple Link Wi-Fi Launchpad
- Groove starter Kit for TIVA Launchpad EK-TM4C123Gx2
- Raspberry PI
- Sensors and Actuators
- Computers
- Code Composer Studio, Python, PHP, HTML, SQL

List of Software/Learning Websites

1. https://github.com/connectIOT/iottoolkit
2. https://pythonprogramming.net/

Online resources

1. Dr.SudipMisra, Video lecture on Internet of Things, Centre for Educational Technology, IIT Kharagpur Sponsored by National Programmeon Technology Enhanced Learning (NPTEL)https://onlinecourses.nptel.ac.in/noc17_cs22/preview