Hand-out for Internet of Things for students & Working Professionals (W = Week; D= Day)							
S. No	**Topic (Theory)**	**Hours**	**Instructor**	**Week & Day**	**Topic (Practical)**	**Instructors**	**Hours**
1. Introduction to IoT Technology and their applications							
Week – 1							
1.	Create awareness on the Skill development programme Course and Career progression; Course assessment and interaction	1.5		W1 – D1	Introduction to MSP 430 – Programmer's Perspective (Theory)	KSR	3.0
2.	**IOT: An Overview** ● Design Principles for connected Devices ● Various applications/ smart objects Major Players/Industry ● Standards	7.5		W1–D1 W1-D2	Introduction MSP 430 Programming environment with IAR tool and programming.	GP/PKT	3.0
3.	**IoT Architecture** ● Node Structure: Sensing, Processing, Communication, Powering ● Networking: Topologies Layer/Stack architecture **IoT Protocols** ● IoT Communication architecture ● IoT Layers & IoT Platforms	9.0		W1-D3 W1–D4 W1–D5	IAR tool and programming the MSP 430 Interfacing with MSP 430 and CC2520 using SPI	GP/PKT	9.0

2. IoT Networking and Protocols							
Week – 2							
4.	Brief introduction to HW and SW tools for MSP430, CC2520 and Raspberry Pi3.	6.0		W2-D1 W2-D2	Establishing Zig bee communication network using MSP430 and CC2520	GP/PKT	3.0
5.	● Practical IoT protocols ✓ Zigbee with WLAN and sever ✓ BLE 4.0/5.0 with WLAN and sever ✓ Zigbee /BLE 4.0/5.0 with GSM	3		W2-D3	Porting Z-stack on MSP 430 using IAR	GP	3
6.	Embedded System Interfacing design-I (UART, I2C, CAN, USB and SPI)	6.0		W2-D4 W2-D5	Embedded System Interfacing	GP/PKT	6
3. Introduction to Hardware platforms and software development for IoT Systems							
Week – 3							
	Internet Principles ● IP Addressing and sub netting ● TCP and UDP Protocols ● Wireless LAN: Introduction to WLAN **Basic concepts of Linux** ● Introduction to Apache Web Server ✓ Client-Server ✓ Publish-Subcribe ✓ P2P ● MySQL and PHP Basics ● PHP Basic Programming ● MySQL basic commands ● Working with PHP and MySQL	6.0		W3-D1 W3-D2	Setting up Apache Web Server, MySQL, PHP and PhpMyadmin (Installation and Configuration) Hands on with MySQL and PHP programming	AS	6.0

7.	**IoT Prototypes** ● IoT Communication Protocols in application layer: JSON, CoAP, XMPP, RESTFULL, MQTT, AMQP, HTML5, WebSocket ● IoT Communication Protocols, IoT Web Services (mDNS, DNS-SD) ● Cloud Computing	3		W3-D3	Networking Lab	AS	3
7.	Brief introduction to HW and SW tools for Arduino Mega, GPS and GSM development boards	2.0		W3-D4	Getting started with Arduino software & Arduino MEGA 2560, Programming Arduino MEGA, Arduino Library writing	AKS	3.0
8.	● Cluster computing, Big Data, Docker and Container, IoT Security	1.0		W3-D4	Understanding of display interfacing with Arduino	AKS	3.0
9.	Introduction to ESP8266 Wi-Fi module ● Working with ESP8266 & HTTP ● Working with ESP8266 & MQTT	3.0		W3-D5	Programming ESP8266 as web server and interfacing with Arduino MEGA for web server, ● Interfacing ESP8266 data with MQTT server and Node-Red application TEST -1	AKS	1.0
4. Sensors /Actuators and GSM/GPS modules interfacing with IoT System							
Week – 4							
10.	• IoT System design with GPS and GSM modules. • **IoT System Design:** Pollution monitoring System	2.0		W4-D1	Programming ESP8266 as web server and interfacing with Arduino MEGA for web server, ● Interfacing ESP8266 data with MQTT server and Node-Red application	AKS/SM	3.0

11.	Embedded System Interfacing design-II (ADC and DAC) ● Sensors (Temp, Ph, Humidity, Gas and Accelerometer, LDR, PIR and Ultrasonic) ● Actuators (Motor, Relay etc.)	6.0		W4-D2 **W4-D3** **(LAB)**	● Interfacing DHT11/22, PIR, Ultrasonic sensor ● Working with serial port ● ADC basics and analog sensor interfacing ● LDR, IR sensor and Gas sensors ● Digital sensor interfacing	AKS/SKB	6.0
21.	**IoT System Design:** Gas detection system	6.0		W4-D4 W4-D5	Experiment of environment monitoring system using GAS sensors	KK/SM	6.0
Data acquisition and Analysis of IoT System's data							
Week – 5							
12.	● Introduction to Python Programming ● IoT System connectivity with WLAN Raspberry Pi3	6.0		W5-D1 W5-D2	Basics of Programming Raspberry pi 3 Establishment of WLAN with Raspberry Pi3 (SRP)	MKL/GP/JSP	6.0
13.	Interfacing Cameras with Raspberry Pi3	3.0		W5-D3	Establishment of Camera with Raspberry Pi3 • Buzzer interfacing • Relay interfacing • Servo and stepper motor interfacing	GP/JSP	3.0
14.	Raspberry Pi3 Camera data transfer using WLAN	3.0		W5-D4	Raspberry Pi3 Camera data transfer using WLAN	GP	3.0

IoT System Design: Case studies							
Week – 6							
8.	• Practical IoT protocols ✓ BLE 4.0/5.0 with Android application connecting to cloud /sever • Case study: IoT System Design for Water Quality Measurement	6.0		W6-D1 W6-D2	TEST -2 Project Discussion		
20.	**IoT System Design:** Water Quality Measurement System	6.0		W6-D3 W6-D4	Lab on microcontroller based system testing and validation using a physical parameter. Water Quality measurement using physical water parameters.	SKV	3.0
22.	Project Work discussions and implementation	3.0	Partici pants	W6-D4	Project Work discussions	KSR	3.0
23.	Project Work discussions and implementation	3.0	Partici pants	W6-D5	EVALUATION & VALIDICTORY	KSR & Others	

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1st Week- 4th -8th June 2018; 2nd Week -11th -15th June 2018; 3rd Week - 18th – 22nd June 2018;
4th Week-25th -29th June 2018; 5th Week-2nd-6th July 2018; 6th Week-9th –13th July 2018

References:

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3. Huansheng Ning, "Unit and Ubiquitous Internet of Things", CRC press, 2013.
4. Charles Bell, "Beginning Sensor Networks with Arduino and Raspberry Pi," Apress, Berkely, CA, USA, 2013.
5. Lee and Seshia, "Introduction to Embedded Systems— A Cyber-Physical Systems Approach," 2Ed, MIT Press, 2017
6. Warren Gay, "Raspberry Pi Hardware Reference," Apress, Berkely, CA, USA, 2014.
7. Julien Bayle, "C Programming for Ardunio", PACKET Publishing, 2013
8. Rick Anderson and Dan Cervo, "Pro Ardunio," Apress, Berkely, CA, USA, 2013.
9. Francia daCosta, "Rethinking the Internet of Things A scalable Approach to Connecting Everything," Apress, Berkely, CA, USA, 2013
10. Gaston C. Hillar, "Internet of Things with Python," Packet publishing, 2016
11. Kai Hwang.Geoffery C.Fox.Jack, J.Dongarra, "Distributed and Cloud Computing From Parallel Processing to the Internet of Things," MORGAN KAUPHANN, 2012