

<b>IoT Theory Course Work 2017</b>			
<b>S.No.</b>	<b>Theory Topics</b>	<b>Hours</b>	<b>Instructor</b>
1	<b>LAMP (Linux, Apache, MySQL, PHP)</b>		Dr. Anil Saini
	• Basic concepts of Linux	1 Hr	
	• Introduction to Apache Web Server, MySQL and PHP Basics	1 Hr	
	• PHP Basic Programming	1 Hr	
	• MySQL basic commands	1 Hr	
	• Working with PHP and MySQL	1 Hr	
2	<b>Introduction to TCP/IP</b>	1 Hr	Dr. Anil Saini
	• Basic computer networks	1 Hr	
	• TCP/IP Layers	1 Hr	
	• IP Addressing and sub netting	1 Hr	
3	<b>Wireless LAN</b>	1 Hr	Dr. Anil Saini
	• Introduction to WLAN	1 Hr	
	• IEEE 802.11 Standards – Architecture – Services	1 Hr	
4	<b>Configuration issues with OS for Networking</b>	2 Hrs	Dr. Anil Saini
	• Troubleshooting Networks		
5	<b>Understanding of IoT protocol stack</b>		Dr. Anil Saini
	• IoT Architecture and Standards	1 Hr	
	• IoT Layers	1 Hr	
6	<b>Basic Communication Networking</b>	1 Hs	Dr. Anil Saini
	• Ipv4/IPv6		
7	Networking with IoT Devices at EDGE and Gateway	2 Hrs	Dr. Anil saini
8	Cloud Connectivity	2 Hrs	Dr. Anil saini
9	<b>Water Monitoring Sensors</b>	4 hrs	Mr.SKV Sai
	• Introduction - Key Water Monitoring Sensors	1 Hr	Mr.SKV Sai
	• pH Sensor	1 Hr	Mr.SKV Sai
	• Principle of Measurement		

	<ul style="list-style-type: none"> <li>Types of pH Sensors</li> </ul>		
	<ul style="list-style-type: none"> <li>Advantages and Disadvantages</li> </ul>		
	<ul style="list-style-type: none"> <li>Dissolved Oxygen Sensors</li> </ul>	1 Hr	Mr.SKV Sai
	<ul style="list-style-type: none"> <li>Principle of Measurement</li> </ul>		
	<ul style="list-style-type: none"> <li>Types of DO Sensors</li> </ul>		
	<ul style="list-style-type: none"> <li>Advantages and Disadvantages</li> </ul>		
	<ul style="list-style-type: none"> <li>Total Dissolved Solids</li> </ul>	0.5 Hrs	Mr.SKV Sai
	<ul style="list-style-type: none"> <li>Principle of Measurement</li> </ul>		
	<ul style="list-style-type: none"> <li>Types of TDS Sensors</li> </ul>		
	<ul style="list-style-type: none"> <li>Advantages and Disadvantages</li> </ul>		
	<ul style="list-style-type: none"> <li>Overview of Other Water Quality Sensors</li> </ul>	0.5 Hrs	Mr.SKV Sai
10	<b>Environment Monitoring Sensors (4 Hours)</b>	4 hrs	Mr.SKV Sai
	<ul style="list-style-type: none"> <li>Introduction - Key Environment Monitoring Sensors</li> </ul>	0.5 Hrs	Mr.SKV Sai
	<ul style="list-style-type: none"> <li>Temperature</li> </ul>	1 Hrs	Mr.SKV Sai
	<ul style="list-style-type: none"> <li>Principle of Measurement</li> </ul>		
	<ul style="list-style-type: none"> <li>Types of Temperature Sensors</li> </ul>		
	<ul style="list-style-type: none"> <li>Advantages and Disadvantages</li> </ul>		
	<ul style="list-style-type: none"> <li>Relative Humidity</li> </ul>	1 Hrs	Mr.SKV Sai
	<ul style="list-style-type: none"> <li>Principle of Measurement</li> </ul>		
	<ul style="list-style-type: none"> <li>Types of RH Sensors</li> </ul>		
	<ul style="list-style-type: none"> <li>Advantages and Disadvantages</li> </ul>		
	<ul style="list-style-type: none"> <li>Wind Measurement</li> </ul>	1 Hrs	Mr.SKV Sai
	<ul style="list-style-type: none"> <li>Principle of Measurement</li> </ul>		
	<ul style="list-style-type: none"> <li>Types of Wind Measurement Sensors</li> </ul>		Mr.SKV Sai
	<ul style="list-style-type: none"> <li>Advantages and Disadvantages</li> </ul>	0.5 Hrs	Mr.SKV Sai
	<ul style="list-style-type: none"> <li>Overview of Other Environment Sensors</li> </ul>		
11	<b>Arduino Platform and Tool</b> <ul style="list-style-type: none"> <li>Arduino Software</li> <li>Arduino programming language</li> <li>Arduino MEGA 2560 specifications</li> <li>Arduino MEGA pin mapping</li> </ul>	3 Hrs	Mr.A K saini
12	<b>Arduino GPIOs and LCD interfacing</b> <ul style="list-style-type: none"> <li>Familiarization of Arduino MEGA GPIOs with their operation</li> <li>LCD display</li> <li>LCD display interfacing with Arduino MEGA</li> </ul>	3 Hrs	Mr.A K saini

13	<b>Analog sensors interfacing</b> <ul style="list-style-type: none"> <li>• Arduino ADC</li> <li>• LDR interfacing</li> <li>• IR sensor interfacing</li> <li>• Gas sensors interfacing</li> </ul>	4 Hrs	Mr.A K saini
14	<b>Digital sensor interfacing</b> <ul style="list-style-type: none"> <li>• DS18B20 temperature sensor</li> <li>• PIR sensor interface</li> <li>• Ultrasonic sensor</li> <li>• GPS and GPRS interfacing</li> </ul>	4 Hrs	Mr.A K saini
15	<b>Actuator Interfacing</b> <ul style="list-style-type: none"> <li>• Buzzer interfacing</li> <li>• Relay interfacing</li> <li>• Stepper motor</li> </ul>	3 Hrs	Mr.A K saini
16	<b>Wi-Fi module</b> <ul style="list-style-type: none"> <li>• Working with ESP8266</li> <li>• Interfacing ESP8266 with Arduino MEGA</li> </ul>	3 Hrs	Mr.A K saini
17	<b>Getting Started with Software Environment</b> <ul style="list-style-type: none"> <li>• Need of Embedded System</li> <li>• Need of operating system</li> <li>• Existing Embedded Systems for pi 3</li> </ul>	3 hrs	

<b>IoT Practical's 2017</b>			
<b>S.no</b>	<b>Labs Assignment</b>	<b>Hours</b>	<b>Instructor</b>
1.	Introduction MSP 430 Programming environment	8	Mr. Somesh Rao/Gaurav
2.	<ul style="list-style-type: none"> <li>• Working with Arduino software</li> <li>• Getting started with Arduino MEGA 2560</li> <li>• Programming Arduino MEGA</li> <li>• Library writing and porting for Arduino</li> </ul>	4	Mr.A K saini
3.	<ul style="list-style-type: none"> <li>• Interfacing of two Arduino board with I2C and UART with terminal, LCD interfacing</li> </ul>	4	Mr.A K saini

4.	<ul style="list-style-type: none"> <li>Interfacing with MSP 430 and CC2520 using SPI</li> </ul>	8	Mr.Gaurav
5.	Instrumentation and Sensors - Water and Environment Monitoring <ul style="list-style-type: none"> <li>Interface of Sensors (with Inbuilt transmitter) with ADC</li> <li>Gain and Offset Calculation</li> <li>Interfacing with ADC</li> <li>Interface of Sensors with Serial Communication</li> <li>Temperature Measurement using Thermocouple Circuit Development</li> <li>Interface and Testing</li> </ul>	8	Mr.S K V sai
6.	MSP 430 + cc2520 + raspberry pi 3		Mr.Gavrav
7.	<ul style="list-style-type: none"> <li>Working with Arduino ADC</li> <li>Interfacing LDR, IR sensor and Gas sensors</li> </ul>	4	Mr.A k Saini
8.	<ul style="list-style-type: none"> <li>Interfacing DS18B20, PIR, Ultrasonic sensor and GPRS module</li> </ul>	4	Mr.A K saini
9.	<ul style="list-style-type: none"> <li>Working with camera and microphone with Raspberry pi3</li> </ul>	4	Mr.Gaurav
10.	<ul style="list-style-type: none"> <li>Buzzer interfacing</li> <li>Relay interfacing</li> <li>Stepper motor</li> </ul>	4	Mr.A k Saini
11.	Setting up Apache Web Server, MySQL, PHP and PhpMyadmin (Installation and Configuration)	4	Dr. A saini
12.	Hands on with MySQL and PHP programming	4	Dr. A saini
13.	Hands on with Networking and its troubleshooting	4	Dr. A saini
14.	Networking with IoT Devices	4	Dr. A saini
15.	Python programming		Mr.Someshwara Rao
16.	<ul style="list-style-type: none"> <li>Programming ESP8266 standalone and interfacing with Arduino MEGA for Internet.</li> </ul>	4	Mr.A k Saini
		4	Dr. A saini

	<ul style="list-style-type: none"> <li>• How to connect various IoT devices and establish communication among these devices.</li> <li>• How to send and receive data on IoT devices at edge, gateway and server levels.</li> </ul>	4	Dr. A saini
17.	<b>System Design for a Particular Sensor</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Power Supply Requirement</li> <li>• Digital I/O Isolation Mechanisms</li> <li>• Sampling &amp; Actuator</li> </ul>	12	Mr.S K V sai
18.	<b>For project</b>	8	
19.	<b>Project Evaluation</b>	4	
20.	<ul style="list-style-type: none"> <li>• Instrumentation and Sensors - Water and Environment Monitoring</li> <li>• Interface of Sensors (with Inbuilt transmitter) with ADC</li> <li>• Gain and Offset Calculation</li> <li>• Interfacing with ADC</li> <li>• Interface of Sensors with Serial Communication</li> <li>• Temperature Measurement using Thermocouple</li> <li>• Circuit Development</li> <li>• Interface and Testing</li> </ul>	12	Mr.S K V sai
21.	System Design for a Particular Sensor.	12	Mr.S K V sai
22.	<b>Introduction</b> <ul style="list-style-type: none"> <li>• Power Supply Requirement</li> <li>• Digital I/O Isolation Mechanisms</li> <li>• Sampling &amp; Actuator</li> <li>• Interfacing with RTC and EEPROM</li> <li>• Data Analysis and Storage</li> </ul>		Mr.S K V sai
23.	<ul style="list-style-type: none"> <li>• Working with Arduino software</li> <li>• Getting started with Arduino MEGA 2560</li> <li>• Programming Arduino MEGA</li> <li>• Library writing and porting for Arduino</li> </ul>	4	Mr.A k Saini
24.	<ul style="list-style-type: none"> <li>• Working with Arduino ADC</li> <li>• Interfacing LDR, IR sensor and Gas sensors</li> </ul>	4	Mr.A k Saini
25.	<ul style="list-style-type: none"> <li>• Interfacing DS18B20, PIR, Ultrasonic sensor and GPRS module</li> </ul>	4	Mr.A k Saini

26.	<ul style="list-style-type: none"> <li>• Buzzer interfacing</li> <li>• Relay interfacing</li> <li>• Stepper motor</li> </ul>	4	Mr.A k Saini
27.	<ul style="list-style-type: none"> <li>• Programming ESP8266 standalone and interfacing with Arduino MEGA for Internet</li> </ul>	4	Mr.A k Saini
28.	<ul style="list-style-type: none"> <li>• Working with camera and microphone with Raspberry pi3</li> </ul>	4	Mr.Gaurav
29.	<ul style="list-style-type: none"> <li>• MSP 430 + cc2520 + raspberry pi 3</li> </ul>	4	Mr.Gaurav
30.	Mini Project ( 1 hrs/day)	30 Hrs	

### Handout for Internet of Things for students & Working Professionals

S.no	Topic (Theory)	Hours	Instructor	Date	Topic (Practical)	Hours
1	Create awareness on the Skill development programme Course and Career progression Course assessment and interaction	3	KSR	15-05-17		
2	Brief introduction to HW and SW tools (MSP430 +CC2520 + Raspberry Pi3), (Arduino Mega + GSM sim900 /A6 (GPS and GSM)) and Arduino Mega + GSM sim900 /A6 (GPS and GSM)+ Raspberry Pi3), OS (Debian), IAR; Languages: C, Python, LAMP (Linux, Apache,MySQL and PHP)	3	KSR	16-05-17	Introduction MSP 430 Programming environment (SRP)	4
3	WSN with WLAN and Server, WSN and BLE with Server and WSN /BLE4.0 with GSM Server Understanding of IoT Applications of IoT	3	KSR	17-05-17	IAR tool and programming the MSP 430 (SRP)	4
4	Knowledge about HW and SW tools for IoT How various trends have enabled the Internet of Things, and changes the way design is performed	3	KSR	18-05-17	Porting Z-stack on MSP 430 using IAR (SRP)	4
5	Embedded System design aspects for IoT	3	KSR	19-05-17	Interfacing with MSP 430 and CC2520 using SPI (SRP)	4
6	Able to work with SW environment Understands how to write a program using HW boards (Raspberry Pi)	6	GP	22-05-17 & 23-05-17	Establishing Zig bee communication network using MSP430 and CC2520 (SRP)	8

7	<ul style="list-style-type: none"> <li>• Arduino Platform and Tool</li> <li>• Arduino Software</li> <li>• Arduino programming language.</li> <li>• Arduino MEGA 2560 specifications</li> <li>• Arduino MEGA pin mapping</li> </ul>	6	AKS	24-05-17 & 25-05-17	<ul style="list-style-type: none"> <li>• Working with Arduino software</li> <li>• Getting started with Arduino MEGA 2560</li> <li>• Programming Arduino MEGA</li> </ul>	8
8	<ul style="list-style-type: none"> <li>• Arduino GPIOs and LCD interfacing</li> <li>• Familiarization of Arduino MEGA GPIOs with their operation</li> <li>• LCD display</li> <li>• LCD display interfacing with Arduino MEGA</li> </ul>	3	AKS	26-05-17	<ul style="list-style-type: none"> <li>• Interfacing of two Arduino board with I2C and UART with terminal, LCD interfacing</li> </ul>	4
9	Interfacing with ADC (Types of ADCs with suitable application and their operations), Basics of DAC, accelerometers	3	SM	29-05-17	Basics of Programming Raspberry pi 3	4
10	Embedded System design Interfacing (UART, I2C and SPI)	3	KSR	30-05-17	Establishment of WLAN with Raspberry Pi3 (SRP)	4
11	Water Monitoring Sensors Introduction - Key Water Monitoring Sensors	3	SKV	31-05-17		
	<ul style="list-style-type: none"> <li>• pH Sensor</li> <li>• Principle of Measurement</li> <li>• Types of pH Sensors</li> </ul>				Instrumentation and Sensors - Water and Environment Monitoring (Practical)	4



	<ul style="list-style-type: none"> <li>• Advantages and Disadvantages</li> <li>• Dissolved Oxygen Sensors</li> <li>• Principle of Measurement</li> <li>• Types of DO Sensors</li> <li>• Advantages and Disadvantages</li> <li>• Total Dissolved Solids</li> <li>• Principle of Measurement</li> <li>• Types of TDS Sensors</li> <li>• Advantages and Disadvantages</li> <li>• Overview of Other Water Quality Sensors</li> </ul>					
12	Embedded System design Interfacing (USB)	3	KSR	01-06-17		
13	<ul style="list-style-type: none"> <li>• Analog sensors Interfacing Arduino ADC</li> <li>• LDR interfacing</li> <li>• IR sensor interfacing</li> <li>• Gas sensors interfacing</li> </ul>	3	AKS	02-06-7	<ul style="list-style-type: none"> <li>• Working with Arduino ADC</li> <li>• Interfacing LDR, IR sensor and Gas sensors</li> </ul>	4
14	Digital sensor interfacing <ul style="list-style-type: none"> <li>• DS18B20 temperature sensor</li> <li>• PIR sensor interface</li> <li>• Ultrasonic sensor</li> <li>• GPS and GPRS interfacing</li> </ul>	3	AKS	05-06-17	<ul style="list-style-type: none"> <li>• Interfacing DS18B20, PIR, Ultrasonic sensor and GPRS module</li> </ul>	4
15	Interfacing Microphones and Cameras with Raspberry Pi3	3	GP	06-06-17	Establishment of Camera with Raspberry Pi3	4
	<ul style="list-style-type: none"> <li>• Actuator Interfacing</li> <li>• Buzzer interfacing</li> <li>• Relay interfacing</li> <li>• Stepper motor</li> </ul>	3	AKS	07-06-17	<ul style="list-style-type: none"> <li>• Buzzer interfacing</li> <li>• Relay interfacing</li> </ul>	4

16	LAMP (Linux, Apache, MySQL, PHP)	3	AS	08-06-17		
	<ul style="list-style-type: none"> <li>• Basic concepts of Linux</li> <li>• Introduction to Apache Web Server,</li> <li>• MySQL and PHP Basics</li> <li>• PHP Basic Programming</li> <li>• MySQL basic commands</li> <li>• Working with PHP and MySQL</li> <li>• Basic concepts of Linux</li> </ul>				Setting up Apache Web Server, MySQL, PHP and PhpMyadmin (Installation and Configuration)	4
	<ul style="list-style-type: none"> <li>• Basic concepts of Linux</li> </ul>				Hands on with MySQL and PHP programming	4
	<p>Introduction to TCP/IP</p> <ul style="list-style-type: none"> <li>• Basic computer networks</li> <li>• TCP/IP Layers</li> <li>• IP Addressing and sub netting</li> </ul> <p>Wireless LAN</p> <ul style="list-style-type: none"> <li>• Introduction to WLAN</li> <li>• IEEE 802.11 Standards – Architecture – Services</li> </ul>				Hands on with Networking and its troubleshooting	4
					Networking with IoT Devices	
17	Application development	3	KSR	09-06-17	Raspberry Pi3 Video data transfer using WLAN	8
18	Raspberry Pi3 Camera data transfer using WLAN	3	GP	12-06-17		
19	<ul style="list-style-type: none"> <li>• Wi-Fi module</li> <li>• Working with ESP8266</li> <li>• Interfacing ESP8266 with Arduino MEGA</li> </ul>	3	AKS	13-06-17	• Programming ESP8266 standalone and interfacing with Arduino MEGA for Internet	4
20	<ul style="list-style-type: none"> <li>• Configuration issues with OS for Networking</li> <li>• Troubleshooting Networks</li> </ul>	3	AS	14-06-17	How to connect various IoT devices and establish communication among these devices.	8
21	<ul style="list-style-type: none"> <li>• Understanding of IoT protocol stack</li> <li>• IoT Architecture and Standards</li> <li>• IoT Layers</li> </ul>	3	AS	15-06-17		

22	<ul style="list-style-type: none"> <li>• Basic Communication Networking</li> <li>• Ipv4/IPv6</li> </ul>	3		16-06-17	How to send and receive data on IoT devices at edge, gateway and server levels.	8
23	<ul style="list-style-type: none"> <li>• Networking with IoT Devices at EDGE and Gateway</li> <li>• Cloud Connectivity</li> </ul>	3		19-06-17		
24	<ul style="list-style-type: none"> <li>• System Design for a Particular Sensor</li> <li>• Introduction</li> <li>• Power Supply Requirement</li> <li>• Digital I/O Isolation Mechanisms</li> <li>• Sampling &amp; Actuator</li> </ul>	3	SKV	20-06-17	Lab on verification of power supply requirements and Digital I/O Isolation mechanisms, Sampling of sensor data and controlling Actuator	4
25	Environment monitoring using GAS sensors	3	SAA	21-06-17	Experiment of environment monitoring system using GAS sensors	4
26	Low WPAN, Zig bee, IEEE 802.15.4	3	KSR	22-06-17	Project work demo and evaluation	4
	Knowledge to establish networking with IoT devices Edge and Gateway		ALL	23-06-17	Closing	
	<b>Total Classes</b>	<b>84</b>				<b>116</b>

#### Instructors:

**KSR** = Kota Solomon Raju; **GP**= Gaurav Purohit; **AKS**= Anil Kumar Saini; **SM**= Santosh Kumar Manabala; **SKV**= Sai Krishna V.; **AS**= Anil Saini; **SRP** = Someshwara Rao P. **SAA** = SA Akbar

#### References:

1. Peter Waher, "Learning Internet of Things", PACKT Publishing, 2015.
2. Honbo Zhou, "The Internet of Things in the Cloud A Middle Ware Perspective", CRC Press, 2013
3. Huansheng Ning, "Unit and Ubiquitous Internet of Things", CRC press, 2013.
4. Charles Bell, "Beginning Sensor Networks with Arduino and Raspberry Pi", Apress open.
5. Warren Gay, "Raspberry Pi Hardware Reference", friends of a press.
6. Julien Bayle, "C Programming for Arduino", PACKET Publishing, 2013
7. Rick Anderson and Dan Cervo, "Pro Arduino", Apress open.

8. Francia daCosta, "Rethinking the Internet of Things A scalable Approach to Connecting Everything", Apress open
9. Gaston C. Hillar, "Internet of Things with Python", Packet publishing, 2016
10. Kai Hwang.Geoffery C.Fox.Jack, J.Dongarra, "Distributed and Cloud Computing From Parallel Processing to the Internet of Things", MORGAN KAUPHANN, 2012.