

Ref No:

< SKIT, BENGALURU >



## COURSE PLAN

Academic Year 2019-20

Program:	B E – Computer Science & Engineering
Semester :	8
Course Code:	15CS81
Course Title:	Internet of Things
Credit / L-T-P:	4 / 4-0-0
Total Contact Hours:	50
Course Plan Author:	Vishwas

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Note : Remove "Table of Content" before including in CP Book  
 Each Course Plan shall be printed and made into a book with cover page  
 Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

## A. COURSE INFORMATION

### 1. Course Overview

Degree:	BE	Program:	CS
Year / Semester :	8	Academic Year:	2018-19
Course Title:	Internet Of Things	Course Code:	15CS81
Credit / L-T-P:	4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50	SEE Marks:	80 Marks
CIA Marks:	20	Assignment	5 / 5Module
Course Plan Author:	Vishwas	Sign	Dt:
Checked By:		Sign	Dt:
Degree:	BE	Program:	CS

**Note:** Define CIA and SEE % targets based on previous performance.

### 2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Module	Content	Teaching Hours	Identified Module Concepts	Blooms Learning Levels
1	What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges,	5	Evolution of IOT	L2, Understand
	IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack	5	IOT Architecture	L4 Analyze
2	Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks	5	Connecting smart objects	L3, Apply
	Connecting Smart Objects, Communications Criteria, IoT Access Technologies	5	Deploying Smart objects	L4 Analyze
3	IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances,	5	Connectivity to network Layer	L3, Apply
	Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	5	protocols	L4 Analyze
4	Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics,	5	Data Management	L3, Apply
	Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	5	Security in IOT	L4 Analyze
5	IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints -	5	Sensor Technologies	L4 Analyze
	Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi,	5		L4

Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.		Application of IOT	Analyze
	<b>50</b>		

### 3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
<b>A</b>	<b>Text books (Title, Authors, Edition, Publisher, Year.)</b>	-	-
	Text books	3, 4	In Lib / In Dept
	1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)	In Lib	
	2. Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017		
2	Reference books		2
	1. Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014. (ISBN: 978-8173719547)	In dept	
	2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1 st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)		
	1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)	In Lib	
	2. Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017		
<b>C</b>	Others (Web, Video, notes, simulation etc)	-	-
C1	<a href="http://vtuplanet.com/browse">vtuplanet.com/browse</a>		

### 4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level
1	15CS52	Computer Networks	Network Layer and its protocols	5		L3,L4
2	17cpl16/26	CPL	Knowledge of Typologies	2	Different types of OSI layer	L3

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## 5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.

Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
1	Communication criteria/Optimizing IP	Higher Study	Gap A seminar on communication criteria & Optimization	Understand L2

## B. OBE PARAMETERS

### 1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Modules	Course Code.#	Course Outcome At the end of the course, student should be able to ...	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
1	15CS81	Understand the impact and challenges in IOT	5	IOT Evolution	Lecture	Viva Assignment	L2 Understand
1	15CS81	Analyze the different IOT architecture	5	IOT Architecture	PPT	Viva Discuss	L4 Analyze
2	15CS81	Explain different methods of Deploying Smart objects	5	Connectivity to network Layer	Discuss	Viva ,Discuss Assignment	L3 Apply
2	15CS81	Connecting smart objects in Internet	5	Deploying Smart objects	PPT	Describe Viva ,Discuss	L4 Analyze
3	15CS81	Connect Internet Protocol to network Layer	5	Connectivity to network Layer	Discuss	Viva Assignment	L3 Apply
3	15CS81	Apply various application protocols for IOT	5	protocols	Discuss	Describe Viva	L4 Analyze
4	15CS81	Understand the need of data Analytics	5	Data Management	Tutorial	Describe Viva ,Discuss	L3 Apply
4	15CS81	Identify the security issues in IOT	5	Security in IOT	Lecture	Viva Assignment	L4 Analyze
5	15CS81	Analyze the different sensing technologies in industry	5	Sensing the real world Objects	Discuss	Describe Viva	L4 Analyze
5	15CS81	Identify the applications of IOT in Industry	5	Application of IOT	Tutorial	Describe Viva ,Discuss	L4 Analyze
			<b>50</b>				<b>L2-L3</b>

## 2. Course Applications

Write 1 or 2 applications per CO.

Students should be able to employ / apply the course learnings to . . .

Mod ules	Application Area Compiled from Module Applications.	CO	Level
1	Google Self driving car.	CO1	L2
2	Smart Creatures	CO2	L4
3	Medical Sensors used in smart objects.	CO3	L2
4	Environmental and Chemical Sensors in Network Layer	CO4	L3
5	Wireless Sensor Networks (WSN) Based on IP for Smart Objects	CO5	L3
6	Low Power Wide-Area-Networks (LPWAN)	CO7	L2

## 3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair.

To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Mod ules	Mapping CO	Mapping PO	Mapping Level	Justification for each CO-PO pair <b>'Area': 'Competency' and 'Knowledge' for specified 'Accomplishment'</b>	Lev el
-	CO	PO	-	<b>'Area': 'Competency' and 'Knowledge' for specified 'Accomplishment'</b>	-
1	CO1	PO1	2.5	Knowledge of different phases of Internet	L2
1	CO1	PO2	2.5	Impact of IoT in the real time applications	L2
1	CO1	PO3	2.5	Solutions for the real time applications	L2
1	CO1	PO4	2.3	The knowledge in the networks behind the subject helps students to do research on developing new smart objects	L2
11	CO2	PO1	2.5	Knowledge about the IoT architectures	L4
1	CO2	PO2	2.5	When architecting an IoT network, the amount of data and the time sensitivity has to be consider.	L4
1	CO2	PO3	2.5	Described different models to manage and analyze the data	L4
2	CO3	PO12	2.5	Learning about the sensors and actuators	L3
2	CO4	PO1	2.5	Knowledge about the access technologies and protocols of IoT	L4
2	CO4	PO2	2.3	Identifying the problems in smart objects to handle data transport in the network	L4
2	CO4	PO3	2.5	Describe about different access technologies to handle the data in a network	L4
2	CO4	PO8	2.5	To build an IoT device , there are formats in the PHY and MAC layer	L4
2	CO4	PO12	2.5	Learning about the protocols and technologies	L4
3	CO5	PO1	2.3	Knowledge about the TCP/IP architecture	L3
3	CO5	PO2	2.4	Identifying the problems in optimizing IP for IoT and smart objects	L3
3	CO5	PO3	2.3	Describe about new protocols to handle the constrained environments where IoT sensors are deployed	L3
3	CO5	PO8	2.5	To build an IoT device , there are formats in the network layer	L3
3	CO5	PO12	2.5	Learning about the network layer in IoT Implementation	L3
4	CO6	PO1	2.5	Knowledge of IoT protocol stack	L4
4	CO6	PO2	2.5	Identifying the problems in handling the IoT application at the upper layer	L4
4	CO6	PO3	2.5	Describe about new methods to handle the IoT application data requirements and are quite efficient for smart objects	L4
4	CO6	PO8	2.5	To build an IoT device , there are formats in the transport layer	L4
4	CO6	PO12	2.5	Learning about the transport layer for data transfer from one layer to another layer	L4
4	CO7	PO1	2.5	Knowledge about big data analytics	L2
4	CO7	PO2	2.4	Identifying the problems in data produced by the smart objects	L2
4	CO7	PO3	2.5	Describe new methods to handle the data	L2
4	CO7	PO12	2.5	Learning about bigdata	L2
5	CO8	PO1	2.5	Knowledge about the security in IoT	L4

5	CO8	PO2	2.5	Security should be provided to the smart objects	L4
5	CO8	PO3	2.5	Many steps are involved to provide security which introduces modern IT network security into legacy industrial environment	L4
5	CO9	PO1	2.5	Knowledge about arduino IDE	L4
55	CO9	PO3	2.5	Design of components to implement IoT devices	L4
5	CO9	PO5	2.5	IoT devices are built using arduino IDE	L4
5	CO10	PO1	2.5	Knowledge about RaspberryPi IDE	L4
5	CO10	PO3	2.5	Design of components to implement IoT devices	L4
5	CO10	PO5	2.5	IoT devices are built using RaspberryPi IDE	L4

#### 4. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

Mod ules	CO.#	Course Outcomes <b>At the end of the course student should be able to ...</b>	Program Outcomes												PS O1	PS O2	PS O3	Lev el
			PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12				
1	15CS81.1	Understand the evolutionary phases of the Internet	2.5	2.5	2.4	2.3	-	-	-	-	-	-	-	-	L2	2.5	2.5	2.4
1	15CS81.2	Describe different IoT architecture models	2.5	2.5	2.5	-	-	-	-	-	-	-	-	-	L4	2.5	2.5	2.5
2	15CS81.3	Understand different methods for Deploying Smart objects	-	-	-	-	-	-	-	-	-	-	-	2.5	L3	-	-	-
2	15CS81.4	Use various technologies for connecting smart sensors	2.5	2.3	2.5	-	-	-	-	2.5	-	-	-	2.5	L4	2.5	2.3	2.5
3	15CS81.5	Apply the protocols in the network layer connectivity	2.3	2.4	2.3	-	-	-	-	2.5	-	-	-	2.5	L3	2.3	2.4	2.3
3	15CS81.6	Apply the higher layer IoT protocols for transport	2.5	2.5	2.5	-	-	-	-	2.5	-	-	-	2.5	L4	2.5	2.5	2.5
4	15CS81.7	Understand the role of data Management	2.5	2.4	2.5	-	-	-	-	-	-	-	-	2.5	L2	2.5	2.4	2.5
4	15CS81.8	Understand the role of providing IT network security	2.5	2.5	2.5	-	-	-	-	-	-	-	-	-	L4	2.5	2.5	2.5
5	15CS81.9	Apply the arduino IDE to build IoT devices	2.5	-	2.5	-	2.5	-	-	-	-	-	-	-	L4	2.5	-	2.5
5	15CS81.10	Apply the RaspberryPi IDE to build IoT devices	2.5	-	2.5	-	-	-	-	-	-	-	-	-	L4	2.5	-	2.5
-	<b>CS501PC</b>	<b>Average attainment (1, 2, or 3)</b>	<b>2.4</b>	<b>2.4</b>	<b>2.5</b>	<b>2.3</b>	<b>2.5</b>	-	-	<b>2.5</b>	-	-	-	<b>2.5</b>	<b>2.4</b>	<b>2.4</b>	<b>2.5</b>	
-	<i>PO, PSO</i>	<i>1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design</i>																

#### 5. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Mod ules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					-
2					

#### 6. Content Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Mod ules	Gap Topic	Area	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1	Communication criteria	Networking	Seminar	<sup>2nd</sup> week April / Seminar	-	

## C. COURSE ASSESSMENT

### 1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Modules	Title	Teach. Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Introduction to IOT and its evolutions	10	2	-	-	1	1	4	CO1	L3
2	Smart Objects and its Connectivity	10	2	-	-	1	1	4	CO2,CO3	L2
3	IOT in Network Layer and its Protocols	10	-	2	-	1	1	3	CO4	L2,L3
4	Data Analytics and Security In IOT	10	-	2	-	1	1	4	CO5	L4
5	IOT Physical Devices and Its Applications	10	-	-	4	1	1	4	CO6	L2
-	<b>Total</b>	<b>50</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>19</b>	-	-

### 2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Modules	Evaluation	Weightage in Marks	CO	Levels
1, 2	CIA Exam – 1	30	CO1, CO2,CO3,CO4	L2, l3, l4, l2
3, 4	CIA Exam – 2	30	CO5, CO6,CO7,CO8	L1, L2, L3, L4
5	CIA Exam – 3	30	CO9,CO10	L3, L1
1, 2	Assignment - 1	05	CO1, CO2,CO3,CO4	L2, L3, L4, L3
3, 4	Assignment - 2	05	CO5, CO6,CO7,CO8	L1, L2, L3, L1
5	Assignment - 3	05	CO9,CO10	L3, L4
1, 2	Seminar - 1	-	-	-
3, 4	Seminar - 2	-	-	-
5	Seminar - 3	-	-	-
1, 2	Other Activities – define – Slip test	-	-	-
3, 4	<b>Final CIA Marks</b>	<b>40</b>	-	-
5				
1 - 5	<b>Final CIA Marks</b>	<b>30</b>	-	-

## D1. TEACHING PLAN - 1

### Module - 1

Title:	Introduction to IOT and its Evolutions	Appr Time:	10 Hrs
<b>a</b>	<b>Course Outcomes</b>	-	<b>Blooms Level</b>
-		-	
1	Understand the impact and challenges in IOT	CO1	L2



2	Analyze the different IOT architecture	CO2	L4
<b>b</b>	<b>Course Schedule</b>	-	-
<b>Class No</b>	<b>Module Content Covered</b>	<b>CO</b>	<b>Level</b>
1	What is IoT	CO1	L2
2	Genesis of IoT	CO1	L2
3	IoT and Digitization, IoT Impact	CO1	L2
4	Convergence of IT and IoT, IoT Challenges	CO1	L2
5	IoT Network Architecture and design	CO2	L4
6	Drivers Behind New Network Architectures	CO2	L4
7	Comparing IoT Architectures	CO2	L4
8	A Simplified IoT Architecture,	CO2	L4
9	The Core IoT Functional Stack	CO2	L4
10	IoT Data Management and Compute Stack	CO2	L4
<b>c</b>	<b>Application Areas</b>	<b>CO</b>	<b>Level</b>
1	Google Self driving car.	CO1	L2
<b>d</b>	<b>Review Questions</b>	-	-
1	What is an IOT?	CO1	L2
2	Explain evolutionary phases of internet?	CO1	L2
3	What are the impact faced by IOT?	CO1	L2
4	What are the challenges of IOT?	CO1	L2
5	Explain different IOT Architectures?	CO2	L4

## Module – 2

<b>Title:</b>	Smart Objects	<b>Appr Time:</b>	10 Hrs
<b>a</b>	<b>Course Outcomes</b>	-	<b>Blooms Level</b>
-		-	
1	Explain different methods of Deploying Smart objects	CO3	L3
2	Connecting smart objects in Internet	CO4	L4
<b>b</b>	<b>Course Schedule</b>	-	-
<b>Class No</b>	<b>Module Content Covered</b>	<b>CO</b>	<b>Level</b>
17	Smart Objects: The "Things" in IoT,	CO2	L3
18	Sensors	CO2	L3
19	Actuators	CO2	L3
20	Smart Objects,	CO2	L3
21	Sensor Networks	CO3	L3
22	Connecting Smart Objects	CO3	L4
23	Communications Criteria	CO3	L4
24	IoT Access Technologies.	CO3	L4
<b>c</b>	<b>Application Areas</b>	<b>CO</b>	<b>Level</b>
1	Smart cities	CO3	L3
<b>d</b>	<b>Review Questions</b>	-	-
12	Explain different types of sensor?	CO2	L3
13	What are the different characteristics of smart objects?	CO2	L3
14	Explain about MEMS?	CO3	L3
15	What are the pros & cons of wireless based solutions?	CO3	L4
16	Explain different typologies?	CO3	L4
17	Explain the protocols stacks which are utilized in IEEE 802.15.4?	CO3	L4
<b>e</b>	<b>Experiences</b>	-	-

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## E1. CIA EXAM – 1

### a. Model Question Paper - 1

Crs Code:	15cs81	Sem:	V	Marks:	40	Time:	75 minutes	
Course:	Computer Networks							
-	-	<b>Note: Answer any 3 questions, each carry equal marks.</b>				<b>Marks</b>	<b>CO</b>	<b>Level</b>
<b>MODULE-1(20 marks)</b>								
1	a	What are the impact faced by IOT?				15	CO1	L2
	b	What are the challenges of IOT?					CO1	L2
2	a	Explain different IOT Architectures?				15	CO2	L2
	b	Explain evolutionary phrases of Internet?					CO2	L2
3	a	What are the different characteristics of smart objects?				15	CO3	L4
	b	Explain the protocols stacks which are utilized in IEEE 802.15.4?					CO3	L4
4	a	What are the pros & cons of wireless based solutions?				15	CO4	L4
	b	Explain about MEMS?					CO4	L4
4	a	Explain socket programming with respect to TCP.				10	CO2	L2
	b	With an example, illustrate the basic operation of SMTP.				10	CO1	L2

### b. Assignment -1

Note: A distinct assignment to be assigned to each student.

<b>Model Assignment Questions</b>								
Crs Code:	15CS81	Sem:	VIII	Marks:	30	Time:	75 minutes	
Course:	Internet of things							
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.								
<b>SNo</b>	<b>USN</b>	<b>Assignment Description</b>				<b>Marks</b>	<b>CO</b>	<b>Level</b>
1		What are the impact faced by IOT?				5	CO1	L2
2		What are the challenges of IOT?				5	CO2	L2
3		Explain different IOT Architectures?				5	CO2	L2
4		Explain evolutionary phrases of Internet?				5	CO1	L2
5		What are the different characteristics of smart objects?				5	CO1	L2
6		Explain the protocols stacks which are utilized in IEEE 802.15.4?				5	CO3	L2
7		What are the pros & cons of wireless based solutions?				5	CO3	L4
8		Explain about MEMS?				5	CO3	L4

## D2. TEACHING PLAN - 2

### Module – 3

<b>Title:</b>	IoT Network Layer	<b>Appr Time:</b>	10 Hrs
<b>a</b>	<b>Course Outcomes</b>	-	<b>Blooms Level</b>
-	The student should be able to:	-	
1	Connect Internet Protocol to network Layer	CO5	L3
2	Compare various application protocols for IOT	CO6	L4
<b>b</b>	<b>Course Schedule</b>		
<b>Class No</b>	<b>Module Content Covered</b>	<b>CO</b>	<b>Level</b>

1	IP as the IoT Network Layer,	CO5	L3
2	The Business Case for IP	CO5	L3
3	The need for Optimization	CO5	L3
4	Optimizing IP for IoT	CO5	L3
5	Profiles and Compliances	CO5	L3
6	Application Protocols for IoT	CO6	L4
7	Transport Layer, IoT	CO6	L4
8	IoT Application Transport Methods.	CO6	L4
<b>c</b>	<b>Application Areas</b>		<b>Level</b>
1	Transport Monitoring	CO6	L3
<b>d</b>	<b>Review Questions</b>	-	-
1	What are the advantages of internet protocol?	CO5	L3
2	Explain the Comparison of an iot protocol stack utilizing 6lowpan & IP Protocol stack?	CO5	L3
3	What are the different mechanism which defines the schedule management?	CO5	L3
4	Comparison b/n CO AP and MQTP?	CO5	L4
5	What are the fields in CO AP Message	CO5	L4
6	How IOT Constrained nodes can be classified?	CO5	L4
7	What are the main factors applicable to IPv4 and IPv6 in IOT?	CO6	L4
8	What is fragmentation?	CO6	L4
9	Compare b/n mesh under v/s mesh over routing?	CO6	L4
10	Compare DAG and DODAG?	CO6	L4
<b>e</b>	<b>Experiences</b>	-	-
<b>e</b>	<b>Experiences</b>	-	-
10	Compare DAG and DODAG?	CO6	L4
<b>e</b>	<b>Experiences</b>	-	-

## Module – 4

<b>Title:</b>	Data and Analytics for IoT,	<b>Appr Time:</b>	10Hrs
<b>a</b>	<b>Course Outcomes</b>	-	<b>Blooms Level</b>
-	The student should be able to:	-	
1	Understand the need of data Analytics	CO7	L3
2	Identify the security issues in IOT	CO8	L4
<b>b</b>	<b>Course Schedule</b>		
<b>Class No</b>	<b>Module Content Covered</b>	<b>CO5</b>	<b>Level</b>
1	Data and Analytics for IoT,	CO7	L3
2	An Introduction to Data Analytics for IoT, Machine Learning	CO7	L3
3	Big Data Analytics Tools and Technology, Edge Streaming Analytics	CO7	L3
4	Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security	CO8	L4
5	How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR	CO8	L4
6	The Phased Application of Security in an Operational Environment	CO8	L4
<b>c</b>	<b>Application Areas</b>	<b>CO</b>	<b>Level</b>
1.	Smart Parking Application	CO8	L4
<b>d</b>	<b>Review Questions</b>		
1	What are the challenges of IOT data Analytic?	CO7	L3
2	What is Machine Learning?	CO7	L3
3	Explain about supervised & unsupervised learning?	CO7	L3
4	Explain about MPP Shared-Nothing Architecture?	CO7	L3

5	What is meant by network analytics	CO7	L3
6	List and explain insecure operational protocols?	CO7	L3
7	Explain the formal risk analysis structure?	CO7	L3
8	Compare b/n structured and unstructured data	CO7	L3
9	What is Machine Learning?	CO7	L4
10	What are the applications of ML for IOT?	CO8	L4
11	Explain distributed hadoop cluster?	CO8	L4
12	Explain about the Lambda Architecture?	CO8	L4
13	Compare big data and edge Analytics?	CO8	L4
14	What are the main components of FNF?	CO8	L4
<b>e</b>	<b>Experiences</b>	-	
9	What is Machine Learning?	CO7	L4
10	What are the applications of ML for IOT?	CO8	L4
11	Explain distributed hadoop cluster?	CO8	L4
12	Explain about the Lambda Architecture?	CO8	L4
13	Compare big data and edge Analytics?	CO8	L4
14	What are the main components of FNF?	CO8	L4
<b>e</b>			

## E2. CIA EXAM – 2

### a. Model Question Paper - 2

Crs Code:	15CS81	Sem:	VIII	Marks:	30	Time:	75 minutes	
Course:	Internet of Things							
-	-	<b>Note: Answer any 2 questions, each carry equal marks.</b>				<b>Marks</b>	<b>CO</b>	<b>Level</b>
<b>Module -1(20 Marks)</b>								
1	a	Explain the Comparison of an iot protocol stack utilizing 6lowpan & IP Protocol stack?					CO5	L3
	b	Comparison b/n CO AP and MQTP?					CO5	L3
<b>OR</b>								
2	a	What are the advantages of internet protocol?					CO6	L4
	b	What are the different mechanism which defines the schedule management?					CO6	L4
<b>MODULE-2(15 marks)</b>								
						<b>15</b>		
3	a	Explain about MPP Shared-Nothing Architecture?					CO7	L3
	b	Explain the formal risk analysis structure?					CO7	L3
<b>OR</b>								
4	a	List and explain insecure operational protocols?					CO8	L4
	b	Explain about supervised & unsupervised learning?					CO8	L4
	b	Explain Formal risk Analytics structure of FAIR?				7	CO8	L4
	c	List the challenges in OT Security?				3	CO8	L4

### b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

<b>Model Assignment Questions</b>								
Crs Code:	15CS81	Sem:	VIII	Marks:	30	Time:	75 minutes	
Course:	Internet Of Things							
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.								
<b>SNo</b>	<b>USN</b>	<b>Assignment Description</b>				<b>Marks</b>	<b>CO</b>	<b>Level</b>
1		What are the advantages of Internet protocol?				5	L1	L2
2		Explain the Comparison of an iot protocol stack utilizing 6lowpan & IP Protocol stack?				5	L3	L3

3	What are the different mechanism which defines the schedule management?	5	L2	L4
4	Comparison b/n CO AP and MQTP?	5	L4	L3
5	What are the fields in CO AP Message	5	L2	L4
6	What is Machine Learning?	5	L5	L2
7	Explain about supervised & unsupervised learning?	5	L2	L3
8	Explain about MPP Shared-Nothing Architecture?	5	L3	L4
9	What is meant by network analytics	5	L1	L2
10	List and explain insecure operational protocols?	5	L3	L3
11	Explain the formal risk analysis structure?	5	L2	L4
12	Explain about the security priorities?	5	L4	L3
13	What are the characteristics of OT network impacting security?	5	L2	L4

### D3. TEACHING PLAN - 3

#### Module - 5

Title:	IoT Physical Devices and Endpoint	Appr Time:	10 Hrs
<b>a</b>	<b>Course Outcomes</b>	-	<b>Blooms Level</b>
-	The student should be able to:	-	
1	Analyze the different sensing technologies in industry	CO9	L4
2	Identify the applications of IOT in Industry	CO10	L4
<b>b</b>	<b>Course Schedule</b>		
<b>Class No</b>	<b>Module Content Covered</b>	<b>CO</b>	<b>Level</b>
1.	IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO	CO9	L4
2.	Installing the Software, Fundamentals of Arduino Programming.	CO9	L4
3.	IOT Physical Devices and Endpoints - Raspberry Pi: Introduction to Raspberry Pi	CO9	L4
4	Raspberry Pi Board: Hardware Layout, Operating Systems on Raspberry Pi, Configuring Raspberry Pi	CO9	L4
5	Programming Raspberry Pi with Python	CO9	L4
6.	Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH,	CO10	L4
7	Processing Temperature from DS18B20 sensors, Remote access to Raspberry Pi,	CO10	L4
8	Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture,	CO10	L4
9	Smart City Security Architecture, Smart City Use-Case Examples.	CO10	L4
<b>c</b>	<b>Application Areas</b>	<b>CO</b>	<b>Level</b>
2	Home Automation	CO10	L4
<b>d</b>	<b>Review Questions</b>		-
1	Explain the features of Arduino?	CO9	L4
2	Explain the Raspberry Pi Model B and its GPIO?	CO9	L4
3	Explain the fundamentals of Arduino Programming?	CO9	L4
4	Explain Raspberry Pi Operating System?	CO10	L4
5	List the different commands used in Raspberry Pi?	CO10	L4
<b>e</b>	<b>Experiences</b>	-	-
7	Discuss the round robin and waited fair queuing scheduling mechanism?	CO10	L2
<b>e</b>	<b>Experiences</b>	-	-

### E3. CIA EXAM – 3

#### a. Model Question Paper - 3

Crs Code:	15CS81	Sem:	VIII	Marks:	30	Time:	75 minutes	
Course:	Internet of Things							
-	-	<b>Note: Answer any 2 questions, each carry equal marks.</b>				<b>Marks</b>	<b>CO</b>	<b>Level</b>
<b>Module -1(15 Marks)</b>					<b>15</b>			
1	a	Explain the features of Arduino?					CO9	L4
	b	Explain the Raspberry Pi2 Model B and its GPIO?					CO9	L4
2	a	Explain Raspberry PI Operating System?					CO9	L4
	b	List the different commands used in Raspberry PI?					CO9	L4
<b>Module -2(15 Marks)</b>								
3	a	List the control flow using python?				15	CO10	L4
	b	Write a program to interface LED switch and Potentiometer?					CO10	L4
4	a	Explain operating system Setup on Raspberry Pi With Python?				15	CO10	L4
	b	Explain about the UDP streaming.				10	CO10	L2

#### b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

<b>Model Assignment Questions</b>								
Crs Code:	15CS81	Sem:	VIII	Marks:	30	Time:	75 minutes	
Course:	Internet of Things				Internet of Things		Internet of Things	
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.								
<b>SNo</b>	<b>USN</b>	<b>Assignment Description</b>				<b>Marks</b>	<b>CO</b>	<b>Level</b>
1		Explain the features of Arduino?				5	CO9	L4
2		Explain the Raspberry Pi2 Model B and its GPIO?				5	CO9	L4
3		Explain Rasper PI Operating System?				5	CO9	L4
4		List the different commands used in Raspberry PI?				5	CO9	L4
5		List the control flow using python?				5	CO9	L4
6		Write a program to interface LED switch and Potentiometre?				5	CO10	L4
7		Explain operating system Setup on RaspberryPi With Python?				5	CO10	L4
8		Write the interface sensor to arduino?				5	CO10	L4
9		Explain Raspberry Pi Interface?				5	CO10	L4
10		What are the steps to install Arduino IDE Software?				5	CO10	L4
		Explain the features of Arduino?				5	CO9	L4

### F. EXAM PREPARATION

#### 1. University Model Question Paper


## 2. SEE Important Questions

Course:	Internet of Things				Month / Year			
Crs Code:	15CS81	Sem:	8	Marks:	80	Time:	180 minutes	
	<b>Note</b>	Answer all FIVE full questions. All questions carry equal marks.				-	-	
Module	Qno.	I-important Question				Marks	CO	Year
1	1	What is an IOT?				16 / 20	CO3	2018
	3	Explain evolutionary phrases of internet?					CO3	2018
	4	What are the impact faced by IOT?					CO3	2018
2	1	What are the challenges of IOT?				16 / 20	CO3	2018
	2	Explain different IOT Architectures?					CO3	2018
	3	What are the impact faced by IOT?					CO3	2018
	4	What are the challenges of IOT?					CO3	2018
		Explain different IOT Architectures?						

## G. Content to Course Outcomes

### 1. TLPA Parameters

**Table 1: TLPA – Example Course**

Module-#	Course Content or Syllabus (Split module content into 2 parts which have similar concepts)	Content Teaching Hours	Blooms' Learning Levels for Content	Final Blooms' Level	Identified Action Verbs for Learning	Instruction on Methods for Learning	Assessment Methods to Measure Learning
A	B	C	D	E	F	G	H
1	What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack	5	L2	L2	Understand	-Lecture	- Slip Test
1	Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies	5	L2	L2	Understand	-Lecture	- Assignment
2	IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	5	L2	L2	Understand	-Lecture	- Assignment
2	Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an	5	L2	L2	Understand	-Lecture	- Slip Test

	Operational Environment						
3	IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.	5	L2	L2	Understand	- Lecture	- Slip Test
3	What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack	5	L2	L2	Understand	- Lecture	- Assignment
4	Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies	5	L3	L3	Apply	- Lecture	- Slip Test
4	IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	5	L2	L2	Understand	- Lecture	- Slip Test
5	Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	5	L3	L3	Apply	- Lecture	- Slip Test
5	IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi,	5	L3	L3	Apply	- Lecture	- Assignment



Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.						
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2. Concepts and Outcomes:

**Table 2: Concept to Outcome – Example Course**

Module #	Learning or Outcome from study of the Content or Syllabus	Identified Concepts from Content	Final Concept	Concept Justification (What all Learning Happened from the study of Content / Syllabus. A short word for learning or outcome)	CO Components (1.Action Verb, 2.Knowledge, 3.Condition / Methodology, 4.Benchmark)	Course Outcome <b>Student Should be able to ...</b>
A	I	J	K	L	M	N
1	-Learning about Protocols in Application Layer	-Genesis of IoT -Impact of IoT - Convergence IT and OT	Genesis of IoT	Evolutionary phases of the internet	1. Understand 2.Application concepts	Describes the Computer Networking concepts and explained about services in application layers
1	-Learning about the IoT architectures	-A Simplified IoT Architecture -The Core IoT Functional Stack -IoT Data Management and Compute Stack	IoT Data Management and Compute Stack	Different architectures to build IoT smart objects	1. Understand 2. IoT architectures 3. Smart devices	Describe different IoT architecture models
2	Learning about the smart objects	-Sensors -actuators -WSN	sensors	Different models to create smart objects	1. Understand 2. smart objects architecture 3. Smart objects	Understand different methods for Deploying Smart objects
2	Learning about the IoT Access Technologies	-IoT access technologies - Communication criteria	IoT access technologies	Different technologies are applied in smart IoT devices	1. Apply 2. IoT access technologies 3. Smart IoT devices	Use various technologies for connecting smart sensors
3	Learning	- IoT	IoT Network	Network protocols	1. Apply	Apply the protocols

	about the Internet protocols	Network Layer - Optimizing IP for IoT	Layer	are applied in network connectivity layer	2. network protocols 3. network Layer connectivity	in the network layer connectivity
3	Learning about the Transport Layer	-IoT Application Transport Methods - Transport Layer	IoT Application Transport Methods	Transport layer are applied to move data from one layer to another layer	1. Apply 2. network protocols 3. transport layer	Apply the higher layer IoT protocols for transport
4	Learning about the Data analysis and management in IoT	-Data analytics -Data management	Data analytics	Understand how the data analysis and managed in IoT	1. Understand 2. Data analysis and management in IoT 3. smart devices	Understand the role of data Management
4	Learning about the OT security	- How IT and OT Security Practices and Systems Vary -Phased Application of Security	Phased Application of Security	Providing security to the IoT devices	1. Understand 2. network security 3. IoT smart devices	Understand the role of providing IT network security
5	Learning about the Arduino physical devices	- Fundamentals of Arduino Programming -Installing the software	Fundamentals of Arduino Programming	To build IoT smart devices by arduino IDE is used	1. Apply 2. Build IoT devices 3. Arduino IDE	Apply the arduino IDE to build IoT devices
5	Learning about the RaspberryPi physical devices	- Fundamentals of RaspberryPi Programming -Installing the software	Fundamentals of RaspberryPi Programming	To build IoT smart devices by RaspberryPi IDE is used	1. Apply 2. Build IoT devices 3. RaspberryPi IDE	Apply the RaspberryPi IDE to build IoT devices