


Government of Karnataka
Department of Technical Education
Bengaluru

	Course Title: Internet of Things		
	Scheme (L:T:P) : 4:0:0	Total Contact Hours: 52	Course Code: 15CS63F
	Type of Course: Lectures, Self Study & Student Activity	Credit : 04	Core/ Elective: Elective
CIE- 25 Marks		SEE- 100 Marks	

Prerequisites

Basic knowledge computer networks and related courses.

Course Objectives

1. To assess the vision of IoT.
2. To classify Real World IoT applications in various Domains.
3. To understand design methodology for IoT platforms.

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course Outcome		CL	Linked PO	Teaching Hours
CO1	Interpret the vision of IoT from a global context.	R,U	1,2,5,6,7,8,9,10	12
CO2	Illustrate the application of IoT in various Domains.	U, A	1,2,4,5,6,8,9,10	12
CO3	Understand the differences and Similarities between IoT and M2M.	R,U	1,2,3,4,5,6,10	06
CO4	Interpretation of different IoT platforms design methodology.	U A	1,2,5,6,8,9,10	08
CO5	Illustration of IoT Physical Devices.	U, A	1,2,5,6,8,9,10	08
CO6	Narration of Ethics in IoT.	U A	1,2,5,6,7,9,10	06
Total				52

Legends: R = Remember U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Internet of Things	3	3	1	2	3	3	2	3	3	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.
 If $\geq 40\%$ of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3
 If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2
 If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1
 If $< 5\%$ of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Hour	Questions to be set for SEE			Marks Weightage	Marks Weightage (%)
			R	U	A	A	
I	Introduction to Internet of Things	12	5	20	10	35	24.13
II	Domain specific IoT	12	-	20	10	30	20.68
III	IoT and M2M	06	5	10	-	15	10.35
IV	IoT Platforms Design Methodology	08	-	10	15	25	17.24
V	IoT Physical Devices & Endpoints.	08	-	15	10	25	17.24
VI	Ethics in IoT	06	-	15	-	15	10.35
Total		52	10	90	45	145	100

UNIT I: Introduction to Internet of Things

12 Hrs

Definition and characteristics of IoT, Physical design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT functional blocks, IoT communication Models, IoT communication API's, IoT enabling Technologies Wireless sensor networks, Cloud Computing, Big Data Analytics, Communication protocols, embedded systems. IoT Levels and Deployment templates – IoT Level-1, IoT Level-2, IoT Level-3, IoT Level-4, IoT Level-5, IoT Level-6

UNIT II: Domain specific IoT

12 Hrs

Introduction, Home automation- Smart lighting, smart appliances, intrusion detection, smoke for gas detectors; Cities- Smart Parking, Smart lighting, Smart Roads, Structural Health Monitoring, surveillance, Emergency Response; Environment- Weather monitoring, air pollution monitoring, noise pollution monitoring, forest fire detection, river flood's detection;

Energy- Smart grids, renewable energy systems, prognostics; Retail- Inventory management, smart payments, smart vending machines; Logistics- Route generation and scheduling, Fleet tracking, Shipment monitoring, Remote vehicle diagnostics; Agriculture- Smart Irrigation, Green house control; Industry- Machine diagnosis and prognosis, indoor air Quality monitoring; Health and Life Style- Health and fitness monitoring, Wearable electronics.

UNIT III: IoT and M2M

06 Hrs

Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT- Software defined networking, network function virtualization;

UNIT IV: IoT Platforms Design Methodology

08 Hrs

Introduction, IoT Design and Methodology- Purpose and requirements specification, Process specification, Domain model specification, Information model specification, service specification, IoT level specification, functional view specification, Operational view specification, Device and component integration, application development.

UNIT V: IoT Physical Devices and Endpoints

08 Hrs

What is an IoT device? , Basic Building blocks of an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Other IoT devices.

UNIT VI: Ethics in IoT

06 Hrs

Characterizing the IoT, Privacy, Control – Disrupting Control, Crowd sourcing; Environment – Physical thing, Electronics, Internet service; Solutions – The IoT as a part of the solution, cautious optimism, the open IoT definition.

Text Books

1. Internet of Things – A Hands on Approach, By Arshdeep Bahga and Vijay Madiseti Universities Press, ISBN: 9788173719547 (Unit I to V)
2. Designing the Internet of Things – Adrian McEwen & Hakim Cassimality Wiley India, ISBN: 9788126556861 (Unit VI)

References

1. The Internet of Things – Key Applications and Protocols, Wiley Publication, Olivier Hersent, David Boswarthick, Omar Elloumi. ISBN: 9788126557653
2. The Internet of Things , Pearson, By Michael Miller ISBN: 9789332552456
3. http://www.cisco.com/c/dam/en_us/solutions/trends/iot/introduction_to_IoT_november.pdf
4. <https://www.bbvaopenmind.com/en/iot-implementation-and-challenges/>
5. <https://www.ftc.gov/system/files/documents/reports/federal-trade-commission-staff-report-november-2013-workshop-entitled-internet-things-privacy/150127iotrpt.pdf>

Suggested list of student activities

Note: the following activities or similar activities for assessing CIE (IA) for 5 marks (Any one)

1. Each student should do any one of the following type activity or any other similar activity related to the course and before conduction, get it approved from concerned course coordinator and program coordinator.
2. Each student should conduct different activity and no repeating should occur.

1	Understand the different protocols and their purposes used to communicate in IoT.
2	Learn and Understand different Cloud Platform Services Offered by Vendors.
3	Learn the Deployment steps of any Domain specific IoT Services.
4	Learn/Compare Different Hardware Boards for Creating IoT Services
5	Understand the different functionalities of sensors in IoT Devices.
6	Understand integrating IoT Services to other third party Clouds.
7	Discuss Privacy Issues in IOT
8	Quiz

Course Delivery

The course will be delivered through lectures and Power point presentations/ Video

Course Assessment and Evaluation Scheme

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE	IA	Students	Three IA tests (Average of three tests will be computed)	20	Blue books	1 to 6
				Student activities	05	Report	1 to 6
				Total	25		
	SEE	End Exam		End of the course	100	Answer scripts at BTE	1 to 6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2,3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1 to 6 Effectiveness of Delivery of instructions & Assessment Methods

Note: Continuous Internal Evaluation shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's taxonomy) such as:

Sl. No	Bloom's Category	%
1	Remembrance	07
2	Understanding	62
3	Application	31

Note to IA verifier: The following documents to be verified by CIE verifier at the end of semester

1. Blue books (20 marks)
2. Student suggested activities report for 5 marks
3. Student feedback on course regarding Effectiveness of Delivery of instructions & Assessment Methods.

FORMAT OF IA TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks			
Ex: I test/6 th week of sem 10-11 AM	VI SEM		20			
	Year: 2017-18					
Name of Course coordinator :						
Units: __ CO's: ____						
Question no	Question		MARKS	CL	CO	PO
1						
2						
3						
4						

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks			
Ex: I test/6 th week of sem 10-11 AM	VI SEM	Internet of Things (IOT)	20			
	Year: 2017-18	Course code: 15CS63F				
Name of Course coordinator :						
Units: 1,2 Co: 1,2						
Note: Answer all questions						
Question no	Question		CL	CO	PO	
1	Discuss Big Data Analytics role in IoT. (5M) OR What is the Role of Things and Internet in IoT? (5M)		U	1	1,2	
2	Describe the characteristics of IoT. (5M)		R	1	1,2	
3	Describe applications of IoT for Cities. (10M) OR Discuss applications of IoT for Logistics. (10M)		A	2	1,2	

Note: Internal choice may be given in each CO at the same cognitive level (CL).

Format for Student Activity Assessment

DIMENSION	Unsatisfactory 1	Developing 2	Satisfactory 3	Good 4	Exemplary 5	Score
Collection of data	Does not collect any information relating to the topic	Collects very limited information; some relate to the topic	Collects some basic information; refer to the topic	Collects relevant information; concerned to the topic	Collects a great deal of information; all refer to the topic	3
Fulfill team's roles & duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs all duties	Performs all duties of assigned team roles with presentation	4
Shares work equally	Always relies on others to do the work	Rarely does the assigned work; often needs reminding	Usually does the assigned work; rarely needs reminding	Does the assigned job without having to be reminded.	Always does the assigned work without having to be reminded and on given time frame	3
Listen to other Team mates	Is always talking; never allows anyone else to speak	Usually does most of the talking; rarely allows others to speak	Listens, but sometimes talk too much	Listens and contributes to the relevant topic	Listens and contributes precisely to the relevant topic and exhibit leadership qualities	3
TOTAL						13/4=3.25=4

Note: This is only an example. Appropriate rubrics/criteria may be devised by the concerned Course Coordinator for assessing the given activity

**Diploma in Computer Science & Engineering
VI Semester****Course Title: Internet of Things**Time: **3 Hours**Max Marks: **100****PART-A**Answer any **SIX** full questions. Each carries 5 marks.**5X6=30****Marks**

1. Describe an Example of IoT Service that uses publish-subscribe communication Model
2. What are the Differences between Machines in M2M and Things in IoT?
3. Describe the characteristics of IoT.
4. Explain architectural constraints of REST.
5. Discuss noise pollution monitoring and forest fire detection on IoT.
6. Explain Operational view specification with an example.
7. List and explain the functional attributes of an IoT device.
8. How Raspberry pi is different from Desktop Computer?
9. Explain the Privacy v/s the IoT.

PART-BAnswer any **SEVEN** full questions each carries 10 marks.**10X7=70 Marks**

1. Explain IoT Communication Models.
2. Explain the Components of IoT
3. Explain applications of IoT for Retail.
4. Discuss Applications of IoT for Homes.
5. Discuss Smart Irrigation and Green House Control
6. Explain Software Defined Networking (SDN) architecture with neat Diagram.
7. Derive the services from process and information model for Home automation IoT System.
8. List and briefly explain the steps involved in IoT System Design Methodology.
9. Explain in brief the various components and peripherals of Raspberry pi Board.
10. Describe crowd sourcing with an example



MODEL QUESTION BANK

**Diploma in Computer Science & Engineering
VI Semester
Course Title: Internet of Things**

CO	Question	CL	Marks
I	Describe the characteristics of IoT.	R	05
	Write a Note on Physical Design of IoT	A	
	Explain IoT Functional Blocks.	U	
	Explain IoT Enabling Technologies.	U	
	Discuss Big Data Analytics role in IoT.	U	
	Explain IoT Level-5.	U	
	Describe an Example of IoT Service that uses publish-subscribe communication Model	U	
	Describe an Example IoT Service that uses web socket-based Communication.	U	
	Explain architectural constraints of REST.	U	
	What is the Role of Things and Internet in IoT?	R	
	Discuss IoT Protocols.	A	
	Explain IoT Communication Models.	A	
Explain IoT Communication API's	U		
Explain the Components of IoT	U		
Discuss IoT Level-1 and IoT Level-2	U		
Discuss IoT Level-3 and IoT Level-4	U		
Explain weather monitoring and air pollution monitoring on IoT.	A	5	
Discuss noise pollution monitoring and forest fire detection on IoT.	A		
Explain remote vehicle diagnostics using IoT.	A		
Discuss Smart Irrigation and Green House Control	A		
Explain the role of IoT in Health and Fitness Monitoring.	A		
List and Briefly explain Domain Specific IoT Services.	U		10
Discuss Applications of IoT for Homes.	A		
Describe applications of IoT for Cities.	A		
Explain applications of IoT for Energy Systems.	U		
Explain applications of IoT for Retail.	A		
Discuss applications of IoT for Logistics.	A		
Discuss Applications of IoT in Industry.	A	5	
Explain SDN Layers.	U		
What are the Differences between Machines in M2M and Things in IoT?	R		
How do Data Collection and Analysis approaches differ in M2M and IoT.	R		
What are the differences between SDN and NFV?	U		
Describe how NFV can be used for virtualizing IoT Devices?	U		
Explain M2M System architecture.	U		
Explain the Differences between IoT and M2M	U		

	Explain Software Defined Networking (SDN) architecture with neat Diagram.	U	10
	Describe NFV architecture with neat block diagram.	U	
IV	Explain purpose and requirement specification of IoT Design.	U	5
	Describe Process specifications for Home Automation IoT Systems.	A	
	Describe information Model of the Home automation IoT Systems.	A	
	Explain Controller service of Home Automation IoT System.	A	
	Explain Operational view specification with an example.	U	
	List and Briefly explain the steps involved in IoT System Design Methodology.	U	
IV	Explain Domain Model of the Home automation IoT system.	A	10
	Derive the services from process and information model for Home automation IoT System.	A	
	Explain functional view specification for Home Automation IoT System.	A	
V	What is an IoT Device? List Examples.	U	5
	List and explain the functional attributes of an IoT device.	A	
	List and explain Raspberry pi interfaces.	A	
	How Raspberry pi is different from Desktop Computer?	U	
	List and explain Other IoT Devices.	U	
	What's the use of SPI and I2C interfaces on Raspberry pi?	U	
	With neat Block diagram explain an IoT Device.	A	10
	Explain in brief the various components and peripherals of Raspberry pi Board.	U	
VI	Illustrate characterizing the Internet of Things.	U	5
	Explain the ideal ethics for IoT.	U	
	Explain the Privacy v/s the IoT	A	
	List and explain 5 critical requirements for sensor commons projects.	A	
	Explain the environmental issues relating to IoT.	U	
	Explain the open Internet of Things definition.	U	
	Describe crowdsourcing with an example.	U	10
	Describe with an example Internet of Things as a part the solutions.	A	

