



|| Jai Sri Gurudev ||  
Sri Adichunchanagiri Shikshana Trust \*

## SJC INSTITUTE OF TECHNOLOGY

Chickballapur – 562 101

Estd: 1986

### Department of Information Science & Engineering LESSON PLAN

<b>SUBJECT TITLE</b>	INTERNET OF THINGS TECHNOLOGY		
<b>SUBJECT TYPE</b>	CORE / ELECTIVE		
<b>SUBJECT CODE</b>	17CS81		
<b>ACADEMIC YEAR</b>	2021 (EVEN SEMESTER)	BATCH	2017-2021
<b>SCHEME</b>	CBCS scheme (Effective from the academic year 2017 -2018)		
<b>SEMESTER &amp; SECTION</b>	<u>VIII A SECTION</u>		
<b>IA MARKS</b>	40	<b>EXAM MARKS</b>	60
<b>NUMBER OF LECTURE HOURS/WEEK</b>	4	<b>TOTAL NUMBER OF LECTURE HOURS</b>	50
<b>FACULTY NAME</b>	CHETHAN.H.V	<b>NO. OF TIMES HANDLED</b>	2 / First time

**COURSE LEARNING OBJECTIVES:** This course will enable students to

- Assess the genesis and impact of IoT applications, architectures in real world.
- Illustrate diverse methods of deploying smart objects and connect them to network.
- Compare different Application protocols for IoT.
- Infer the role of Data Analytics and Security in IoT.
- Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

**Course Outcomes:** At the end of this course, students are able to:

CO1	Interpret the impact and challenges posed by IoT networks leading to new architectural models.
CO2	Compare and contrast the deployment of smart objects and the technologies to connect them to networks
CO3	Appraise the role of IoT protocols for efficient network communication
CO4	Elaborate the need for Data Analytics and Security in IoT
CO5	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

### CO-PO MATRIX

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	-	-	1	1	1
CO2	1	1	2	-	-	-	-	-	-	-	-	1	2	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	1	1
CO4	1	2	2	-	2	-	-	-	-	-	-	1	1	1
CO5	2	1	1	1	1	1	-	-	-	-	-	1	1	2

# JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	3/2/1	JUSTIFICATION
CO1-PO1	2	Knows about challenges in IOT & able to give solution with new architecture
CO1-PO2	1	Able to identify challenges & analyze to overcome challenges
CO1-PO3	1	Able to develop components to meet the challenges
CO1-PO12	1	Continuous learning helps to know day to day challenges
CO1-PSO1	1	Employ new communication model to overcome challenges
CO1-PSO2	1	Use of low power & reliable network for industry purpose
CO2-PO1	1	Knowledge about things and technologies to connect things/objects to network (wireless).
CO2-PO2	1	Identify how objects are made to communicate with various wireless technologies & analyze its performance with various merits.
CO2-PO3	2	Able to give solutions for specific needs through IOT based applications which are helpful for health, security, environmental etc..
CO2-PO12	1	Need to learn evolving smart objects & technologies so as to change as per developments.
CO2-PSO1	2	Learning and employ new wireless sensor technology
CO2-PSO2	1	Use efficient sensor devices with less cost for industry automation
CO3-PO1	2	Knowledge about different layer protocols need for M2M communication/network is gained.
CO3-PO2	2	Identify the new protocols requirement as per the global standardization by analyzing existing protocols.
CO3-PO12	1	Need to know changes in global standardization
CO3-PSO1	1	Knowledge about Protocols used and modernize existing protocols as per IOT standards.
CO3-PSO2	1	Use of different protocols for improve performance & reliable communication
CO4-PO1	1	Knowledge about IOT related data management & security challenges in IOT based applications
CO4-PO2	2	Identify & analyze various categories of data that can be sensed, processed, stored & communicated via network , also use of different security techniques.
CO4-PO3	2	Able to develop solutions for gathering of data, faster processing, storage solution & security challenges.
CO4-PO5	2	Use of data analytic tools for analysis also using simulation tools.
CO4-PO12	1	Updating about new tools for analysis & security purpose.
CO4-PSO1	1	Learn about IOT data analysis & security need using tools
CO4-PSO2	1	Use of analysis to improve system performance, use enhanced security techniques for IOT based real time data.
CO5-PO1	2	Knowledge about WSN & PAN required for IOT application development.
CO5-PO2	1	Identify which IEEE 802.15. ___ standard is used for application that works with real world values.
CO5-PO3	1	Develop & analyze applications required for industry automation.
CO5-PO4	1	Design new automation techniques for Industry automation (M2M communication without interference of human) through research.
CO5-PO5	1	Able to use tools for develop & analyze new IOT based applications & networks for communication.
CO5-PO6	1	IOT applications are made simple, cheaper for monitoring health.

COS-PO12	1	environment & societal purpose.
COS-PSO1	1	Learning about new sensor techniques.
COS-PSO2	2	Learn about new sensor technologies
		Develop applications used for industry automation

## DELIVERY PLAN WITH DETAILS

### MODULE - 1

Lecture #	Topic	Mode of Delivery (Pls Tick ✓)				Date of Delivery	COs Covered
		1	2	3	4		
1	What is IoT, Genesis of IoT, IoT and Digitization		Online			22/4	CO-1
2	IoT Impact	✓				22/4	CO-1
3	Convergence of IT and IoT	✓				23/4	CO-1
4	IoT Challenges	✓				29/4	CO-1
5	IoT Network Architecture and Design	✓				29/4	CO-1
6	Drivers Behind New Network Architectures	✓				30/4	CO-1
7	Comparing IoT Architectures	✓				6/5	CO-1
8	A Simplified IoT Architecture	✓				6/5	CO-1
9	The Core IoT Functional Stack	✓				7/5	CO-1
10	IoT Data Management and ComputeStack	✓				7/5	CO-1

Textbook : David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry."IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1<sup>st</sup> Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)

and Chapter 1 and Chapter 2

Signatures	Faculty:	#HOURS	Allotted	Taken
	HOD:		10	10
Remarks	Executed as per plan.			

### MODULE - 2

Lecture #	Topic	Mode of Delivery (Pls Tick ✓)				Date of Delivery	COs Covered
		1	2	3	4		
1	Smart Objects: The "Things" in IoT,	✓				13/5	CO-2
2	Sensors, Actuators, and Smart Objects	✓				13/5	CO-2
3	Sensors, Actuators, and Smart Objects	✓				14/5	CO-2
4	Sensor Networks,	✓				20/5	CO-2
5	Connecting Smart Objects	✓				20/5	CO-2
6	Communications Criteria	✓				21/5	CO-2
7	IoT Access Technologies.	✓				23/5	CO-2
8	IoT Access Technologies.	✓				23/5	CO-2
9	IoT Access Technologies.	✓				3/6	CO-2
10	IoT Access Technologies.	✓				3/6	CO-2

Textbook : David Hanes, Gonzalo Salgueiro, Patrick Grossete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1<sup>st</sup> Edition, Pearson Education (Cisco Press Indian Reprint), (ISBN: 978-9386873743)  
and Chapter 3 and Chapter 4

Signatures	Faculty: <i>Raman.H.V</i>	#HOURS	Allotted	Taken
			10	10
Remarks	<i>Executed as per plan</i>			

### MODULE - 3

Lecture #	Topic	Mode of Delivery (Pls Tick ✓)				Date of Delivery	COs Covered
		1	2	3	4		
1	IP & the IoT Network Layer	✓				4/6	CO-3
2	The Business Case for IP	✓				10/6	CO-3
3	The need for Optimization	✓				10/6	CO-3
4	Optimizing IP for IoT	✓				11/6	CO-3
5	Optimizing IP for IoT	✓				17/6	CO-3
6	Profiles and Compliances	✓				17/6	CO-3
7	Application Protocols for IoT,	✓				18/6	CO-3
8	The Transport Layer	✓				24/6	CO-3
9	IoT Application Transport Methods	✓				24/6	CO-3
10	IoT Application Transport Methods	✓				25/6	CO-3

Textbook : David Hanes, Gonzalo Salgueiro, Patrick Grossete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1<sup>st</sup> Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)

and Chapter 5 and Chapter 6

Signatures	Faculty: <i>Raman.H.V</i>	#HOURS	Allotted	Taken
			10	10
Remarks	<i>Executed as per plan</i>			

### MODULE - 4

Lecture #	Topic	Mode of Delivery (Pls Tick ✓)				Date of Delivery	COs Covered
		1	2	3	4		
1	Data and Analytics for IoT, An Introduction to Data Analytics for IoT	✓				1/7	CO-4
2	Machine Learning,	✓				1/7	CO-4
3	Big Data Analytics Tools and Technology	✓				2/7	CO-4

4	Edge Streaming Analytics, Network Analytics	✓		217	CO-4
5	Securing IoT, A Brief History of OT Security,	✓		517	CO-4
6	Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary,	✓		617	CO-4
7	Formal Risk Analysis Structures: OCTAVE and FAIR,	✓		617	CO-4
8	Formal Risk Analysis Structures: OCTAVE and FAIR,	✓		717	CO-4
9	The Phased Application of Security in an Operational Environment	✓		717	CO-4
10	The Phased Application of Security in an Operational Environment	✓		817	CO-4

Textbook : David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1<sup>st</sup> Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743) and Chapter 7 and Chapter 8

Signatures	Faculty: <i>Dhan.M.V</i>	#HOURS	Allotted	Taken
	HoD: <i>S.Sekaray</i> 10/7/24		10	10
Remarks	Executed as per plan.			

## MODULE - 5

Lecture #	Topic	Mode of Delivery (Pls Tick ✓)				Date of Delivery	COs Covered
		1	2	3	4		
1	IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming	✓				817	CO-5
2	IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming	✓				917	CO-5
3	IoT Physical Devices and Endpoints - Raspberry Pi: Introduction to Raspberry Pi,	✓				917	CO-5
4	About the Raspberry Pi Board: Hardware Layout, Operating Systems on Raspberry Pi,	✓				1017	CO-5
5	About the Raspberry Pi Board: Hardware Layout, Operating Systems on Raspberry Pi,	✓				1117	CO-5
6	Configuring Raspberry Pi, Programming Raspberry Pi with Python,	✓				1217	CO-5
7	Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor	✓				1317	CO-5
8	Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to Raspberry Pi	✓				1317	CO-5
9	Smart and Connected Cities, An IoT Strategy for Smarter	✓				1417	CO-5

10	Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.  Textbook : Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017				14-7	CD-S
Signatures	Faculty: <i>Risham.kv</i> HoD: <i>S. Reddy 15/7/21</i>		#HOURS	Allotted	Taken	10
Remarks	Executed as per plan.					

**Text Books:**

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<sup>st</sup> Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Srinivasa K G, "Internet of Things", CENGAGE Learning India, 2017

**Reference Books:**

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1<sup>st</sup> Edition, VPT, 2014. (ISBN: 978-8173719547)
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1<sup>st</sup> Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

(Note: Mode of Delivery : 1. Black Board 2. PPT 3. Video 4. Demo/Hands-on)

**INTERNAL/ASSIGNMENT/QUIZ SCHEDULE**

TEST and QUIZ		COs and Portions Covered		ASSIGNMENT	
Test# and Quiz#	DATE	CO	Modules	Assignment#	DATE
T1 & Q1	27/5	C01 & C02	m <sub>1</sub> & m <sub>2</sub>	A1	24/5
T2 & Q2	28/6	C02 & C03	m <sub>2</sub> & m <sub>3</sub>	A2	24/6
T3 & Q3	15/7	C04 & C05	m <sub>4</sub> & m <sub>5</sub>	A3	7/7

**SUMMARY**

Signatures With Date	Faculty: <i>Risham.kv</i> HoD: <i>S. Reddy 15/7/21</i>	Total #HOURS	Allotted	Taken
Remarks	100% syllabus covered			

## ENCLOSURES

1. Syllabus
2. CO Attainment
3. Gap Analysis
4. Special lectures/talks arranged if any

### Feedback by PAC

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Faculty

  
Course coordinator

PAC

  
HOD



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# SJC INSTITUTE OF TECHNOLOGY

Chickballapur – 562 101

## Department of Information Science & Engineering

### QUESTION BANK

<b>SUBJECT TITLE</b>	<b>INTERNET OF THINGS TECHNOLOGY</b>		
<b>SUBJECT TYPE</b>	<b>CORE /-ELECTIVE</b>		
<b>SUBJECT CODE</b>	<b>17CS81</b>		
<b>ACADEMIC YEAR</b>	<b>2021 (EVEN SEMESTER)</b>	<b>BATCH</b>	<b>2017-2021</b>
<b>SCHEME</b>	<b>CBCS scheme- 2017</b>		
<b>SEMESTER</b>	<b>VIII &amp; A SECTION</b>		
<b>FACULTY NAME and DESIGNATION</b>	<b>CHETHAN.H.V, Assistant Professor</b>		

#### Module -I

<b>Q. No.</b>	<b>Questions</b>	<b>Bloom's LL</b>	<b>COs</b>
1	What is fog computing? Describe the characteristics of fog computing?	L1	CO1
2	Describe the various IoT Challenges.	L1	CO1
3	List out the difference between IT and OT networks.	L1	CO1
4	Explain in detail on Genesis of IoT.	L2	CO1
5	Explain the IoT Architectural Drivers.	L2	CO1
6	Explain the Access Network Sublayer.	L2	CO1
7	Demonstrate the impact of IoT on connected roadways.	L3	CO1
8	Demonstrate the IoT Reference model published by the IoT World Forum.	L3	CO1
9	Differentiate between IoT and Digitization?	L4	CO1
10	How can we reduce the IoT Architectures framework down to a pair of three-layer stacks? Evaluate the same.	L5&L6	CO1

Module -2		Bloom's LL	COs
Q. No.	Questions		
1	List out the various types of Sensors.	L1	CO2
2	List out the various types of Actuators.	L1	CO2
3	Describe the design constraints for Wireless Smart Objects.	L1	CO2
4	Explain the protocol stack utilizing IEEE802.15.4.	L2	CO2
5	Explain the 4 characteristics of Smart Objects.	L2	CO2
6	What is SANET? Explain some of the advantages and disadvantages that a wireless-based solution offers.	L2	CO2
7	Demonstrate the LoRaWAN layers of IoT Access Technologies.	L3	CO2
8	Demonstrate the ZigBee IP Protocol stack.	L3	CO2
9	Illustrate the various communication criteria.	L4	CO2
10	How Sensors and Actuators interact with the physical world? Evaluate the same.	L5&L6	CO2

Module -3		Bloom's LL	COs
Q. No.	Questions		
1	Describe the key advantages of Internet Protocol.	L1	CO2
2	Define the two main protocols that are specified for Transport layer.	L1	CO3
3	Describe the DNP3 Protocol over 6LoWPAN Networks with MAP-T.	L1	CO3
4	What is Adaptation and Adoption of IP? Explain the factors that trying to determine, which model is best suit for last-mile connectivity?	L2	CO3
5	Explain the Need for IP Optimization by considering constrained nodes, networks & IP versions.	L2	CO3
6	Explain the Protocol stack for Transporting Serial DNP3 SCADA over IP.	L2	CO3
7	Demonstrate the Constrained Application Protocol (CoAP) along with its message format and message field.	L3	CO3

8	Write a note on following: a) Comparison of an IOT Protocol Stack Utilizing 6LoWPAN b) 6LoWPAN Header stacks c) 6LoWPAN Fragmentation Header d) Application Layer Protocol not present	L3	CO3
9	Illustrate the working of MQTT Publish/Subscribe Framework.	L4	CO3
10	How to Optimize IP for IoT using an Adaptation layer? Evaluate the same.	L5&L6	CO3

**Module -4**

<i>Q. No.</i>	<i>Questions</i>	<i>Bloom's LL</i>	<i>COs</i>
1	List out the Types of Data Analysis Results.	L1	CO4
2	List out the common challenges faced in OT security.	L1	CO4
3	Describe the concept of Distributed Analytics throughout the IoT system.	L1	CO4
4	What is Machine Learning? Explain its types.	L2	CO4
5	Explain any two Big data analytics tools and technologies (MPP/ NoSQL/Hadoop).	L2	CO4
6	Explain Lambda Architecture for Parallel data flow.	L2	CO4
7	Demonstrate the Flexible Netflow Architecture.	L3	CO4
8	Write a note on following: a) Structured versus unstructured data b) Data in Motion versus Data in Rest	L3	CO4
9	Illustrate the concept of OCTAVE and FAIR.	L4	CO4
10	How IT and OT security practices and systems vary in real time? Evaluate the same.	L5&L6	CO4

**Module -5**

<i>Q. No.</i>	<i>Questions</i>	<i>Bloom's LL</i>	<i>COs</i>
1	What is Arduino? What are the advantages of Arduino?	L1	CO5
2	What are the Key Use Cases for Smart Cities.	L1	CO5
3	Describe the concept of Smart Traffic Control.	L1	CO5
4	Explain in detail Smart City IoT Architecture.	L2	CO5

5	Explain the Raspberry Pi board with neat diagram.	L2	CO5
6	Explain the wireless temperature monitoring system using Raspberry Pi.	L2	CO5
7	Demonstrate the Smart City Security Architecture.	L3	CO5
8	Demonstrate the case study of Connected Street Lighting with respect to Smart City.	L3	CO5
9	Differentiate between Raspberry Pi and Arduino.	L4	CO5
10	How to install Arduino software for the windows PCs? Evaluate the same.	L5&L6	CO5

## Note:

1. Questions shall be framed by consolidating comprehensively from the following sources
  - Exercise problems of text books/ references
  - Previous year question VTU exam Question paper. (Mark the year/exam beside the question)
  - Questions by Experts during Interview/Academic Audit
  - Internet sources/ other Universities examination question papers.
  - Own / experience.
  - Gate questions mentioning the year.
2. Questions shall follow all the Bloom's learning levels with appropriate action verbs
3. There shall be a total of 50 questions considering 10 questions from each module, of which, 3 questions each at L1 and L2, 2 questions at L3, 1 question each at L4 and L5/L6.
4. Ensure the coverage of all Cos.



Estd: 1986

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## SJC INSTITUTE OF TECHNOLOGY

Chickballapur – 562 101

### Department of Information Science & Engineering ASSIGNMENT

<b>SUBJECT TITLE</b>	<b>INTERNET OF THINGS TECHNOLOGY</b>		
<b>SUBJECT TYPE</b>	<b>CORE / -ELECTIVE</b>		
<b>SUBJECT CODE</b>	<b>17CS81</b>		
<b>ACADEMIC YEAR</b>	<b>2021 (EVEN SEMESTER)</b>	<b>BATCH</b>	<b>2017-2021</b>
<b>SCHEME</b>	<b>CBCS scheme- 2017</b>		
<b>SEMESTER</b>	<b>VIII A SECTION</b>		
<b>FACULTY NAME and DESIGNATION</b>	<b>CHETHAN.H.V, Assistant Professor</b>		

#### Module -1

<b>Q. No.</b>	<b>Questions</b>	<b>Bloom's LL</b>	<b>COs</b>
1	Demonstrate the impact of IoT on connected roadways.	L3	CO1
2	Demonstrate the impact of IoT on connected Factory.	L3	CO1
3	Demonstrate the IoT Reference model published by the IoT World Forum.	L3	CO1
4	How can you differentiate the term IoT with respect to Digitization?	L4&L5	CO1
5	How can we reduce the IoT Architectures framework down to a pair of three-layer stacks?	L4&L5	CO1

#### Module -2

<b>Q. No.</b>	<b>Questions</b>	<b>Blooms LL</b>	<b>COs</b>
1	Demonstrate the LoRaWAN layers of IoT Access Technologies.	L3	CO2
2	Show the various types of Sensors and Actuators? Also write example for each.	L3	CO2
3	Demonstrate the ZigBee IP Protocol stack.	L3	CO2
4	How can you design the constraints for Wireless Smart Objects?	L4&L5	CO2
5	How Sensors and Actuators interact with the physical world?	L4&L5	CO2

#### Module -3

<i>Q. No.</i>	<i>Questions</i>	<i>Bloom' s LL</i>	<i>COs</i>
1	Demonstrate the Constrained Application Protocol (CoAP) along with its message format and message field.	L3	CO3
2	Discover the key advantages of Internet Protocol.	L3	CO3
3	Write a note on following: a) 6LoWPAN Fragmentation Header b) Application Layer Protocol not present	L3	CO3
4	How can you say that MQTT is a Lightweight protocol? Illustrate the working of MQTT Publish/Subscribe Framework?	L4&L5	CO3
5	How to Optimize IP for IoT using an Adaptation layer?	L4&L5	CO3

*Module -4*

<i>Q. No.</i>	<i>Questions</i>	<i>Bloom' s LL</i>	<i>COs</i>
1	Demonstrate the Flexible Netflow Architecture.	L3	CO4
2	Demonstrate the concept of OCTAVE.	L3	CO4
3	Discover the common challenges faced in OT security.	L3	CO4
4	How can you differentiate between Structured versus unstructured data	L4&L5	CO4
5	How IT and OT security practices and systems vary in real time?	L4&L5	CO4

*Module -5*

<i>Q. No.</i>	<i>Questions</i>	<i>Bloom' s LL</i>	<i>COs</i>
1	Demonstrate the Smart City Security Architecture.	L3	CO5
2	Demonstrate the Raspberry Pi board with neat diagram.	L3	CO5
3	Demonstrate the case study of Connected Street Lighting with respect to Smart City.	L3	CO5
4	How can you differentiate between Raspberry Pi and Arduino.	L4&L5	CO5
5	How to install Arduino software for the windows PCs?	L4&L5	CO5

**Note:**

1. Questions shall be framed by consolidating comprehensively from the following sources
  - Exercise problems of text books/ references
  - Previous year question VTU exam Question paper. (Mark the year/exam beside the question)
  - Questions by Experts during Interview/Academic Audit
  - Internet sources/ other Universities examination question papers.
  - Own / experience.
2. Questions shall follow all the Bloom's learning levels with appropriate action verbs
3. There shall be a total of 25 questions considering 5 questions from each module, of which, 3 questions at L3, 2 questions each at L4/L5.
4. Ensure the coverage of all COs
5. Rubrics to be specified for all assignment questions.

|| Jai Sri Gurudev ||  
**S.J.C INSTITUTE OF TECHNOLOGY**  
**DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING**

**Subject:** Internet of Things Technology (17CS81)

**Semester:** 8<sup>th</sup> A & B

**Faculty Name:** Anand Tilagul & Chethan H V

**Date:** 24-05-2021

**Tutorial - I**

1. What is IoT? With a diagram explain Genesis of IoT.
2. Compare IoT and Digitization with examples.
3. Mention Impact of IoT.
4. Write a note on the following: a) Connected Roadways b) Connected factory  
c)connected Buildings d) Smart Creatures.
5. Compare Operational Technology (OT) with Information Technology (IT).
6. What are the IoT Challenges, Explain Briefly.
7. Explain IoT Architectural Drivers.
8. With diagram Explain main elements of oneM2M IoT Architecture.
9. Explain briefly IoT Reference model Published by IoT World Forum.
10. Write expanded view of Simplified IoT Architecture. Explain briefly a) Core IoT Functional Stack b) IoT Data management & Compute Stack.
11. Explain Access Network Sublayer.
12. What do you mean by Fog Computing.
13. Explain the 2 types of gateway and backhaul sublayers.
14. What is edge computing? Explain with example.
15. Illustrate the hierarchy of edge, fog and cloud with a neat diagram.



**Internal Test Question paper format- CBCS Scheme****Name of the Staff: ANAND TILAGUL ,CHETHAN H V****Date: 27/05/2021****Reviewer's Signature:**

NOTE: Only the following information's to be given to the students

**S.J.C. Institute of Technology****Department of Information Science and Engineering****Test: I****Subject Name & Code: Internet of Things Technology (17CS81)****Semester: VIII A & B Duration: 100 minutes Max Marks: 50****Answer the following questions by selecting one full question from each part.**

Question Number		Marks	CO	Level
1	What is IOT? With a diagram explain Genesis of IOT.	10	CO1	L2
<b>Or</b>				
2	What are the IOT Challenges and their impact with any one example?	10	CO1	L2
3	With diagram explain main elements of one M2M IOT Architecture.	10	CO1	L2
<b>Or</b>				
4	Explain briefly IOT Reference model Published by IOT World Forum.	10	CO1	L2
5	What is Fog Computing? Explain with example.	10	CO1	L2
<b>Or</b>				
6	What is edge computing? Explain with example.	10	CO1	L2
7	Explain in detail the expanded simplified IOT Architecture.	10	CO1	L2
<b>Or</b>				
8	Illustrate the hierarchy of edge, fog and cloud with a neat diagram.	10	CO1	L2
9	a) Explain Access Network Sublayers with neat diagram. b) Explain the functionality of IOT network management Sublayers.	5 5	CO1 CO1	L2 L2
<b>Or</b>				
10	a) Explain Core IOT Functional Stack. b) Compare Operational Technology (OT) with Information Technology(IT).	5 5	CO1 CO1	L2 L2

|| Jai Sri Gurudev ||  
**S.J.C INSTITUTE OF TECHNOLOGY**  
**DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING**

**Tutorial - II**

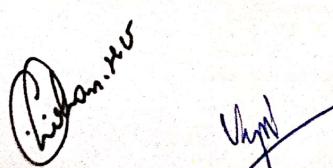
**Subject:** Internet of Things Technology (17CS81)

**Semester:** 8<sup>th</sup> A & B

**Faculty Name:** Anand Tilagul & Chethan H V

**Date:** 24-06-2021

1. Explain in detail the IEEE 802.15.4 wireless access technology.
2. Explain in detail the LoRaWAN technology.
3. Give the key advantages of Internet Protocol.
4. What is Adaptation and Adoption of IP ?
5. Explain the factors that trying to determine, which model Adaptation v/s Adoption is best suit for last-mile connectivity?
6. Explain the Need for IP Optimization by considering constrained nodes, networks & IP versions.
7. Write a note on following: (any one point)
  - a) Optimizing IP for IOT using an Adaption layer.
  - b) Comparison of IOT Protocol Stack Utilizing 6LoWPAN.
  - c) 6LoWPAN Header stack.
8. Explain Optimizing IP for IOT. ( any 3 out of 7 points).
9. Write a note on: i) Header Compression ii)Fragmentation iii)Mesh addressing iv) 6TiSCH v) RPL vi) Authentication & Encryption on Constrained nodes. (any one point)
10. Explain Constrained Application Protocol (CoAP) along with its message format and message field.
11. Explain Message Queuing Telemetry Transport (MQTT) along with its message format and message types.
12. Explain Protocol stack for Transporting Serial DNP3 SCADA over IIP.
13. Explain the various network topologies with examples.
14. Explain the classification of smart objects with examples.
15. What is IEEE 802.15.4 protocol? How is it related to IoT?
16. Classify different types of sensors with examples.
17. What is an actuator? Explain how sensors and actuators interact with the physical world.
18. Classify the actuator, with examples.
19. With a neat diagram, explain the characteristics of smart objects. List the trends in smartobjects.
20. What are SANETs? List its advantages.
21. List and explain different communication criterias in IoT.
22. Explain LoRaWAN layers and its architecture

  
Chethan H V



### Internal Test Question paper format- CBCS Scheme

Name of the Staff: ANAND THILAGUL , CHETHAN H V  
Date: 28/06/2021

Signature:

Reviewer's Signature:

NOTE: Only the following information's to be given to the students

S.J.C. Institute of Technology

Department of Information Science and Engineering

Test: II

Subject Name & Code: Internet of Things Technology (17CS81)

Semester: VIII A & B

Duration: 100 minutes

Max

Marks: 50

Answer the following questions by selecting one full question from each part.

Question Number		Marks	CO	Level
1	Explain in detail the IEEE 802.15.4 wireless access technology.	10	CO2	L2
<b>Or</b>				
2	Explain in detail the LoRaWAN technology.	10	CO2	L2
3	Explain the various network topologies with examples.	10	CO2	L2
<b>Or</b>				
4	Classify different types of sensors with examples.	10	CO2	L2
5	Explain Constrained Application Protocol (CoAP) along with its message format and message field.	10	CO3	L2
<b>Or</b>				
6	Explain Message Queuing Telemetry Transport (MQTT) along with its message format and message types.	10	CO3	L2
7	Explain the Need for IP Optimization by considering constrained nodes, networks & IP versions.	10	CO3	L2
<b>Or</b>				
8	Explain Protocol stack for Transporting Serial DNP3 SCADA over IIP.	10	CO3	L2
9	Give the key advantages of Internet Protocol.	10	CO3	L2
<b>Or</b>				
10	Explain the Header Compression, Fragmentation and Mesh addressing.	10	CO3	L2

|| Jai Sri Gurudev ||  
**S.J.C INSTITUTE OF TECHNOLOGY**  
**DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING**

Tutorial - III

**Subject:** Internet of Things Technology (17CS81)

**Faculty Name:** Anand T and Chethan H V

**Semester:** 8<sup>th</sup> A & B

**Date:** 07-07-2021

1. Explain 4 data analysis results and IOT data Analytics challenges.
2. With diagram explain Lambda Architecture for Parallel data flow.
3. Discuss some common challenges faced in OT security.
4. Explain Machine Learning concept along with its types.
5. With logical frame work show how the Purdue Model for control hierarchy is applied for Manufacturing.
6. Explain any 2 Big data analytics tools and technologies (MPP/NoSQL/Hadoop).
7. Discuss OCTAVE and FAIR formal risk analysis.
8. Explain in detail how IT and OT security practices and systems vary in real time.
9. Explain details of Arduino UNO hardware, software & programming.
10. Explain details of Rasberry Pi hardware, software & programming.
11. With a neat diagram explain wireless temperature monitoring system using Raspberry Pi.
12. Explain in detail smart city IOT architecture.
13. Write a note on following:
  - a) Connected Street Light with respect to Smart City
  - b) Smart City Security Architecture



A handwritten signature in black ink, appearing to read "Anand T and Chethan H V". The signature is written in a cursive style with a small circle containing a dot to the left of the name.



## Internal Test Question paper format- CBCS Scheme

Name of the Staff: ANAND TILAGUL , CHETHAN H V  
Date: 15/07/2021

Signature:

Reviewer's Signature:

NOTE: Only the following information's to be given to the students

S.J.C. Institute of Technology

Department of Information Science and Engineering

Test: III

Subject Name &amp; Code: Internet of Things Technology (17CS81)

Semester: VIII A &amp; B

Duration: 100 minutes

Max Marks: 50

Answer the following questions by selecting one full question from each part.

Question Number		Marks	CO	Level
1	Discuss OCTAVE and FAIR formal risk analysis	10	CO4	L2
<b>Or</b>				
2	With logical frame work show how the Purdue Model for control hierarchy is applied for Manufacturing	10	CO4	L2
3	Explain in detail how IT and OT security practices and systems vary in real time.	10	CO4	L2
<b>Or</b>				
4	Explain any 2 Big data analytics tools and technologies (MPP/NoSQL/Hadoop).	10	CO4	L2
5	Explain Machine Learning concept along with its types	10	CO4	L2
<b>Or</b>				
6	With diagram explain Lambda Architecture for Parallel data flow	10	CO4	L2
7	Explain details of Arduino UNO hardware, software & programming.	10	CO5	L3
<b>Or</b>				
8	Explain details of Rasberry Pi hardware, software & programming.	10	CO5	L3
9	With a neat diagram explain wireless temperature monitoring system using Raspberry Pi.	10	CO5	L3
<b>Or</b>				
10	Explain in detail smart city IOT architecture.	10	CO5	L3

**Eighth Semester B.E. Degree Examination, Aug./Sept.2020**  
**Internet of Things and Technology**

Time: 3 hrs.

Max. Marks: 80

*Note: i) For Regular Students: Answer any FIVE full questions irrespective of modules.  
ii) For Arrear Students : Answer any FIVE full questions, choosing ONE full question from each module.*

**Module-1**

- 1 a. Define IoT and discuss the Genesis of IoT in detail. (04 Marks)
- b. List out the difference between IT and OT networks and their various challenges. (06 Marks)
- c. List out the most significant challenges and problems that IoT is currently facing. (06 Marks)
  
- 2 a. List and explain the defining characteristics of fog computing. (06 Marks)
- b. Explain the IoT reference model published by the IoTWG. (10 Marks)

**Module-2**

- 3 a. Define sensor and its characteristics. (06 Marks)
- b. List out the most useful classification scheme for the pragmatic application of sensors in a IoT network. (10 Marks)
  
- 4 a. Briefly describe about communication criteria. (08 Marks)
- b. What are the main topologies used for IoT connecting devices? (08 Marks)

**Module-3**

- 5 a. What are the key advantages of the IP suite for the IoT? (10 Marks)
- b. What are the points to be considered while comparing the transport of DLMS/COSEM over a cellular network versus an LLN deployment? (06 Marks)
  
- 6 a. Explain in detail COAP message format. (08 Marks)
- b. Explain Message Queuing Telemetry Transport (MQTT). (08 Marks)

**Module-4**

- 7 a. What are the ways IoT data is categorized? Explain in detail. (06 Marks)
- b. Discuss the following :
  - (i) Supervised learning
  - (ii) Unsupervised learning
  - (iii) Neural Networks.
(10 Marks)
  
- 8 a. Explain any two Big data analytics tools and technologies. (10 Marks)
- b. Explain Lambda Architecture in details. (06 Marks)

For More Question Papers Visit - [www.pediawikiblog.com](http://www.pediawikiblog.com)

- Module-5**
- 9 a. What is Arduino? What are the advantages of Arduino? (06 Marks)  
b. How to install arduino software for the windows PCs? (10 Marks)
- 10 a. Distinguish between Raspberry Pi and Arduino. (04 Marks)  
b. Develop a python program which monitors a temperature of an engine using DS18B20 sensor and Raspberry Pi. (12 Marks)

# CBGS SCHEME

USN 

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15CS81

## Eighth Semester B.E. Degree Examination, Dec.2019/Jan.2020 Internet of Things Technology

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. What is IOT? Explain evolutionary phases of the internet.  
b. Explain Access Network sublayer with a neat diagram.  
c. What are the elements of one M2M IOT architecture? Explain

(06 Marks)  
(06 Marks)  
(04 Marks)

OR

- 2 a. Explain the functionality of IOT network management sub layer.  
b. Describe IOT World Forum (IOTWF) Standardized architecture.  
c. Compare and contrast IT and OT.

(05 Marks)  
(07 Marks)  
(04 Marks)

### Module-2

- 3 a. With a neat diagram, explain how actuators and sensors interact with physical world. Classify actuators based on energy type.  
b. List out the limitations of the smart objects in WSNs and explain the data aggregation in WSN with a neat diagram

(08 Marks)  
(08 Marks)

OR

- 4 a. What is Zigbee? Explain 802.15.4 physical layer, MAC layer, and security.  
b. Explain LoRaWAN standard and alliance MAC layer and security

(08 Marks)  
(08 Marks)

### Module-3

- 5 a. With a neat diagram, explain 6LOWPAN protocol header comparison and fragmentation.  
b. List and explain the key advantages of internet protocol.  
c. Explain RPL encryption and authentication on constraint nodes.

(08 Marks)  
(04 Marks)  
(04 Marks)

OR

- 6 a. Explain tunneling legacy SCADA over IP networks ad SCADA protocol translation with a neat diagram.  
b. Describe MQTT framework and message format in detail.

(08 Marks)  
(08 Marks)

### Module-4

- 7 a. Explain the elements of Hadoop with a neat diagram.  
b. Explain neural network in machine learning with a detailed example.  
c. Describe the components of FNF.

(07 Marks)  
(05 Marks)  
(04 Marks)

OR

- 8 a. Explain Formal Risk Analysis Structures  
b. Explain the Purdue model for control hierarchy and OT network characteristics.

(08 Marks)  
(08 Marks)

Module-5

- 9 a. Explain the following with respect to Arduino programming.
- i) Structure
  - ii) Functions
  - iii) Variables
  - iv) Flow control statements
  - v) Data type
  - vi) Constants.
- b. Explain Raspberry Pi learning board.
- OR
- 10 a. Write a python program on Raspberry Pi to blink an LED. (06 Marks)
- b. Explain Smart city security architecture. (06 Marks)
- c. Write a short note on :
- i) IOT challenges
  - ii) Backhaul Technologies. (04 Marks)

SJCIT/NBA/  
COURSE/  
2020-21

**S J C INSTITUTE OF TECHNOLOGY**  
Chickballapur - 562 101  
**Department of Information Science & Engineering**

**Course Information**

Programme Name:	Information Science & Engineering				
Academic Year:	2020-21	Semester:	8	Section:	A & B
Programme Name:	Internet of Things Technology				
Course Instructor Name:	Anand Tilagul & Chethan H V				
Subject Code:	17CS81	Course No:	1	Course ID:	C411
					76

**Scheme of Teaching & Marks**

Contact Hr/Week:	4	Lecture Hours (Hr.):	4	Tutorials (Hr.):	0
Max.CIE Marks:	40	Max. SEE Marks:	60	Total Max.Marks:	100
Min.CIE Marks:	19	Min.SEE Marks:	21	Total Min.Marks:	40
Final CIE (IA) Marks:	40	Assignment Marks:	10	Test Marks:	30

**Threshold Values for Attainment Calculation**

Attainment level	3	%	2	%	1	%	Percentage Contribution, %		
	CIE	40	SEE	50	-	CES	10		
Internal Assessment	>=	70	>=	60	>=	50			
SE Examination	>=	60	>=	50	>=	40			

**Statements of Course Outcomes**

	No.of CO's	Target(%)	BL
C411.1	Interpret the impact and challenges posed by IOT networks leading to new architectural models .	60	3
C411.2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.	60	4
C411.3	Illustrate the role of IOT protocols for efficient network communication.	60	3
C411.4	Demonstrate the need for data analytics and security in IOT.	60	3
C411.5	Illustrate different sensor technologies of IOT.	60	3
C411.6	Analyze the various IOT protocols for better services.	60	4
Semester End Exam. (SEE) Target(%)	60	Course End Survey(CES) Target (%):	70

**CO-PO Mapping Table (In the scale of 3)**

CO/PO	1	2	3	4	5	6	7	8	9	10	11	12	CO/PSO	1	2	4
C411.1	3	2		1									C411.1	1	1	
C411.2	1	3	2	2	1								C411.2	2	1	
C411.3	3	2	2	3	1				2		2		C411.3	1	1	
C411.4	3	2	2	3							1		C411.4	1	1	
C411.5	2	2	1	3					2				C411.5	1	1	
C411.6	1				2								C411.6	1	1	
Total	13	11	7	12	4					4	5		Total	7	6	
	2.2	2.2	1.8	2.4	1.3					2	1.7			1.2	1	



**S J C INSTITUTE OF TECHNOLOGY**  
Chickballapur - 562 101  
Department of Information Science & Engineering

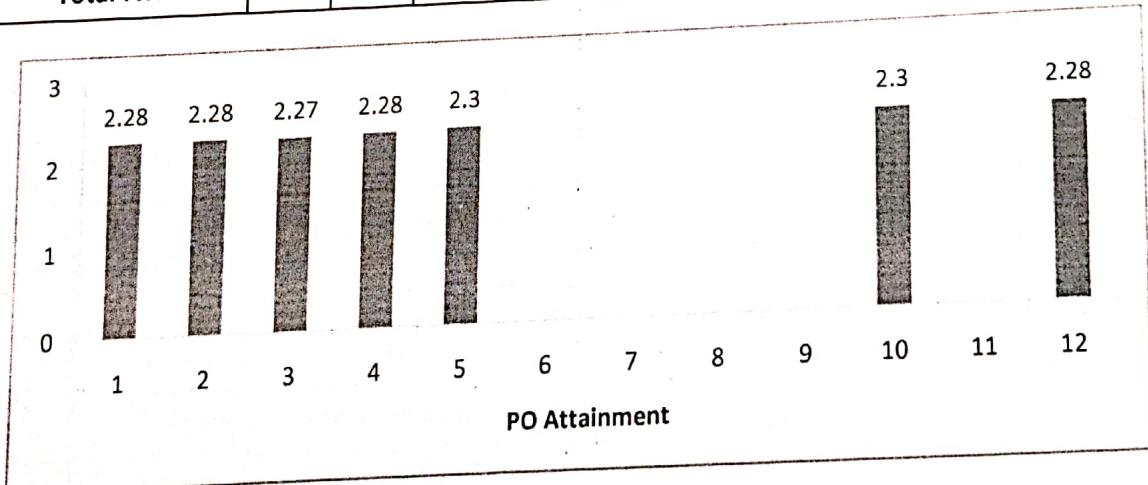
Course Title	Internet of Things Technology					Course Code	C411
Subject Code	17CS81	Semester	8	Section	A & B	Emp.ID	2095
Faculty Name	Anand Tilagul & Chethan H V					No.students	76

**Summary of CO attainments of Sub: 17CS81 Based on (ACTUAL-TYPE-1) Academic Year:2020-21**

CO	CID_CO	CIE			SEE			CES			TOT_Attainment		
		S_AT	T_ST	ATN	S_AT	T_ST	ATN	S_AT	T_ST	ATN	ATN	%	Status
CO1	C411.1	76	76	3	39	76	1.5	67	67	3	2.3	75	YES
CO2	C411.2	76	76	3	39	76	1.5	67	67	3	2.3	75	YES
CO3	C411.3	76	76	3	39	76	1.5	67	67	3	2.3	75	YES
CO4	C411.4	73	76	2.9	39	76	1.5	67	67	3	2.2	74	YES
CO5	C411.5	76	76	3	39	76	1.5	67	67	3	2.3	75	YES
CO6	C411.6	76	76	3	39	76	1.5	67	67	3	2.3	75	YES

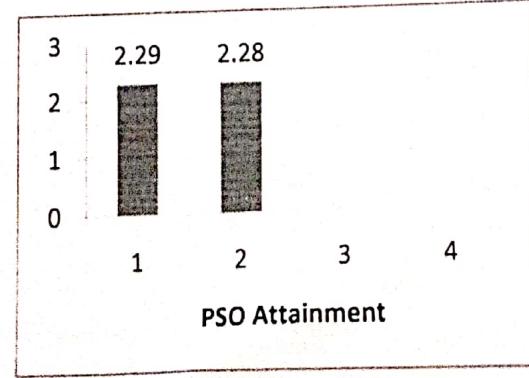
**Summary of PO attainments of Sub: 17CS81 Based on (ACTUAL-TYPE-1) Academic Year:2020-21**

PO Number	1	2	3	4	5	6	7	8	9	10	11	12
Direct ATNT(D)	2.16	2.16	2.15	2.16	2.17					2.17		2.16
Indirect ATNT(ID)	3	3	3	3	3					3		3
Total-ATNT	2.28	2.28	2.27	2.28	2.3					2.3		2.28



**Summary of PSO attainments in Year:2020-21**

PSO Number	1	2	3	4
Direct ATNT(D)	2.16	2.16		
Indirect ATNT(ID)	3	3		
Total-ATNT	2.29	2.28		





## A. Course Details

Course Title	Internet of Things Technology				Course Code	C411
Subject Code	17CS81	Semester	8	Section	A & B	Programme
Course	Theory	Course Type		CORE		No.of students
Date of commencement	19-4-21	Date of Closure		20-7-21		

## B. Course Instructor Details

Course Instructor Name	Anand Tilagul & Chethan H V	Emp.ID	2095
Total Teaching Experience	04	No.of times taught this course	1

## C. Course Delivery

1	Course Plan was circulated among students before the start of course	YES		
2	Total No of Modules/Chapters the course consists	S	Covered	S % 100
3	Total No of Classes Planned for the course	50	Classes Held	50 % 100
4	Any reasons for non-coverage of 100 % syllabus (if not covered)			

Syllabus Covered.

## D. Course Outcome(s) &amp; University Examination Results

University Examination Results					76
1	Appeared	76	Pass	76	%Pass 100
2	Lost eligibility due to shortage of attendance	-NIL-		%	#VALUE!
3	No. of students obtained minimum CIE marks	0		%	0

## Grades obtained by the students (No. of students)

Grade Letter	S	A	B	C	D	E	E	Marks	Max.	Avg.
	10	9	8	7	6	4	0			
Grade Point	10	9	8	7	6	4	0	CIE	40	39
No. of Students	1	15	38	19	3			SEE	60	35
% Students)	1	20	50	25	4			Total	100	74



## Summary of Course Outcomes

Weight, %	Attainment				Blooms Levels	No.
	40	50	10			
CO-Number	CIE	SEE	CES	Total	Level's	No.
C411.1	3	1.5	3	2.3	Apply	3
C411.2	3	1.5	3	2.3	Analyze	4
C411.3	3	1.5	3	2.3	Apply	3
C411.4	2.9	1.5	3	2.2	Apply	3
C411.5	3	1.5	3	2.3	Apply	3
C411.6	3	1.5	3	2.3	Analyze	4

## E. Students Feedback

Over all feedback value	98.21,
-------------------------	--------

## F. Remarks on CIE, attainment and suggestion(s) to improve course delivery by course instructor

All Co's are attained.

## G. Innovative/Best methods used for course delivery by the course instructor

- \* Chalk & Talks
- \* PPT'S & videos.

## H. Remarks of the Module Coordinator

All the Co's are attained. Suggested to increase the target level for all Co's.

Signature

Name

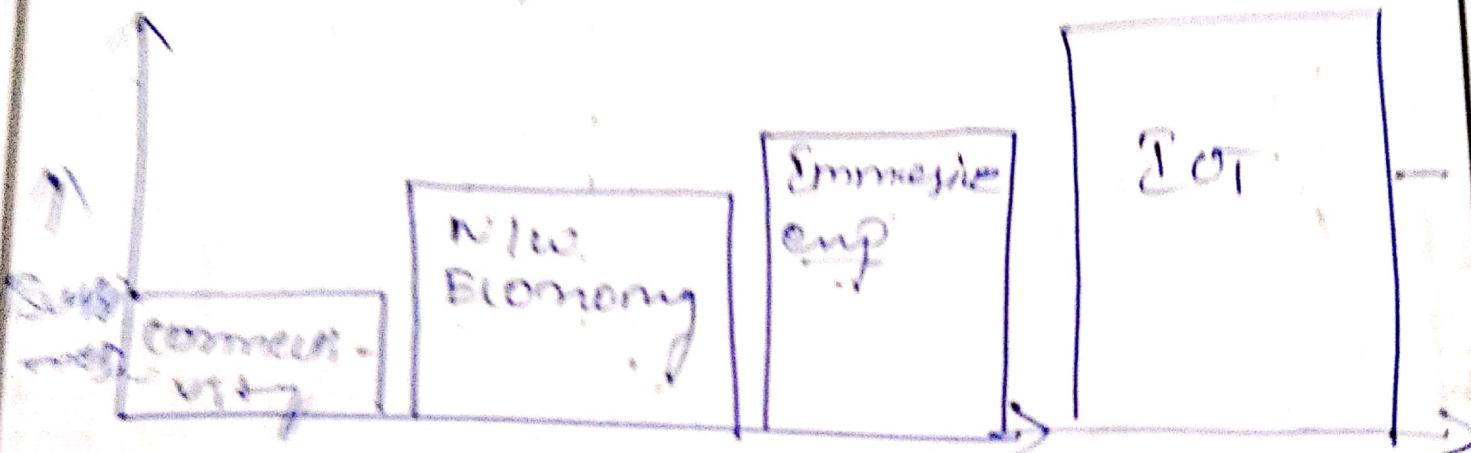
Anand Tilagul  
Module Coordinator

Anand Tilagul & Chethan H V  
Course Instructor

Signature of the HOD 28/5/21

### Solution

- (a) Future of IoT  
→ Impact of IoT  
→ Benefits of IoT



Intelligent connections  
with implementation.

### IoT Challenges

- Safety
- mobility
- Environment
- prioritizing
- operational policy

with example

Subject Title: IoT

Subject Code: 18ISJ-1

Question Number	Solution
(8)(a)	<p>main elements of an M2M Arch</p> <pre> graph TD     subgraph Application_Layer [Application layer]         direction LR         A[Automotive APP] --- B[Home APP]         B --- C[Energy APP]     end     subgraph Service_Layer [Service layer]         direction TB         D[AP] --- E[H]         E --- F[EP]         F --- G[common security]         G --- H[common protocol]         H --- I[protocol, rule]         I --- J[Handover]     end     subgraph Network_Layer [Network layer]         direction LR         K[ ] --- L[ ]         L --- M[ ]         M --- N[ ]         N --- O[ ]         O --- P[ ]         P --- Q[ ]         Q --- R[ ]         R --- S[ ]         S --- T[ ]         T --- U[ ]         U --- V[ ]         V --- W[ ]         W --- X[ ]         X --- Y[ ]         Y --- Z[ ]     end     A --&gt; D     B --&gt; D     C --&gt; D     D --&gt; G     G --&gt; H     H --&gt; I     I --&gt; J     J --&gt; P     P --&gt; Q     Q --&gt; R     R --&gt; S     S --&gt; T     T --&gt; U     U --&gt; V     V --&gt; W     W --&gt; X     X --&gt; Y     Y --&gt; Z     </pre> <p>with encapsulation.</p>
(4)(a)	<p>IoT reference model proposed by IET world forum</p> <ol style="list-style-type: none"> <li>7 → IoT abstraction &amp; processes</li> <li>6 → Application (Reporting, Analysis)</li> <li>5 → Data abstraction (Aggregation) → 3m</li> <li>4 → Data accumulation (Storage)</li> <li>3 → Edge computing (Data Element analysis)</li> <li>2 → Connectivity (communications)</li> <li>1 → Physical devices &amp; controllers (Things in IoT)</li> </ol>

Implementation of all layers → 7m  
10m

Subject Title:

Subject Code:

Question Number	Solution	Marks Allocated
(5)(a) <u>fog computing</u>	<p>Diagram of fog computing architecture:</p> <pre> graph TD     Cloud["Cloud Datacenter/Internet"]     Core[Core SPVC]     FogLayer[Fog layer]     SmartObjects[Smart Objects]     EmbeddedSystem[Embedded System]     MultiGen[Multi Generative edge]     Rethink[Rethink DB]     Database[Database]     App[APP]     VM[VM]     OS[OS]      Cloud --&gt; Core     Core --&gt; FogLayer     FogLayer --&gt; SmartObjects     SmartObjects --&gt; EmbeddedSystem     EmbeddedSystem --&gt; MultiGen     MultiGen --&gt; Rethink     Rethink --&gt; Database     Database --&gt; App     App --&gt; VM     VM --&gt; OS   </pre> <p>The diagram illustrates the fog computing architecture with the following layers from top to bottom:</p> <ul style="list-style-type: none"> <li><b>Cloud:</b> Represented by a cloud icon containing "Cloud Datacenter/Internet".</li> <li><b>Core SPVC:</b> Represented by an oval containing "DD DD".</li> <li><b>Fog layer:</b> Represented by an oval containing "DD".</li> <li><b>Smart Objects:</b> Represented by an oval containing "BB".</li> <li><b>Embedded System:</b> Represented by an oval containing "BB".</li> <li><b>Multi Generative edge:</b> Represented by an oval containing "DD D".</li> <li><b>Rethink DB:</b> Represented by an oval containing "DD".</li> <li><b>Database:</b> Represented by an oval containing "DD".</li> <li><b>APP:</b> Represented by an oval containing "APP".</li> <li><b>VM:</b> Represented by an oval containing "VM".</li> <li><b>OS:</b> Represented by an oval containing "OS".</li> </ul>	4m
(6)(a) <u>Edge computing</u>	<p><u>Edge computing</u> layer consolidation.</p> <p><u>Edge computing</u> implementation</p> <p>The diagram shows two endpoint configurations for edge computing implementation:</p> <ul style="list-style-type: none"> <li><b>Endpoint APP'A:</b> Contains boxes for APP, Database, OS, and VM.</li> <li><b>Endpoint APP'B:</b> Contains boxes for APP, Database, and OS.</li> </ul> <p>A bracket indicates a consolidation between APP'A and APP'B, leading to a total allocation of 10m.</p>	6m 10m.

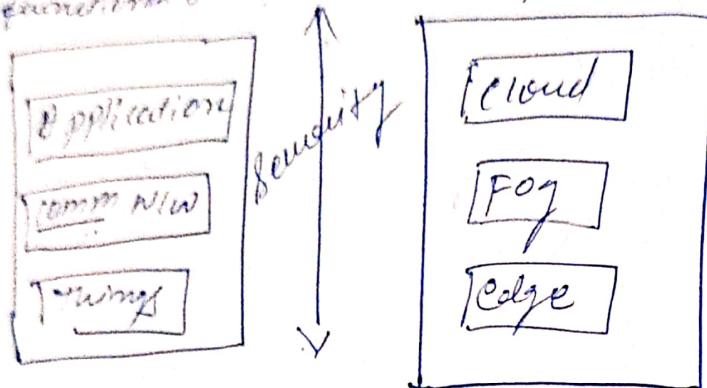
Question  
Number

Solution

Max  
Allow

(Q6)(a)

Semi-structured IoT Data  
are IoT function/states.



3m

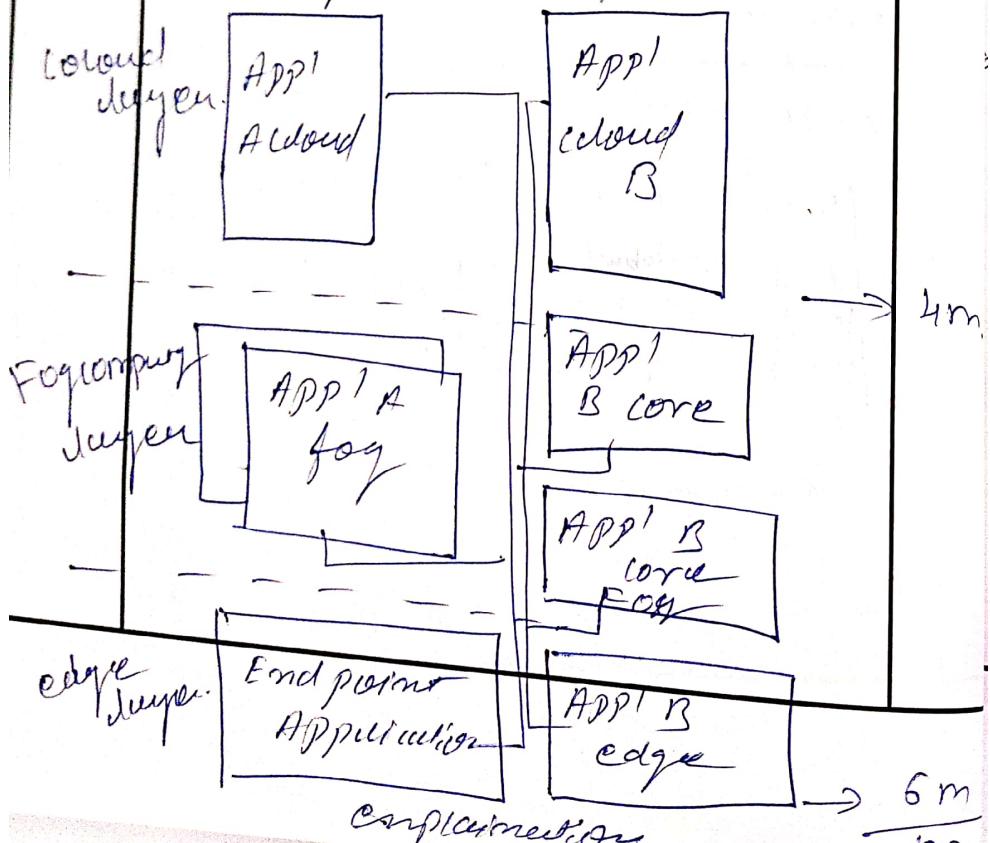
Explanation of all the layers

7m

10m

(Q6)(a)

Hierarchy of edge, fog & cloud



4m

6m

Subject Title: IoT

Subject Code: 17CS81

Question Number	Solution	Marks Allocated
(9)(a)	<u>Access &amp; NW Sublayer</u> <p>The diagram illustrates the Network Layer (NW) sublayers of IoT. It shows concentric layers representing different communication ranges:</p> <ul style="list-style-type: none"> <li><b>NFC:</b> Innermost layer, typically used for short-range communication up to 10cm.</li> <li><b>Bluetooth:</b> Layer just outside NFC, typically used for short-range communication up to 1m.</li> <li><b>WPAN:</b> Layer for personal area networks, typically used for short-range communication up to 5m.</li> <li><b>WMAN:</b> Layer for metropolitan area networks, typically used for medium-range communication up to 25km.</li> <li><b>WWAN:</b> Layer for wide-area cellular networks, typically used for long-range communication up to 100km.</li> <li><b>LPWA:</b> Layer for low-power wide-area networks, typically used for very long-range communication up to 1000km.</li> </ul> <p>Annotations include "zigbee." near the WMAN layer and "wireless." near the WWAN layer.</p>	
(9)(b)	<u>Functionality of IoT NW management sublayer</u> <ul style="list-style-type: none"> <li>→ Data analytics</li> <li>→ Network analytics</li> </ul>	2M 2M. 4M. 6M.
(10)(a)	<u>Core of IoT functional stack</u> <ul style="list-style-type: none"> <li>→ Sensors layer</li> <li>→ Communications NW layer</li> <li>→ Access network layer</li> <li>→ Gateways &amp; beam hand NW layer</li> <li>→ NW transport layer</li> <li>→ IoT network management layer</li> <li>→ Application Analytics layer</li> </ul>	6M 6M.



Subject Title: IOT

Question Number	Section
10(b)	<p>Difference b/w OT &amp; IoT</p> <ul style="list-style-type: none"><li>→ OT needs</li><li>→ operational focus</li><li>→ gathering</li><li>→ storage</li><li>→ processing</li></ul>



## DEPARTMENT :Information Science &amp; Engineering

## TEST-II Scheme &amp; Solutions

Subject Title:Internet of Things,17CS81

Sem : VIII

Question Number	Solution	Marks Allocated
1.	<ul style="list-style-type: none"><li>* Types of Deployments.</li><li>* Standardizations &amp; Alliances.</li><li>* Protocol Stack.</li><li>* ZigBee</li></ul>	2 Marks 2 marks 4 marks 2 Marks  10 Marks
2.	<p>LoRaWAN Standardizations &amp; Alliances. -2m-</p> <p>LoRaWAN layers.</p> <pre>graph TD; A[Applications] --- B[IPv6]; B --- C[MAC]; C --- D[PHY MODULATION]; D --- E[ALLIANCE]</pre>	-2m - -10M -
3.	<p><u>Explanation:-</u></p> <p>Star Topology.</p> <p>Mesh Topology</p> <p>Ring Topology.</p>	- 6m - - 10m -



Question Number	Solution	Marks Allocated
4.	<p>Sensor Types.</p> <ul style="list-style-type: none"><li>* Position</li><li>* Occupancy &amp; Motion.</li><li>* Velocity &amp; Acceleration</li><li>* Force</li><li>* Pressure.</li><li>* Flow</li><li>* Humidity</li><li>* Light</li><li>* Radiation.</li><li>* Temperature</li></ul>	1x10 10M.
5.	<p>Controlled Applications Protocol (CoAP). 2m- Standards CoAP.</p> <p>CoAP message format &amp; message fields with Diagram. -</p> <p>The diagram illustrates the structure of a CoAP message. It consists of four horizontal fields stacked vertically, enclosed in a rectangular frame. An arrow at the top points from left to right, labeled "4 Bytes". The fields are labeled from top to bottom: "CODE", "TOKEN", "OPTIONS", and "PAYLOAD".</p>	2m- -10M- -8m-



Question Number	Solution	Marks Allocated
6.	<p><u>Message Queuing Telemetry Transport (MQTT)</u></p> <p>MQTT Message format with Diagram.</p> <p>The diagram illustrates the structure of an MQTT message. It consists of four horizontal layers within a rectangular frame. The top layer is labeled "message type". The second layer is labeled "length". The third layer is labeled "header". The bottom layer is labeled "Payload".</p>	-5M- -10M.
	<p><u>MQTT Message Types:-</u></p> <ul style="list-style-type: none"><li>Contact</li><li>Connack</li><li>Publish</li><li>PUB Recv</li><li>Subscribe</li></ul>	-5M-
7.	<p><u>Need for IP optimization:-</u></p> <ul style="list-style-type: none"><li>Constrained Nodes.</li><li>Constrained NW's.</li><li>IP Versions.</li></ul>	-3M- -3M- -4M-
8.	<p>Protocol Stack for transporting Serial DNP3 SCADA over ZEP.</p>	

Question Number	Solution	Marks Allocated
	<pre> graph TD     subgraph Master [MASTER]         direction TB         A[Application layer] --&gt; B[Transport]         B --&gt; C[Data link]         C --&gt; D[Network]         D --&gt; E[Data link layer]         E --&gt; F[Physical]         A &lt;--&gt; logical communication  B     end     subgraph Slave [OUT STATION]         direction TB         A[Application layer] --&gt; B[Transport]         B --&gt; C[Data link]         C --&gt; D[Network]         D --&gt; E[Data link layer]         E --&gt; F[Physical]         A &lt;--&gt; logical communication  B     end </pre>	-5M-
Q. <u>Advantages of IP:-</u>	<p>* Open &amp; Standard Base.</p> <p>* Versatile</p> <p>* Scalable</p> <p>* Manageable</p> <p>* Stable</p> <p>* Innovation factor</p>	-10M



SCH

Date \_\_\_\_\_  
Page \_\_\_\_\_

Question Number	Question	Marks Allocated
10.	<p>1) Header Compression * Decompression * Mesh Oddcuring with Explanation.</p>	<p>3 M 3 M 4 M = 10 M</p>

**DEPARTMENT :Information Science & Engineering****TEST-III Scheme & Solutions****Subject Title:Internet of Things,17CS81****Sem : VIII**

Question Number	Solution	Marks Allocated
1.	<p><u>OCTAVG :-</u></p> <pre> graph LR     A[Establish Drives] --&gt; B[Profile Assets]     B --&gt; C[Identify Threats]     C --&gt; D[Identify Risk.]   </pre>	-5m-
	<p><u>Explanation :-</u></p> <p><u>FAIR :-</u></p> <p><u>Explanation</u></p>	-10m-
2.	<p><u>Purdue Model Control Hierarchy.</u></p> <p>Enterprise Net</p> <p>↓</p> <p>Business planning</p> <p>↓</p> <p>Shared Areas</p> <p>↓</p> <p>Operation &amp; Control</p> <p>↓</p> <p>Supervisory Control</p> <p>↓</p> <p>Basic Control</p> <p>↓</p> <p>Process</p> <p>↓</p> <p>Safety Control with Ge planario</p>	-5m- -10m- -5m- -10m-



Question Number	Solution	Marks Allocated
3.	<p><u>IT &amp; OT Security Practices.</u></p> <ul style="list-style-type: none"><li>* Purdue Model for Control Hierarchy. -3m-</li><li>* OT Network Characteristics Impacting Security -3m</li><li>* Security Properties. -2m-</li><li>* Security Focus. -2m-</li></ul>	-10m-
4.	<p><u>Big data Analytics Tools.</u></p> <ul style="list-style-type: none"><li>* NoSQL Database. -1m-</li><li>* Hadoop -4M-</li><li>* MPP -2m-</li></ul>	-10m-
5.	<p><u>Machine Learning Overview.</u></p> <ul style="list-style-type: none"><li>* Supervised Learning. Sx2</li><li>* Unsupervised Learning.</li><li>* Neural Networks.</li><li>* Intelligence</li><li>* Predictive Analytics.</li></ul>	-10m-



Question Number	Solution	Marks Allocated
6.	<p>Lambda <u>Architecture</u></p> <pre>graph TD; Stream[Stream layer] --&gt; Realtime[Realtime view]; Stream --&gt; Batch[Batch layer]; Stream --&gt; PreComp[Pre-computed views]; Kafka[Kafka] --&gt; Stream; Smart[Smart Objects] --&gt; Kafka;</pre>	<p>-10M-</p> <p>-5M-</p> <p>-5M-</p>
7.	<p><u>Arduino Uno Hardware</u></p> <p>Hardware Types.</p> <p>Software Types</p> <p>Programming Types.</p> <p>Arduino board.</p>	<p>-3M-</p> <p>-3M-</p> <p>-2M-</p> <p>-2M-</p>
8.	<p><u>Raspberry Pi</u></p> <p>Hardware types</p> <p>Software type.</p>	<p>-5M-</p> <p>-5M-</p>



Question Number	Solution	Marks Allocated
10.	<p>Smart city <u>IoT Architecture</u> - 5x2</p> <p>* Smart city layered Architecture</p> <p>* Street layer.</p> <p>* City layer.</p> <p>* Data Center layer.</p> <p>* Service layer.</p> <p>* On Premises</p>	-10M-



<b>Course Title:</b>		Internet of Things Technology											
<b>Subject Code:</b>		17CS81	<b>Semester &amp; Section</b>				B - A & B	<b>No. Students</b>		75			
<b>Course Instructor Name:</b>		Anand Tilagul & Chethan H V				<b>Course ID:</b>		C411					
		<b>Test No:1</b>											
<b>Ref-Question Number:</b>		1	2	3	4	5	6	7	8	9	10		
<b>CIE Marks Entry Format For the Academic Year - 2020-21</b>													
<b>Questions</b>		1,2	3,4	5,6	7,8	9,10	11						
<b>Main Question No.</b>		1	3	5	7	9	11						
<b>Mapped CO-No.</b>		1	1	1	1	1	5						
<b>Sl.</b>	<b>USN/Q-Marks</b>	10	10	10	10	10	10						
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35	1SJ17IS043	10	10	10	10	10	10	10					

SICT/NBA/ CIE-MARKS/ 2020-21		SJC INSTITUTE OF TECHNOLOGY Chickballapur - 562 101 Department of Information Science & Engineering											
Course Title:	Internet of Things Technology												
Subject Code:	17CS81	Semester & Section				B - A & B	No. Students	75					
Course Instructor Name:	Anand Tilagul & Chethan H V				Course ID:	C411							
Test No:1													
Ref-Question Number:	1	2	3	4	5	6	7	8	9	10			
CIE Marks Entry Format For the Academic Year - 2020-21													
Questions	1,2	3,4	5,6	7,8	9,10	11							
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70	1SJ17IS085	10	10	9	9	8	10						



Course Title:

Internet of Things Technology

Subject Code:

17CS81

Semester &amp; Section

B - A &amp; F

No. Students

76

Course Instructor Name:

Anand Tilagul &amp; Chethan HV

Course ID:

C411

Test No:2

Ref - Question Number:

11 12 13 14 15 16 17 18 19 20

## CIE Marks Entry Format For the Academic Year - 2020-21

Questions	1,2	3,4	5,6	7,8	9,10	11				
Main Question No.	1	3	5	7	9	11				
Mapped CO-No.	2	2	3	3	3	6				
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CIE MARKS/  
2020-21



**SJC INSTITUTE OF TECHNOLOGY**

Chickballapur - 562 101

**Department of Information Science & Engineering**

**Course Title:**

Internet of Things Technology

**Subject Code:**

17CSB1

**Semester & Section**

B-A & F

No. Students

76

**Course Instructor Name:**

Anand Tilagul & Chethan HV

Course ID:

C411

Test No:2

**Ref Question Number:**

11

12

13

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**CIE Marks Entry Format For the Academic Year - 2020-21**

Questions	1,2	3,4	5,6	7,8	9,10	11				
<b>Main Question No.</b>	1	3	5	7	9	11				
<b>Mapped CO-No.</b>	2	2	3	3	3	6				
<b>Sl.</b>	<b>USN/Q-Marks</b>	10	10	10	10	10	10			
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SICT/NBA/ CIE MARKS/ 2020 21	 <p><b>SJC INSTITUTE OF TECHNOLOGY</b> Chickballapur - 562 101 <b>Department of Information Science &amp; Engineering</b></p>												
<b>Course Title:</b>	Internet of Things Technology												
<b>Subject Code:</b>	17CS81	<b>Semester &amp; Section</b>			B - A & E	<b>No. Students</b>		76					
<b>Course Instructor Name:</b>	Anand Tilagul & Chethan HV				<b>Course ID:</b>		C411						
	<b>Test No:3</b>												
<b>Ref - Question Number:</b>	21	22	23	24	25	26	27	28	29	30			
<b>CIE Marks Entry Format For the Academic Year - 2020-21</b>													
<b>Questions</b>	1,2	3,4	5,6	7,8	9,10	11	11						
<b>Main Question No.</b>	1	3	5	7	9	11	11						
<b>Mapped CO-No.</b>	4	4	4	5	5	5	6						
<b>Sl.</b>	<b>USN/Q-Marks</b>	10	10	10	10	10	10						
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64	1SJ17IS079	10	10	9	10	10	10	10					
65	1SJ17IS080	10	9	10	10	10	10	10					
66	1SJ17IS081	10	10	10	9	10	10	10					
67	1SJ17IS082	10	10	10	9	9	10	10					
68	1SJ17IS083	10	9	10	10	9	10	10					
69	1SJ17IS084	10	9	10	9	10	10	10					
70	1SJ17IS085	10	9	9	10	9	10	10					

SICT/NBA/  
CIE-MARKS/  
2020-21



**SJC INSTITUTE OF TECHNOLOGY**

Chickballapur - 562 101

Department of Information Science & Engineering

**Course Title:**

Internet of Things Technology

**Subject Code:**

17CSB1

**Semester & Section**

B-A & F

No. Students

76

**Course Instructor Name:**

Anand Tilagul & Chethan HV

Course ID:

C411

**Test No:3**

**Ref-Question Number:**

21	22	23	24	25	26	27	28	29	30
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**CIE Marks Entry Format For the Academic Year - 2020-21**

Questions	1,2	3,4	5,6	7,8	9,10	11	11		
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Main Question No.	1	3	5	7	9	11	11		
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Mapped CO-No.	4	4	4	5	5	5	6		
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Sl.	USN/Q-Marks	10	10	10	10	10	10	10	
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36	15J17IS044	10	10	10	10	10	10	10	
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37	15J17IS045	10	10	9	10	10	10	10	
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38	15J17IS046	10	9	10	10	10	10	10	
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39	15J17IS049	10	0	10	10	9	10	10	
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40	15J17IS050	10	9	10	9	10	10	10	
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41	15J17IS051	10	9	10	9	10	10	10	
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42	15J17IS052	10	10	9	10	9	10	10	
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43	15J17IS054	10	9	10	9	9	10	10	
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44	15J17IS055	10	9	9	10	9	10	10	
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45	15J17IS056	10	10	9	9	10	10	10	
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46	15J17IS057	9	0	10	10	10	10	10	
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47	15J17IS059	9	10	1	19	9	10	10	
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48	15J17IS061	10	9	9	10	10	10	10	
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49	15J17IS062	10	10	9	1	10	10	10	
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50	15J17IS063	10	9	10	9	10	10	10	
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51	15J17IS064	10	9	9	10	9	10	10	
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52	15J17IS065	10	9	10	10		10	10	
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53	15J17IS066	10	9	9	9	9	10	10	
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54	15J17IS067	10	9	9	10	10	10	10	
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55	15J17IS068	10	10	9	10	9	10	10	
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56	15J17IS069	10	9	9	9		10	10	
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57	15J17IS070	10	9	10	10	9	10	10	
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58	15J17IS072	10	10	10	10	9	10	10	
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59	15J17IS073	10	9	10	9	9	10	10	
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60	15J17IS074	10	9	9	9	10	10	10	
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61	15J17IS076	0	10	10	10	9	10	10	
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62	15J17IS077	10	9	9	10	9	10	10	
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63	15J17IS078	10	9	10	10	10	10	10	
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64	15J17IS079	10	10	9	10	10	10	10	
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65	15J17IS080	10	9	10	10	10	10	10	
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66	15J17IS081	10	10	10	9	10	10	10	
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67	15J17IS082	10	10	10	9	9	10	10	
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68	15J17IS083	10	9	10	10	9	10	10	
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69	15J17IS084	10	9	10	9	10	10	10	
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70	15J17IS085	10	9	9	10	9	10	10	
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SJCT/NBA/  
SEE REPT/  
2020-21



SJC INSTITUTE OF TECHNOLOGY

Chickballapur - 562 101

Department of Information Science & Engineering

Course Title

Internet of Things Technology

Course Code

C411

Subject Code

17CS81

Semester

8

Section

A & B

Emp.ID

2095

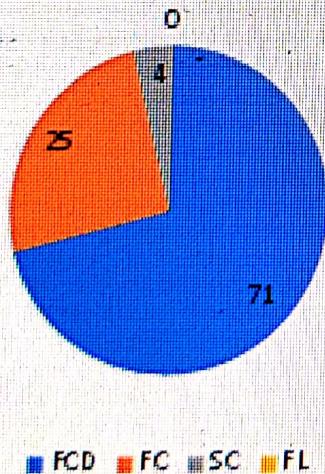
Faculty Name

Anand Tilagul & Chethan H V

No. students

76

Result Analysis of Subject Code -17CS81 -for the Academic year 2020-21



Result Analysis of Section: 8 - A & B

No. Students	Pass	%	Fail	%
76	76	100	0	0

Class Analysis of Section: 8 - A & B

No. Students	76	%	Grade Point
FCD	54	71	10,9,8
FC	19	25	7
SC	3	4	6,4
FL	0	0	0

Max. and Avg. Marks

CIE	AVG	SEE	AVG	TOT	AVG
40	39	60	35	100	74

CO Attainment in SEE	
Sum_AT	168
T_students	76
Avg.ATNT	2.2
Sum_AT(=3)	39
AT(=3)%	51
Attainment	NO

ANALYSIS OF GRADE POINT AND GRADE LETTER

Grade Letter	S	A	B	C	D	E	F
Grade Point	10	9	8	7	6	4	0
No. of Students	1	15	38	19	3		
% of Students	1	20	50	25	4		

CIE and SEE correlation Coefficient

0.36