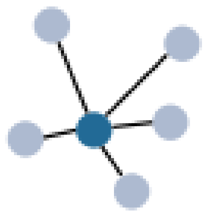
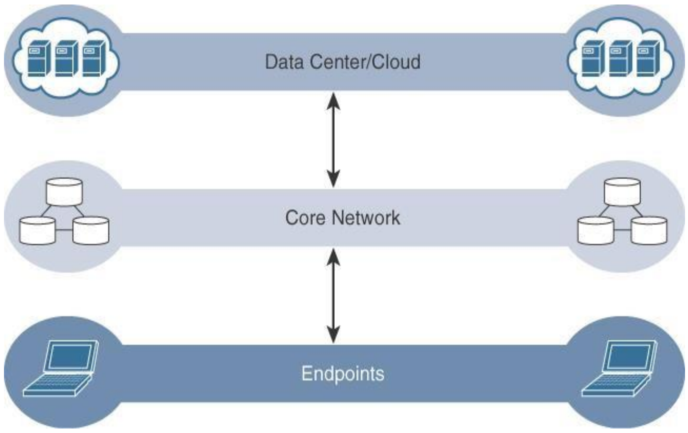
USN

Internal Assessment Test 1 – March-2024

Sub:	Internet of Things				Sub Code:	18CS81	Branch:	CSE
Date:	16-03-2024	Duration:	90 mins	Max Marks:	50	Sem / Sec:	VIII (A, B & C)	OBE

<u>Answer any FIVE FULL Questions</u>

		MARKS	CO	RBT
1 (a)	Write the main goal of adding a common service layer in oneM2M architecture. Name the interface used in this architecture for promoting end-to-end IoT Communication.	2	CO1	L2
1 (b)	Discuss the different Evolution phases of the internet with a neat diagram.	3	CO1	L2
1(c)	 Explain the challenges associated with implementing the above topology in IoT deployments, especially in terms of single points of failure and scalability limitations. How can you address these challenges?	5	CO2	L3
2 (a)	Identify the challenges of IoT in real-life Scenarios.	5	CO1	L1
2 (b)	Imagine you are managing a large-scale agricultural operation that specializes in cultivating tomatoes. How can you optimize the crop yield with various IoT sensors?	3	CO5	L3
2(c)	Elaborate the role of IoT and digitization technology for a company to streamline operations and enhance efficiency. Provide a detailed comparison between IoT and digitization, along with suitable examples.	2	CO1	L1
3(a)	Explain the IEEE 802.15.4 high-level Zigbee protocol stack with a neat diagram.	5	CO2	L2
3(b)	Discuss the importance of designing an IoT-enabled smart home system to improve the quality of life for elderly individuals and children. Identify the sensors and actuators needed for the design.	5	CO5	L3
4(a)	With an example, show how the data aggregation function is used in Wireless Sensor Networks (WSN).	5	CO2	L2
4(b)	Classify access technologies based on communication range. Give an example for each.	3	CO2	L1

4(c)	Explain event-driven and periodic communication patterns of smart objects with examples.	2	CO2	L2
5 (a)	 How Fog Computing addresses the challenges faced by the computing model shown in the above diagram? explain.	6	CO3	L3
5 (b)	Define smart objects. Explain any three characteristics.	4	CO2	L1
6(a)	Explain the IEEE 802.15.4 frame format for security.	6	CO2	L2
6(b)	 Consider the above scenario and describe how IoT can handle the situation safely with various sensors.	4	CO5	L3

CI **CCI** **HOD**

PO Mapping

Course Outcomes			Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Interpret the impact and challenges posed by IoT networks leading to new architectural models.	**L2**	**1**	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-	3
CO2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.	**L2**	**2**	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-	3
CO3	Appraise the role of IoT protocols for efficient network communication.	**L2**	**3**	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-	3
CO4	Elaborate the need for Data Analytics and Security in IoT.	**L2**	**4**	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-	3
CO5	Illustrate different sensor technologies for sensing real world entities	**L3**	**,5**	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-	3

COGNITIVE LEVEL	REVISED BLOOMS TAXONOMY KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)				CORRELATION LEVELS	
PO1	Engineering knowledge	PO7	Environment and sustainability	0	No Correlation
PO2	Problem analysis	PO8	Ethics	1	Slight/Low
PO3	Design/development of solutions	PO9	Individual and team work	2	Moderate/ Medium
PO4	Conduct investigations of complex problems	PO10	Communication	3	Substantial/ High
PO5	Modern tool usage	PO11	Project management and finance		
PO6	The Engineer and society	PO12	Life-long learning		
PSO1	Develop applications using different stacks of web and programming technologies				
PSO2	Design and develop secure, parallel, distributed, networked, and digital systems				
PSO3	Apply software engineering methods to design, develop, test and manage software systems.				
PSO4	Develop intelligent applications for business and industry				

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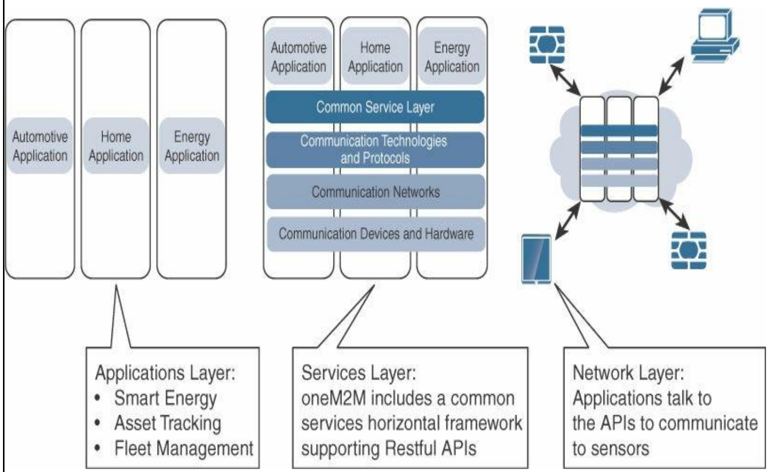
Internal Assessment Test 1 – March-2024-SCHEME & SOLUTION

Sub:	Internet of Things				Sub Code:	18CS81	Branch:	CSE
Date:	16-03-2024	Duration:	90 mins	Max Marks: 50	Sem / Sec:	VIII (A, B & C)		OBE

<u>Answer any FIVE FULL Questions</u>

		MARKS	CO	RBT
1 (a)	Write the main goal of adding a common service layer in oneM2M architecture. Name the interface used in this architecture for promoting end-to-end IoT Communication. Solution:(1 Mark) The goal of oneM2M is to create a common services layer, which can be readily embedded in field devices to allow communication with application servers.1 oneM2M's framework focuses on IoT services, applications, and platforms. These include smart metering applications, smart grid, smart city automation, e-health, and connected vehicles.  Interface: Restful API - 1 Mark	2	CO1	L2
1 (b)	Discuss the different Evolution phases of the internet with a neat diagram. Solution:	3	CO1	L2

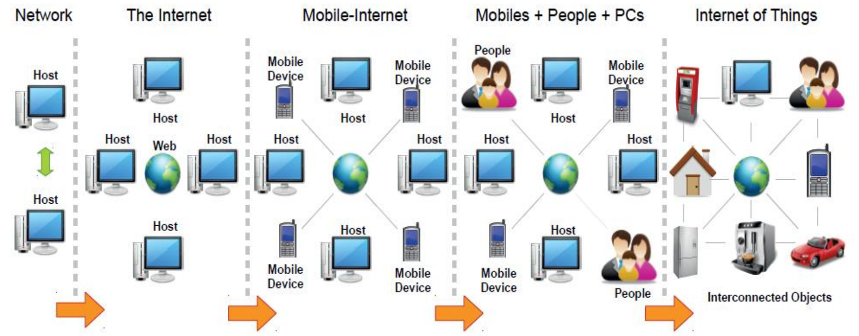
<table>
<tr><td></td><td>

Fig. 1. Evolution of the Internet in five phases. The evolution of Internet begins with connecting two computers together and then moved towards creating World Wide Web by connecting large number of computers together. The mobile-Internet emerged by connecting mobile devices to the Internet. Then, peoples' identities joined the Internet via social networks. Finally, it is moving towards Internet of Things by connecting every day objects to the Internet.
Diagram - 1 Mark
Explanation - 2 Marks</td><td></td><td></td><td></td></tr>
<tr><td>1(c)</td><td>
Explain the challenges associated with implementing the above topology in IoT deployments, especially in terms of single points of failure and scalability limitations.

Solution:

The above topology is star topology. 1 Mark

Challenges: 1 Mark

In a star topology, the central hub serves as a single point of failure. If the hub fails, all communication between devices connected to it is disrupted.

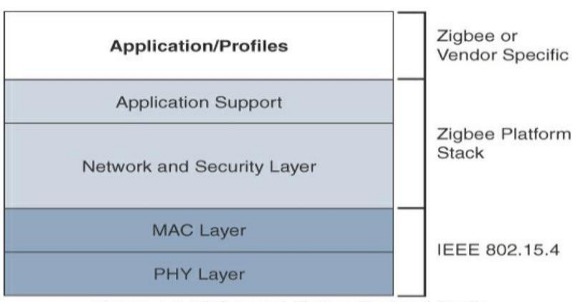
This can lead to significant downtime and loss of connectivity across the IoT network.

As the number of devices in the IoT network increases, the central hub may become overloaded with data traffic. This can result in performance degradation and bottlenecks, impacting the overall scalability of the deployment.

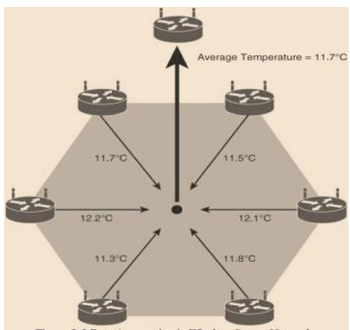
How can you address these challenges?

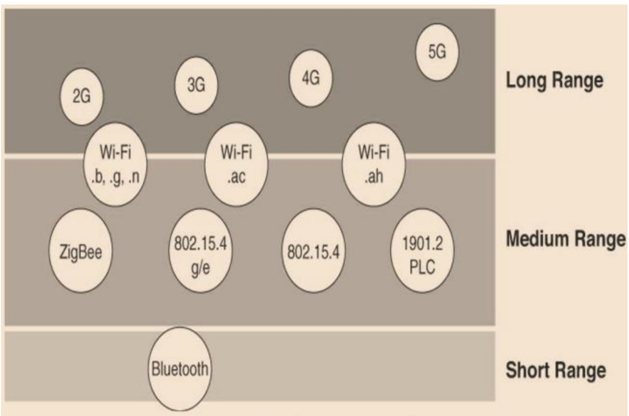
Solution: 1 - Mark & Explanation -2 Marks
Mesh topology can be used.
One of the property of Mesh networks is redundancy.</td><td>5</td><td>CO2</td><td>L3</td></tr>
</table>

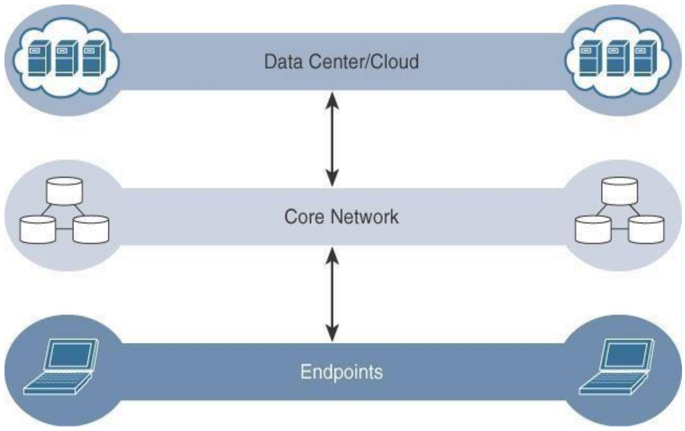
	The disappearance of one node does not necessarily interrupt network communication.Data may still be relayed through other nodes to reach the intended destination			
2 (a)	Identify the challenges of IoT in real-life Scenarios. Solution: Any 5 challenges:(Explain Each) 5 * 1 Mark = 5 Marks Scalability Technological Standardization Discovery Software complexity Data volumes and interpretation (BIG DATA) Power Supply Interaction and short range communication Wireless communication Fault tolerance Privacy Security Autonomy and Control Social control Political manipulation Design Environmental impact Influences human moral decision making	5	CO1	L1
2 (b)	Imagine you are managing a large-scale agricultural operation that specializes in cultivating tomatoes. How can you optimize the crop yield with various IoT sensors? Solution: 1 Mark each for sensors **Soil Monitoring Sensors:** Deploy soil moisture sensors to monitor the moisture levels in the soil. **Weather Stations:** Install weather sensors to monitor environmental conditions such as temperature, humidity, wind speed, and precipitation. **Nutrient Management Sensors:** Use nutrient sensors to monitor the levels of essential nutrients in the soil, such as nitrogen, phosphorus, and potassium. **Remote Monitoring Cameras:** Install cameras in the fields or greenhouses to visually monitor plant growth and detect any abnormalities or signs of stress. **Automated Irrigation Systems**: Integrate soil moisture sensors with automated irrigation systems to deliver water precisely when and where it's needed.	3	CO5	L3
2(c)	Elaborate the role of IoT and digitization technology for a company to streamline operations and enhance efficiency. Provide a detailed comparison between IoT and digitization, along with suitable examples.	2	CO1	L1

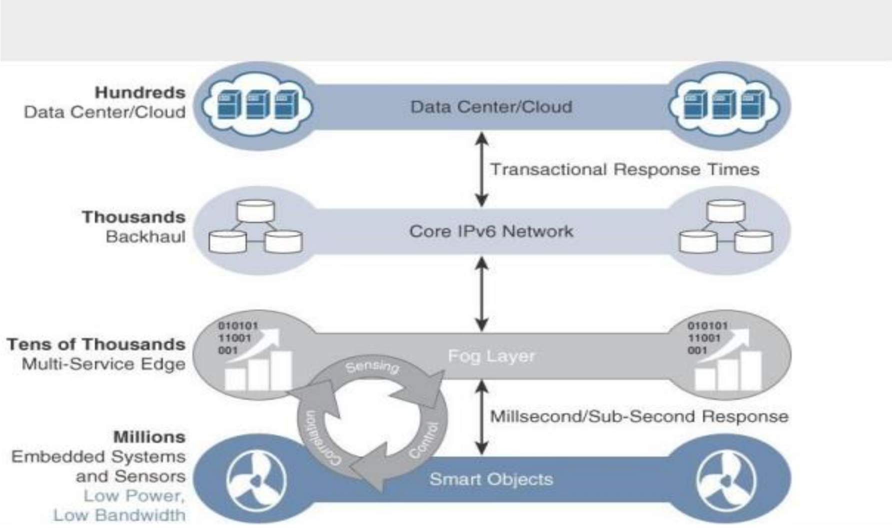
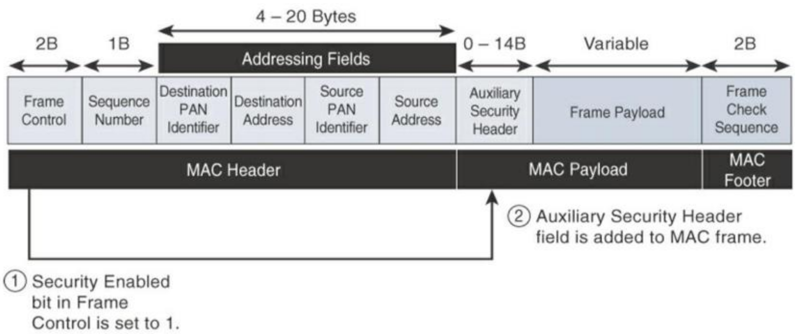
	Solution: IoT focuses on connecting “Things” such as objects and machines, to a computer network, such as the internet. IoT is a well understood term used across the industry as a whole. Digitization can mean different things to different people but generally encompasses the connection of “ Things”. With the data key generate and the business insights that result. Digitization as defined in its simple format, is the conversion of information into a digital format. IoT (Internet of Things): 1 Mark Real-Time Data Monitoring Predictive Maintenance Supply Chain Optimization: Energy Efficiency Digitization: 1 Mark Digital Documentation and Workflow Automation Data Analytics and Decision Support Remote Collaboration and Communication E-commerce and Online Transactions. (Explain Each)			
3(a)	Explain the IEEE 802.15.4 high-level Zigbee protocol stack with a neat diagram. ZigBee solutions are aimed at smart objects and sensors that have low bandwidth, interoperate and low power needs. Solution: Diagram 2 Marks . Explanation 3 Marks  **Figure 4-3** High-Level ZigBee Protocol Stack ZigBee utilizes the IEEE 802.15.4 standard at the lower PHY and MAC Layers: • Network and security layer and application support layer that sit on top of the	5	CO2	L2

	lower layers. **Network layer:** • For forming the appropriate topology, which is a mesh, star or tree. **Security layer:** • ZigBee utilizes 802.15.4 for security at the MAC layer, using the Advanced Encryption Standard (AES) with a 128-bit key and also provides security at the network and application layers. **Application Layer:** • Interfaces the lower portion of the stack dealing with the network of ZigBee devices and with the higher-layer applications.			
3(b)	Discuss the importance of designing an IoT-enabled smart home system to improve the quality of life for elderly individuals and children. Identify the sensors and actuators needed for the design. Solution: For elderly individuals IoT-enabled smart home systems offer numerous benefits: **Safety and Security:** Sensors can detect falls or emergencies and alert caregivers or emergency services. Smart door locks and surveillance cameras enhance home security, providing peace of mind to both the elderly residents and their families. **Health Monitoring:** Wearable devices and health sensors can monitor vital signs, medication adherence, and overall health status, allowing for proactive healthcare interventions. **Assistance with Activities of Daily Living (ADLs):** Smart appliances and voice-activated assistants can assist with tasks such as cooking, cleaning, and managing appointments, promoting independence and reducing the need for external assistance. **Environmental Control:** IoT-enabled thermostats, lighting systems, and motorized blinds can be adjusted automatically or through voice commands, optimizing comfort and energy efficiency without the need for manual intervention. **For children, IoT-enabled smart home systems offer several advantages:** **Safety and Supervision:** Sensors can monitor the child's location within the home and detect any hazardous situations, such as access to restricted areas or potential dangers like open windows or unlocked doors. Smart cameras and baby monitors provide real-time supervision, allowing parents to keep an eye on their children even when they are not physically present. **Education and Entertainment:** Smart devices can facilitate educational activities through interactive learning apps, e-books, and educational videos. Voice-activated assistants can answer children's questions and provide educational content tailored to their interests and developmental stage.	5	CO5	L3

	Routine Management: Smart scheduling systems can help parents manage their children's routines, including bedtime reminders, homework schedules, and extracurricular activities. Automated lighting and temperature control systems can create a conducive environment for sleep and relaxation. **Sensors/Actuators:** **Motion Sensors:** Detect movement within the home and can be used for security purposes or to monitor activity levels. **Door and Window Sensors:** Monitor access points to the home, providing alerts for unauthorized entry or open doors/windows. **Fall Detection Sensors:** Detect falls and trigger alerts for immediate assistance. **Health Sensors:** Monitor vital signs such as heart rate, blood pressure, and oxygen levels, as well as detect changes in activity patterns or sleep quality. **Environmental Sensors:** Measure temperature, humidity, and air quality to optimize comfort and ensure a healthy living environment. Smart Appliances: Voice-Activated Assistants: Security Cameras and Baby Monitors:			
4(a)	With an example, show how the data aggregation function is used in Wireless Sensor Networks (WSN). Solution: Example - 2 Marks Explanation - 3 Marks Large numbers of sensors permit the introduction of hierarchies of smart objects. Such a hierarchy provides, among other organizational advantages, the ability to aggregate similar sensor readings from sensor nodes that are in close proximity to each other. These data aggregation techniques are helpful in reducing the amount of overall traffic (and energy) in WSNs with very large numbers of deployed smart objects. Figure shows an example of such a data aggregation function in a WSN where temperature readings from a logical grouping of temperature sensors are aggregated as an average temperature reading  **Figure 3-9** Data Aggregation in Wireless Sensor Networks	5	CO2	L2

4(b)	Classify access technologies based on communication range. Give an example for each. Solution: 1 Mark for each (Each range + example) **Short range:** The classical wired example is a serial cable. Wireless short-range technologies are often considered as an alternative to a serial cable, supporting tens of meters of maximum distance between two devices. Examples of short-range wireless technologies are IEEE 802.15.1 Bluetooth and IEEE 802.15.7 **Medium range:** In the range of tens to hundreds of meters, many specifications and implementations are available. The maximum distance is generally less than 1 mile between two devices, Examples of medium-range wireless technologies include IEEE 802.11 Wi-Fi, IEEE 802.15.4, and 802.15.4g WPAN **Long range:** Distances greater than 1 mile between two devices require long-range technologies. Wireless examples are cellular (2G, 3G, 4G) and some applications of outdoor IEEE 802.11 Wi-Fi and Low-Power Wide-Area (LPWA) technologies  **Figure 4-1** Wireless Access Landscape	3	CO2	L1
4(c)	Explain event-driven and periodic communication patterns of smart objects with examples. Solution: 1 Mark each (with example) Wirelessly connected smart objects generally have one of the following two communication patterns: **Event-driven:** Transmission of sensory information is triggered only when a smart object detects a particular event or predetermined threshold. **Periodic:** Transmission of sensory information occurs only at periodic intervals. The decision of which of these communication schemes is used depends greatly on the specific application. For example, in some medical use cases, sensors periodically send postoperative vitals, such as temperature or blood pressure readings. In other medical use cases,	2	CO2	L2

	the same blood pressure or temperature readings are triggered to be sent only when certain critically low or high readings are measured			
5 (a)	 How Fog Computing addresses the challenges faced by the computing model shown in the above diagram? explain. Solution: Challenges faced by the traditional computing model - 2 Marks Fog computing explanation 2 Marks ,Diagram - 2 Marks Challenges faced by the traditional computing model: ● Bandwidth in last-mile IoT networks is very limited. ● Latency can be very high. ● Network backhaul from the gateway can be unreliable and often depends on 3G/LTE or even satellite links. ● The volume of data transmitted over the backhaul can be high. ● Big data is getting bigger. The solution to the challenges is to distribute data management throughout the IoT system, as close to the edge of the IP network as possible-Fog Computing. .Any device with computing, storage, and network connectivity can be a fog node. Examples include industrial controllers, switches, routers, embedded servers, and IoT gateways. Analyzing IoT data close to where it is collected minimizes latency, offloads gigabytes of network traffic from the core network, and keeps sensitive data inside the local network.	6	CO3	L3

				
5 (b)	Define smart objects. Explain any three characteristics. Solution: Definition- 1 Marks characteristics - 3 Marks Smart Objects are what transform everyday objects into a network of intelligent objects that are able to learn from and interact with their environment in a meaningful way.Smart objects in IoT comes from being networked together rather than being isolated as standalone objects. A smart object, is a device that has, at a minimum the following four defining characteristics: Processing unit Sensor(s) and/or actuator(s) Communication device Power source (Explain each)	4	CO2	L1
6(a)	Explain the IEEE 802.15.4 frame format for security. Solution: Diagram 3 Marks Explanation - 3Marks  **Figure 4-8** Frame Format with the Auxiliary Security Header Field for 802.15.4-2006 and Later Versions	6	CO2	L2

6(b)	 Consider the above scenario and describe how IoT can handle the situation safely with various sensors. Solution: Intersection Movement Assist (IMA) - 1 Mark Explanation - 3 Marks With IoT-connected roadways, a concept known as Intersection Movement Assist (IMA) is possible.This application warns a driver (or triggers the appropriate response in a self-driving car) when it is not safe to enter an intersection due to a high probability of a collision—perhaps because another car has run a stop sign or strayed into the wrong lane. This sort of scenario can be handled quickly and safely using IoT.	4	CO5	L3

CI **CCI** **HOD**

PO Mapping

Course Outcomes			Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	Interpret the impact and challenges posed by IoT networks leading to new architectural models.	**L2**	**1**	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-	3
CO2	Compare and contrast the deployment of smart objects and the technologies to connect them to network.	**L2**	**2**	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-	3
CO3	Appraise the role of IoT protocols for efficient network communication.	**L2**	**3**	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-	3
CO4	Elaborate the need for Data Analytics and Security in IoT.	**L2**	**4**	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-	3
CO5	Illustrate different sensor technologies for sensing real world entities	**L3**	**,5**	3	2	2	-	-	2	-	-	-	-	-	-	-	-	-	3

COGNITIVE LEVEL	REVISED BLOOMS TAXONOMY KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)				CORRELATION LEVELS	
PO1	Engineering knowledge	PO7	Environment and sustainability	0	No Correlation
PO2	Problem analysis	PO8	Ethics	1	Slight/Low
PO3	Design/development of solutions	PO9	Individual and team work	2	Moderate/ Medium
PO4	Conduct investigations of complex problems	PO10	Communication	3	Substantial/ High
PO5	Modern tool usage	PO11	Project management and finance		
PO6	The Engineer and society	PO12	Life-long learning		
PSO1	Develop applications using different stacks of web and programming technologies				
PSO2	Design and develop secure, parallel, distributed, networked, and digital systems				
PSO3	Apply software engineering methods to design, develop, test and manage software systems.				
PSO4	Develop intelligent applications for business and industry				