Department of BCA (Hon.)

Details of Lesson Plan

S.No.	Particulars	Details
1.	Course Name	Internet of Things
2.	Course Code	BCAMJ-403
3.	Academic Year	2024-25
4.	Semester	4th
5.	Number of Lesson plans	33
6.	Faculty Assigned	Ms. Gurpreet Raina

Faculty Signature

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Lesson Plan No. 1	Course Name: IoT Topic: Introduction to IoT	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to: a. Appreciate the evolution of IoT and its requirements. b. Defining and explaining the "Internet of Things" concept and its applications in various contexts. c. Able to realize the revolution of the Internet in Mobile Devices, Cloud & Sensor Networks. d. Examine the potential business opportunities that IoT can uncover.
Teaching Aids (if any)	a. ICT

Teaching Development	1. **Introduction** (5 minutes)
	- How many smart devices do you use daily?
	- Definition of IoT
	- How IoT is transforming industries (examples: smart homes, healthcare, smart cities)
	
	2. **Development** (30 minutes)
	  a. Relevance of studying IoT subject
	    1. **Interdisciplinary Skills Development**
	    • Engineering and Technology
	    • Data Analysis
	    • Problem Solving
	    2. **Career Opportunities**
	    3. **Hands-On Learning**
	    4. **Industry 4.0 and Smart Systems**
	    5**. Solving Real-World Problems**
	
	  b. **Real-World Applications**
	
	- Industry-Specific IoT Use Cases (10 min)
	- Smart Homes (e.g., Alexa, Google Nest)
	- Healthcare (e.g., remote patient monitoring)
	- Industrial IoT (e.g., predictive maintenance in factories)
	- Smart Cities (e.g., traffic management, smart lighting)

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	c. **Challenges & Future of IoT** - Challenges - Security & Privacy Issues - Scalability and Interoperability - Energy consumption and sustainability d **Future Trends** - AI + IoT (Edge AI) - 6G and IoT - Blockchain for IoT Security - IoT in Autonomous Vehicle 3. Exercise (5 minutes) – Ask students to brainstorm IoT applications in their field (Computer applications and electrical, etc.)
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading K. N. Raja Rao, "Internet of Things" Wiley, Page No.1- 3 Rahul Dubey, "An Introduction to Internet of Things" Page No.7- 8 Link: https://youtu.be/7iWriXyI2cE 3. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why,Who?). Allow students to answer and discuss. Name some smart devices you use daily? 3. Spend 5 minutes to evaluate student assimilation of the lesson contents

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Lesson Plan No. 2	Course Name: IoT Topic: Fundamentals of IoT	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to:
	   a. Identify the key components of an IoT system.
	   b. Explain the role of each component in IoT architecture.

Teaching Aids (if any)	b. ICT

Teaching Development	**1** **Introduction** (5 minutes)
	
	- "Can you name a device you use daily that is part of IoT?"
	- Discuss the need of IoT?
	- Increased automation and efficiency.
	- Real-time monitoring and decision-making.
	- Transforming industries like healthcare, agriculture, and manufacturing.
	
	  2. **Key Components of IoT** (30 minutes)
	
	  Sensors & Actuators
	  Connectivity
	  Edge & Cloud Computing
	  Data Processing & Analytics
	  User Interface
	4. Exercise (5 minutes) – Divide students into small groups.
	  Assign each group an industry (e.g., healthcare, agriculture, smart cities).
	
	  Ask them to list IoT components used in their assigned industry and explain how they work together.

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Closure	4. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	5. Suggested Reading/links
	K. N. Raja Rao, "Internet of Things" Wiley
	Page No.1-8
	https://youtu.be/WUYAjxnwjU4?list=PLJ5C_6qdAvBG7SHg5mLOQq6bzF-sOPu3k
	Encourage students to explore more IoT applications.
	Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	Recap key IoT components.
	Discuss future trends in IoT.
	Spend 5 minutes to evaluate student assimilation of the lesson contents

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Lesson Plan No. 3	Course Name: IoT Topic: Characteristics of IoT	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to: a. Define the key characteristics of IoT. b. Explain how these characteristics enable IoT functionality. c. Apply their understanding through discussions.
Teaching Aids (if any)	c. ICT
Teaching Development	**Introduction** (5 minutes) 4. Characteristics of IoT (30 minutes) - Connectivity - Dynamic & self adapting - Self configuring - Interoperable communication protocols - Heterogeneity - Unique identity - Security & privacy Integrated into information system d. **Real time examples** Each characteristic is explained with real-world examples: **Connectivity –** Devices must stay connected through Wi-Fi, Bluetooth, 5G, etc. (Example: Smart home devices sync via cloud.) **Dynamic & Self-Adapting** – IoT devices adjust based on data input. (Example: Smart thermostats learning usage patterns.) **Self-Configuring** – New IoT devices automatically integrate into networks. (Example: Plug-and-play IoT sensors.) **Interoperable Communication Protocols** – Devices use different protocols (MQTT, HTTP, CoAP) to communicate. (Example: A smartwatch syncing with both Android and iOS.) **Heterogeneity** – IoT systems consist of diverse hardware and networks. (Example: Drones, wearables, and industrial sensors working together.) **Unique Identity** – Each device has a unique identifier (MAC address, IP). (Example: Smart locks only recognizing authorized devices.) **Security & Privacy** – IoT systems must protect user data. (Example: Encrypted communication in smart banking.) **Integration into Information Systems** – IoT data integrates into

	broader IT systems for analytics. (Example: Smart hospitals using real-time patient monitoring.)
	
	5. Exercise (5 minutes) –
	   Quick Quiz
	
	   Multiple-choice or short-answer questions on IoT characteristics.

Closure	6. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	7. Suggested Reading
	   K. N. Raja Rao, "Internet of Things" Wiley,
	
	   Link:https://youtu.be/WUYAjxnwjU4?list=PLJ5C_6qdAvBG 7SHg5mLOQq6bzF-sOPu3k
	
	5. Spend 5 minutes to wrap up and consolidate the learnings

Evaluation	1. Reflective Questions (What, Why,Who?). Allow students to answer and discuss.
	   Recap key IoT characteristics.
	   Ask students to write one characteristic they found most interesting and why.
	   Spend 5 minutes to evaluate student assimilation of the lesson contents

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Lesson Plan No. 4	Course Name: IoT Topic: Physical Design of IoT	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to: a. Differentiate between Physical and Logical Design of IoT. b. Identify key components involved in both designs.
Teaching Aids (if any)	ICT
Teaching Development	**1. Introduction** (5 minutes) Explain that IoT design consists of two layers: Physical Design – The actual hardware components. Logical Design – The software, architecture, and data flow. **2. Physical layout (30 minutes)** - Key Components: - Sensors & Actuators – Detect and respond to physical changes. (Example: Motion sensor, temperature sensor.) - Edge Devices (Microcontrollers & Processors) – Process data locally. (Example: Raspberry Pi, ESP32.) - Connectivity Modules – Enable communication. (Example: Wi-Fi, Zigbee, LoRa.) - Power Sources – Supply energy. (Example: Batteries, solar panels.) **Logical Design of IoT** Definition: The architecture, communication models, and data processing strategies in an IoT system. Key Components: IoT Communication Models Request-Response Model (Example: Smart thermostat adjusting temperature on request.) Publisher-Subscriber Model (Example: MQTT-based messaging for smart home systems.) Push-Pull Model (Example: Cloud-based notifications.) Exclusive Pair Model (Example: Bluetooth connections.) **3. Exercise (5 minutes)** – Differentiate edge computing vs. cloud computing.

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Closure	4. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 5. Suggested Reading K. N. Raja Rao, "Internet of Things" Wiley, Page No.1- 3 Link:https://youtu.be/WUYAjxnwjU4?list=PLJ5C_6qdAvBG 7SHg5mLOQq6bzF-sOPu3k Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	6. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Recap key points Spend 5 minutes to evaluate student assimilation of the lesson contents

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Lesson Plan No. 5	Course Name: IoT Topic: Logical Design of IoT	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to:
	    a. Differentiate between Physical and Logical Design of IoT.
	    b. Identify key components involved in both designs.

Teaching Aids (if any)	ICT
Teaching Development	**1. Introduction** (5 minutes) Recap the difference Physical Design – The actual hardware components. Logical Design – The software, architecture, and data flow. **2. Logical Design of IoT (30 minutes)** Definition: The architecture, communication models, and data processing strategies in an IoT system. Key Components: IoT Communication Models Request-Response Model (Example: Smart thermostat adjusting temperature on request.) Publisher-Subscriber Model (Example: MQTT-based messaging for smart home systems.) Push-Pull Model (Example: Cloud-based notifications.) Exclusive Pair Model (Example: Bluetooth connections.) **IoT Protocols** **Application Layer:** HTTP, MQTT, CoAP. **Network Layer:** IPv6, 6LoWPAN. **Data Link Layer:** Wi-Fi, Zigbee, Bluetooth. **IoT Data Processing & Cloud Integration** Explain cloud platforms (AWS IoT, Google Cloud IoT, Azure IoT). **3. Exercise (5 minutes) –** .Mentimeter Quiz

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Closure	4. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 5. Suggested Reading K. N. Raja Rao, "Internet of Things" Wiley, Page No.1- 3 Link: https://youtu.be/BvRYudfwtY4
Evaluation	6. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Recap key points_What are different types of models used? Summarize. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 6	Course Name: IoT Topic: Enabling Technologies in IoT	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to:
	    a. Identify and explain key enabling technologies in IoT.
	    b. Understand how these technologies contribute to IoT functionality.

Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) "How do smart devices work? What technologies power them?" **1.** Enabling technologies of IoT **(30 minutes)** Discuss Enabling technologies with real-world examples: **Sensor Technology** Types: Temperature, motion, humidity, pressure sensors. Wireless: **Wi-Fi, Bluetooth, Zigbee, LoRa, 5G.** **Wired:** Ethernet, fiber optics. **Cloud Computing & Edge Computing** Cloud: Data storage and remote access Edge: Processing data closer to devices for faster responses. **Big Data & Data Analytics** IoT generates vast amounts of data, requiring real-time analysis. **Artificial Intelligence & Machine Learning** AI-driven decision-making in IoT devices. **Cybersecurity in IoT** Exercise (5 minutes) – . Open ended questions on topic
Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading

	K. N. Raja Rao, "Internet of Things" Wiley, Link: Encourage students to explore advanced topics like IoT security and AI integration. Spend 5 minutes to wrap up and consolidate the learnings	
Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Recap key points Discuss emerging technologies that may shape the future of IoT. Spend 5 minutes to evaluate student assimilation of the lesson contents	

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Lesson Plan No. 7	Course Name: IoT Topic: IoT Entities	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to: a. Define IoT entities and their roles in an IoT ecosystem. b. Identify different types of IoT entities and how they interact.
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) Entities in the Internet of Things (IoT), can refer to physical devices, digital representations of those devices, or embedded logic in smart objects **1.** Entities in IoT **(30 minutes)** Discuss each entity with real-world examples: **Perception Layer (Physical Entities - Sensors & Actuators)** Role: Data collection from the environment. **Network Layer (Communication Entities - Connectivity & Protocols)** Role: Transmitting data between IoT devices and platforms. **Edge & Fog Computing Entities** Role: Processing data locally before sending it to the cloud. . **Cloud Entities (Processing & Storage)** Role: Storing and analyzing large-scale IoT data. . **Application Layer (User Interface & Decision-Making)** Role: Presenting data to users via dashboards, mobile apps, or alerts. . **Security & Identity Management Entities** Role: Ensuring secure communication and authentication.

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	Exercise (5 minutes) – .Summarize topic

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	
	 Suggested Reading
	 K. N. Raja Rao, "Internet of Things" Wiley, Page No. 9-10
	
	                 Link:
	                 https://youtu.be/WUYAjxnwjU4?list=PLJ5C_6qdAvBG7SHg
	                 5mLOQq6bzF-sOPu3k
	 Spend 5 minutes to wrap up and consolidate the learnings

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	                 Recap key points
	                 answer questions on IoT entities.
	
	                 Spend 5 minutes to evaluate student assimilation of the
	                 lesson contents

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Lesson Plan No. 8	Course Name: IoT Topic: IoT Frameworks	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to: a. Understanding of IoT frameworks, their components, and their significance in developing IoT applications
Teaching Aids (if any)	ICT

Teaching Development	**Introduction** (5 minutes)
	Introducing students to the foundational concepts of the Internet of Things (IoT), exploring various IoT frameworks Communication, Processing, and Applications.
	
	1.Understanding IoT Frameworks (30 minutes)
	
	● Definition and purpose of IoT frameworks
	● Overview of popular IoT frameworks:
	    ○ Open-source frameworks
	    ○ Proprietary frameworks
	● Criteria for selecting an IoT framework
	
	Exercise (5 minutes) –
	  .
	One minute paper activity.

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	Suggested Reading
	      K. N. Raja Rao, "Internet of Things" Wiley,
	      Page No.13-16
	      Link: https://www.youtube.com/watch?v=Zss4Jgniqe0&utm
	Spend 5 minutes to wrap up and consolidate the learnings

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	    Recap key points
	    Give example of proprietary system in IoT
	
	    Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 9	Course Name: IoT Topic: M2M	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to: a. Define M2M communication and its role in automation and IoT. b. Differentiate M2M from IoT in terms of scope and application c. Analyze the difference between M2M vs IOT .
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) Briefing machine-to-machine communication How networked devices to exchange information and perform actions without human intervention. Discuss the key components used to achieve this automation. **1. M2M (30 minutes)** M2M Basics What is M2M,how it works , where it is used M2M Device. Network M2M Service Enablement. M2M communication protools Advantages Disadvantages **Comparison between M2M & IoT** Key application areas a. Security b. Tracking & Tracing c. Payment d. Health : e. Remote Maintenance/Control f. Metering h. Facility Management Exercise (5 minutes) –

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	.
	Make teams and assign group a real-world M2M application and ask them to identify at least four entities
Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading 　　　K. N. Raja Rao, "Internet of Things" Wiley,Page no 11-16 　　　Link: 　　　https://youtu.be/oxMdDsud5vg Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 　　　Recap key points 　　　State advantages & disadvantages of M2M system

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Lesson Plan No. 10	Course Name: IoT Topic: M2M Architecture	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to:
	    a Understand the fundamental concepts of M2M architecture and its role in IoT ecosystems.
	    b. Identify the key components of M2M architecture, including sensors, communication networks, and data processing units.
	    c. .Analyze the difference between M2M

Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) M2M architecture in IoT consists of several layers, including the device layer (sensors and actuators), communication layer (gateways and networks like Wi-Fi, cellular, or LPWAN), application layer (IoT platforms and services), and the common services layer (standardized communication protocols) **1. M2M** Architecture **(30 minutes)** M2M Area Network What is M2M,how it works , where it is used M2M Gateway M2M core Network M2M Application Exercise (5 minutes) – Summarize

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	Suggested Reading
	    K. N. Raja Rao, "Internet of Things" Wiley,Page no 9
	    Link:
	      https://youtu.be/oxMdDsud5vg
	Spend 5 minutes to wrap up and consolidate the learnings

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	    Recap key points
	    What are the various block diagram of M2M system?

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Lesson Plan No. 11	Course Name: IoT Topic: Iot Basic Architecture	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to:
	    a . Understand the concept of IoT architecture.
	    b. Understand how architectures are used to manage large-scale
	      device communication..

Teaching Aids (if any)	ICT

Teaching Development	**Introduction** (5 minutes)
	Discuss about components such as sensors, actuators, cloud services, Protocols and layers that make up IoT networking systems.
	How to divide layers that allow administrators to evaluate, monitor, and maintain the integrity of the system.
	
	   1..IoT Architecture **(30 minutes)**
	
	  Layer 1: Perception Layer (Physical Layer)
	
	(Sensors and actuators that collect data (temperature sensors, RFID, etc.).
	
	Layer 2: Network Layer (Communication Layer) – Detailed Components of the Network Layer:
	
	Communication Protocols (Data Transmission)
	
	Exercise (5 minutes) –
	Summarize different module of Architecture

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	Suggested Reading
	     K. N. Raja Rao, "Internet of Things" Wiley,Page no 23-24
	     Link:
	     https://www.youtube.com/watch?v=KeaeuUcw02Q
	Spend 5 minutes to wrap up and consolidate the learnings

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Recap key points

Lesson Plan No. 12	Course Name: IoT Topic: Iot Basic Architecture	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to: a . Understand the concept of IoT architecture. b. Understand how architectures are used to manage large-scale device communication..
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) Ask students how smart home devices like Alexa or smart lights work. Discuss how communication layer, application layer, and the common services layers have defined roles. 1..IoT Architecture **(30 minutes)** **Layer 1:** Perception Layer (Physical Layer) (Sensors and actuators that collect data (temperature sensors, RFID, etc.). **Layer 2**: Network Layer (Communication Layer) – Detailed Components of the Network Layer: Communication Protocols (Data Transmission) Exercise (5 minutes) – Summarize different module of Architecture
Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading K. N. Raja Rao, "Internet of Things" Wiley,Page no 23-24 Link: https://www.youtube.com/watch?v=SwvLCE-U44g Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Recap key points Discuss the device level architecture of IoT.

Lesson Plan No. 13	Course Name: IoT Topic: Sensors	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to:
	      a . Understand the concept of sensors and their role in IoT.
	      b. Identify different types of sensors and their working principles.

Teaching Aids (if any)	ICT

Teaching Development	**Introduction** (5 minutes)
	Discuss the applications of sensors in IoT-based systems
	1..IoT Architecture **(30 minutes)**
	  What is a Sensor?
	  Definition and basic working principle.
	  Importance of sensors in automation, data collection, and real-time monitoring.
	  Role of Sensors in IoT
	  Sensors as the key data collection component in IoT ecosystems.
	  Example: How sensors help in smart homes, healthcare, industrial automation, etc.
	  Types of Sensors
	Classification of Sensors:
	
	Based on Data Type:
	Analog Sensors (e.g., temperature sensor)
	Digital Sensors (e.g., IR sensor)
	Based on Functionality:
	Environmental Sensors: Temperature, Humidity, Gas, Pressure.
	Motion & Proximity Sensors: IR, Ultrasonic, Accelerometer, et.
	Optical Sensors: LDR, Photodiode, PIR.
	Biometric Sensors: Fingerprint, ECG, EEG.
	Chemical Sensors: Gas sensors
	Working Principle of Key Sensors
	
	Temperature Sensor (LM35, DHT11)
	Motion Sensor (PIR)
	Gas Sensor (MQ-135)
	
	Exercise (5 minutes) –
	 Summarize any one types of sensor.

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Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	Suggested Reading
	        K. N. Raja Rao, "Internet of Things" Wiley,Page no 32-36
	        Link: https://www.youtube.com/watch?v=F0cNJjfVe-U
	        https://youtu.be/z3VEZPwl5gA?list=PLE7VH8RC_N3bpVn-e8QzOAHziEgmjQ2qE
	
	        Spend 5 minutes to wrap up and consolidate the learnings

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	   Where are proximity sensors ?.
	    Give an example of heat sensor.
	   Any example where gas sensors are used.

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Lesson Plan No. 14	Course Name: IoT Topic: Actuators	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to:
	     a . Understand the concept of actuators and their role in IoT.
	     b. Identify different types of actuators and their working principles.

Teaching Aids (if any)	ICT

Teaching Development	**Introduction** (5 minutes)
	 Discuss the applications of sensors in IoT-based systems
	 1..IoT Architecture **(30 minutes)**
	   What is an Actuator?
	 Definition and working principle.
	 Difference between sensors and actuators.
	 Actuators as the "action-taking" component in IoT.
	 Role of Actuators in IoT
	 Receiving signals from controllers to perform mechanical movements or adjustments.
	 Examples: Smart home automation, robotics, industrial control.
	 Types of Actuators
	 Classification of Actuators:
	
	 Based on Motion Type:
	 Linear Actuators (e.g., Solenoid, Hydraulic)
	 Rotary Actuators (e.g., Servo Motor, Stepper Motor)
	 Based on Energy Source:
	 Electrical Actuators: DC motors, Servo motors, Stepper motors.
	   Pneumatic Actuators: Air-driven pistons.
	   Hydraulic Actuators: Oil-based motion systems.
	   Thermal and Magnetic Actuators: Shape-memory alloys, electromagnets.
	   Working Principle of Key Actuators
	
	   DC Motors: Used in automation (e.g., fans, robotic wheels).
	  Servo Motors: Precise control in robotics and IoT systems.
	  Stepper Motors: Used in CNC machines, robotics.
	  Solenoids: Used in electric door locks, fluid flow control.
	
	 Actuators in IoT Application
	  Smart Home, Healthcare, Smart Agriculture,
	 Industrial Automation,Smart Cities etc

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	Exercise (5 minutes) – Summarize any one types of Actuators.

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	 Suggested Reading
	       K. N. Raja Rao, "Internet of Things" Wiley,Page no 32-36
	       Link:
	
	       Shttps://youtu.be/z3VEZPwl5gA?list=PLE7VH8RC_N3bpVn-e8QzOAHziEgmjQ2qEpend 5 minutes to wrap up and consolidate the learnings

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	     Classify different types of actuators ?.
	     What kind of motors are used in robotics automation?

Lesson Plan No. 15	Course Name: IoT Topic: Data acquisition System	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to: a . Understand the concept of actuators and their role in IoT. b. Identify different types of actuators and their working principles.
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) What is data in IoT? Overview of the IoT data flow: Sensing → Acquisition → Processing → Transmission → Action Where and why data acquisition systems are used **A. Architecture of a Data Acquisition System (30 minutes)** 1. **Sensor Layer**: Physical signal sensing (e.g., temperature, motion) 2. **Signal Conditioning**: Amplification, filtering, isolation 3. **Analog-to-Digital Conversion (ADC)**: Digitizing the sensor signal 4. **Processing Unit**: Microcontroller/microprocessor processes data 5. **Communication Interface**: Data transmission to the cloud/gateway **B. Types of Data Acquisition:** 1. **Analog vs. Digital acquisition** 2. **Synchronous vs. Asynchronous** 3. **Single-channel vs. Multi-channel DAS** Exercise (5 minutes) Summarize any one

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	Suggested Reading
	        K. N. Raja Rao, "Internet of Things" Wiley,Page no 32-36
	        Link

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	   Why is signal conditioning essential in data acquisition?
	   When would you choose an external ADC over an internal one?
	   servo motor.

Lesson Plan No. 21	Course Name: IoT Topic: Edge Devices	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to:
	    a.Define edge devices in IoT and explain their role in data processing.
	    b. Describe the key benefits of edge computing, such as reduced latency, bandwidth efficiency, and enhanced security.
	    c.Analyze how edge computing improves IoT applications in real-world scenarios.

Teaching Aids (if any)	ICT

Teaching Development	**Introduction** (5 minutes)
	
	1..Edge devices **(30 minutes)**
	  What are Edge Devices?
	
	  - Devices that process data closer to the source rather than relying on cloud computing.
	  -Examples: Smart cameras, sensors, industrial robots, smart thermostats.
	  1.**Why are Edge Devices Important?**
	
	-Reduced latency
	
	-Improved efficiency
	
	-Enhanced security

	-Less reliance on the cloud
	2. Benefits of Edge Computing
	Low latency(Processes data locally, reducing response time).
	Bandwidth(Less data sent to the cloud, reducing costs).
	Security(Sensitive data stays on the device.)
	Reliability (Works even with limited internet connectivity)
	Exercise (5 minutes) – Summa
Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading K. N. Raja Rao, "Internet of Things" Wiley Link: Home assignment Prepare a demonstration of the working of an edge device using a simple smart traffic light simulation.
Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss. How do edge devices differ from cloud computing? Name **two examples** of edge devices in real life. What are the key benefits of using edge computing?

Lesson Plan No. 22	Course Name: IoT Topic: IoT Gateways	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to: a. able to understand IoT Gateway and explain its role in IoT architecture. b. understand the functions and architecture of an IoT Gateway. c. Identify common protocols used by IoT Gateways. d.Analyze real-world use cases where IoT Gateways are essential. .
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) Ask "How many of you use smart devices at home?" "How do these devices communicate with each other and the cloud?" 1. IoT Gateway (**30 minutes**) Definition Functions of IoT Gateway: protocol translation, edge processing, security. Gateway architecture: sensors/devices → gateway → cloud. Why a gateway is required How does a gateway works Protocols: MQTT, CoAP, HTTP, Zigbee, Bluetooth, Wi-Fi. Examples of IoT Gateways: Raspberry Pi, Cisco IoT Gateway etc Exercise (10 minutes) –

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	Group Activity – IoT Gateway Design Challenge (15 minutes): Divide students into small groups. Give each group a scenario (e.g., smart agriculture, smart home,industrial monitoring). Ask them to sketch a basic architecture using an IoT Gateway. Prompt them to identify: Sensors and devices used Connectivity protocols

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	Suggested Reading
	      K. N. Raja Rao, "Internet of Things" Wiley,Page no 32-36
	      Link:
	
	      YouTube demo of a real-time IoT Gateway (e.g., Raspberry Pi as a Gateway)

Evaluations	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
	  a.What would happen if there were no IoT gateways in a smart system?
	  b. How can gateway-level processing reduce cloud dependency?
	  c. What are inbound & outbound traffic in gateway.

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Lesson Plan No. 23	Course Name: IoT Topic: Cloud Data Platform	Course No.: BCAMJ-403

Objectives	At the end of the lesson the student shall be able to:
	    a Define what a cloud data platform is and explain its purpose.
	    b.Identify and describe the four key layers of a cloud data platform.
	    c.Understand how data flows through each layer using a real-world example.

Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) Where does all the data from your mobile apps go?" Introducing the concept of cloud data platforms. 1.. Cloud Data Platform **(30 minutes)** . **Definition:** A Cloud Data Platform is a centralized, scalable system . The Four Layers of Cloud Data Platform Architecture **Data Ingestion Layer** Function: Collects raw data from multiple sources (databases, IoT devices, APIs). Tools/Examples: Apache Kafka, AWS Kinesis, Azure Event Hubs. Use Case: A retail app sends customer clickstream data in real time to the cloud. **Data Storage Layer Function**: Stores raw or pre-processed data for long-term and short-term use. Types: Data lakes, data warehouses. Tools/Examples: Amazon S3 (data lake), Google BigQuery (warehouse), Snowflake.

		Exercise (5 minutes) – Summarize any one layer

Closure		Summarize the Lesson Learning Outcomes and get affirmation from students on these.
		Suggested Reading
		      K. N. Raja Rao, "Internet of Things" Wiley
		      Link: What are the key components of cloud data management architecture?
		      https://onlinecourses.nptel.ac.in/noc20_cs65/preview
		Case Study1
		      Equifax Simplifies Cloud Operations Management Globally with Cloud Data Platform

Evaluation		Reflective Questions (What, Why, Who?). Allow students to answer and discuss.?
		  a What is a cloud data warehouse?
		  b. Name public cloud services.

Lesson Plan No. 24	**Course Name: IoT** **Topic: Cloud Data Management**	**Course No.: BCAMJ-403**

Objectives	At the end of the lesson the student shall be able to:
	      a Understand the principles and components of cloud data management architecture.
	      b.analyze the different layers of cloud storage, including the data storage layer and data processing layer.
	      c. understand the importance of data redundancy, backup, and data recovery in cloud storage systems.
	      d.Identify different cloud storage models (e.g., object storage, file storage, block storage).

Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) Overview of cloud computing and its relevance to data management. Discuss the significance of cloud data storage in modern IT Ecosystems. Introduction to Cloud Data Management (**30 minutes**)

Cloud Storage Models

Public Cloud: Cloud resources are owned and operated by third-party cloud providers (e.g., AWS, Google Cloud). It is cost-effective but can raise concerns about data security and privacy.

Private Cloud: Dedicated cloud infrastructure for a single organization. It offers more control and security but comes with higher costs.

Hybrid Cloud: Combines public and private clouds. Provides flexibility but requires management across different cloud platforms.

Challenges in Cloud Data Management

Scalability: Cloud storage must be able to scale as the data volume increases.

Security and Privacy: Sensitive data in the cloud must be protected from unauthorized access.

Data Availability: Ensuring that cloud data is always available, even in the case of hardware failure.

Data Backup and Disaster Recovery: Critical for cloud systems to minimize data loss in case of failure

Exercise (5 minutes) –

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	 Suggested Reading
	         K. N. Raja Rao, "Internet of Things" Wiley
	         Link: [What are the key components of cloud data management architecture?](#)
	         https://www.youtube.com/watch?v=_MoqsvTOrlA
	         https://www.youtube.com/watch?v=50Q2zVLX8t4

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.? a. What are the key components of cloud data management architecture? b.How do block storage, file storage, and object storage differ in cloud environments? c.Why is data availability a critical challenge in cloud data management?

	d. Explain the difference between public, private, and hybrid cloud models for data storage.

Lesson Plan No.25	Course Name: IoT Topic: Processors	Course No.: BCAMJ-403

	a. Understand the role of IoT processors in embedded systems. b. Differentiate between microcontrollers, microprocessors, SoCs, and ASICs. c. Analyze and compare different IoT processors based on specifications. d. Identify appropriate processors for given IoT applications.
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) Where does all the data from your mobile apps go?" Introducing the concept of cloud data platforms. 1. Cloud Data Platform **(30 minutes)** . Exercise (5 minutes) – Summarize any one layer

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	Suggested Reading
	    K. N. Raja Rao, "Internet of Things" Wiley
	    Link:
	    https://onlinecourses.nptel.ac.in/noc21_ee85/preview
	    https://www.youtube.com/watch?v=1y4vY9p0h3Q

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.? How does connectivity influence processor selection?

Lesson Plan No.25	Course Name: IoT Topic: IoT Processors	Course No.: BCAMJ-403

	a. Understand the role of IoT processors in embedded systems. b. Differentiate between microcontrollers, microprocessors, SoCs, and ASICs. c. Analyze and compare different IoT processors based on specifications. d. Identify appropriate processors for given IoT applications.
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) Ask To recall IoT Devices & their architecture Explain the Importance of processors in IoT (the brain of an IoT device) 1.IoT Processors **(30 minutes)** . Definition Role of IoT - Real Time capabilities - Deterministic Behavoir - Energy Efficiency - Low Power Mode - Scalability - Robust Security feature - Cloud Integration - Arduino Exercise (5 minutes) – Summarize any one

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Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	Suggested Reading
	K. N. Raja Rao, "Internet of Things" Wiley
	Link: https://www.youtube.com/watch?v=1y4vY9p0h3Q
Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.?
	Definition of IoT processors
	Difference between general-purpose processors and IoT processors

Lesson Plan No.27	Course Name: IoT Topic: IoT Processors-I	Course No.: BCAMJ-403

	a. Understand the role of IoT processors in embedded systems.
	b. Differentiate between microcontrollers, microprocessors, SoCs, and ASICs.
	c. Analyze and compare different IoT processors based on specifications.
	d. Identify appropriate processors for given IoT applications.
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) Ask To recall IoT Devices & their architecture Explain the Importance of processors in IoT (the brain of an IoT device) 1.IoT Processors **(30 minutes)** . Key Concepts: IoT Device Constraints: IoT devices are often battery-powered, with limited CPU, memory, and bandwidth. They must operate efficiently under constrained conditions. Communication Bottlenecks: In large-scale deployments (e.g., smart homes, elder care facilities), ensuring reliable, low-latency, and energy-efficient communication is critical.

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Why Protocols Matter: Conventional TCP/IP protocols are too heavy. Special IoT stacks are designed for low-power, lossy networks (LLNs).
What is OpenWSN?
OpenWSN is an open-source project that implements a full standards-based protocol stack for IoT networking.
It emphasizes energy efficiency, robustness, and interoperability.

Architecture:
Cross-platform (runs on Contiki, RIOT, Bare Metal)

Modular components

Real hardware and simulation support (e.g., OpenSim)

Supported Standards:
IEEE 802.15.4e TSCH (Time Slotted Channel Hopping)

IETF 6TiSCH, RPL, 6LoWPAN, UDP, and CoAP
OpenWSN Use Cases (10 mins)

Exercise
 Summarize any one

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading 　　　K. N. Raja Rao, "Internet of Things" Wiley 　　　Link: https://www.youtube.com/watch?v=JIr7Xm_riRs
Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.? Define IoT processor. Difference between general-purpose processors and IoT processors

Lesson Plan No.28	Course Name: IoT Topic: IoT Processors-II	Course No.: BCAMJ-403

	a. Understand the role of IoT processors in embedded systems. b. Differentiate between microcontrollers, microprocessors, SoCs, and ASICs. c. Analyze and compare different IoT processors based on specifications. d. Identify appropriate processors for given IoT applications.
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) Application Areas **(30 minutes)** Smart Cities: Automated street lighting Pollution and traffic sensors Elder Care (Relevant to CareTech Sentinels): Non-intrusive monitoring (motion, vital signs) Low-power alert systems Reliable routing in facility-wide sensor networks Environmental Monitoring: Soil moisture and temperature sensors in agriculture Forest fire or wildlife tracking systems Why OpenWSN? Deterministic and energy-aware communication Supports scalable mesh networks Easy integration with IPv6 backbones Exercise Summarize any one
Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.

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	Suggested Reading
	K. N. Raja Rao, "Internet of Things" Wiley
	Link: https://www.youtube.com/watch?v=LK_a1RtCspo
Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.?
	Difference between general-purpose processors and IoT processors

Lesson Plan No.29	**Course Name: IoT**	**Course No.: BCAMJ-403**
	Topic: Oen WSN	

	a. Understand the core features of OBN, TinyOS, and FreeRTOS.
	b. ale to learn the modular design and hardware structure each system typically uses.
	c.Identify the primary programming language and development approach for each OS.
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes)
	Discuss
	What is a mote?
	What is the role of the operating system in an IoT device?
	Name two examples of real-time operating systems used in IoT
	OpenWSN-style OS) **(30 minutes)**
	Features:
	Real-time support
	Lightweight, modular
	Focused on sensor network applications
	Design Modules:
	Communication stack (6LoWPAN, CoAP)
	Time synchronization (e.g., TSCH)
	Modular services for building automation
	Hardware Structure:
	Microcontrollers (e.g., MSP430, STM32)
	Radios (IEEE 802.15.4 compatible)
	Programming Language:
	C/C++ with system configuration scripts

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	Exercise Draw a simple block diagram of a system using one of the discussed RTOSs, showing MCU, sensor, network module, and power supply.

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	Suggested Reading
	       K. N. Raja Rao, "Internet of Things" Wiley
	       Link: https://www.youtube.com/watch?v=LK_a1RtCspo
	       Resources:

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.?
	  What is the main programming language used in OS?
	  Name two features that make FreeRTOS suitable for real-time embedded applications.

Lesson Plan No.30	Course Name: IoT Topic: IOT Software	Course No.: BCAMJ-403

	a. Understand the core features of TinyOS, and FreeRTOS. b. ale to learn the modular design and hardware structure each system typically uses. c.Identify the primary programming language and development approach for each OS.
Teaching Aids (if any)	ICT

Teaching Development	**Introduction** (5 minutes)
	  How does an IoT device typically send data to the cloud?
	  Name two programming languages commonly used to develop IoT applications.
	
	Tiny OS **(30 minutes)**
	
	TinyOS Features:
	Event-driven
	Highly energy efficient

Ideal for low-power embedded systems
Design Modules:
Component-based architecture
Scheduler and task queue
Messaging interface
Hardware Structure:
TelosB, MicaZ motes, MSP430
Programming Language:
nesC (network embedded systems C – a dialect of C)

Exercise
Draw typical architecture of sensor node.

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading
	K. N. Raja Rao, "Internet of Things" Wiley
	Link: https://www.youtube.com/watch?v=Ihy785MpH7g

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.?
	What is the main programming language used in TinyOS?
	Name different operating system for WSN

Lesson Plan No.31	Course Name: IoT Topic: IOT Security	Course No.: BCAMJ-403

	a.Able to learn the importance of security and privacy in IoT systems.
	b.Identify major security threats and privacy issues in IoT environments.
	c.Understand the role of encryption, authentication, and secure communication protocol
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes)
	How can device authentication help secure IoT networks?
	What role do firewalls play in securing IoT networks?
	IoT security **(30 minutes)**
	Importance of IoT Security & Privacy IoT devices handle personal, medical, industrial, and real-time data.
	Vulnerabilities affect user safety, data confidentiality, and system

reliability.
Examples: Smart door locks, health trackers, industrial SCADA systems.
Common Security Issues
Weak or default passwords
Unsecured APIs
Lack of regular firmware updates
Physical device tampering
Insecure network services

Exercise
 Draw typical architecture of sensor node.

Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	Suggested Reading
	       K. N. Raja Rao, "Internet of Things" Wiley
	       Link:
	       https://www.youtube.com/watch?v=1EgYx2ioNUA
	       https://www.youtube.com/watch?v=4XycTona5qI

Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.?
	   Why is IoT security more complex than traditional IT security?
	   How can encryption help secure IoT data?

Lesson Plan No.32	Course Name: IoT Topic: IOT Security & privacy	Course No.: BCAMJ-403

	a.Able to learn the importance of security and privacy in IoT systems. b.Identify major security threats and privacy issues in IoT environments. c.Understand the role of encryption, authentication, and secure communication protocol d. basic mitigation strategies for common IoT threats.
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) What's one example of an IoT-related privacy breach you've heard about? How can encryption help secure IoT data? Privacy Concerns **(30 minutes)** Data collected without user consent

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	Profiling users' habits and behavior
	Location tracking
	IoT devices in shared environments (e.g., smart speakers)
	Mitigation & Best Practices End-to-end encryption (TLS, DTLS)
	Device authentication
	Secure boot and signed firmware
	Major Threats Botnets (e.g., Mirai) – IoT devices used in DDoS attacks
	Man-in-the-Middle (MitM) – Attackers intercept data
	Replay Attacks – Repeating valid data to gain access
	Firmware Hijacking
	Data leakage from sensors – e.g., user location or activity patterns
	Exercise
Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these. Suggested Reading 　　　K. N. Raja Rao, "Internet of Things" Wiley 　　　Link: https://www.youtube.com/watch?v=1EgYx2ioNUA 　　　https://www.youtube.com/watch?v=4XycTona5qI
Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.? 　What are the major types of security threats to IoT devices? 　What are the risks associated with default passwords in IoT devices?

Lesson Plan No.33	**Course Name: IoT** **Topic: Key Challenges in IOT Security**	**Course No.: BCAMJ-403**

	a.Able to learn the importance of security and privacy in IoT systems. b.Identify major security threats and privacy issues in IoT environments. c.Understand the role of encryption, authentication, and secure communication protocol d. basic mitigation strategies for common IoT threats.
Teaching Aids (if any)	ICT
Teaching Development	**Introduction** (5 minutes) What steps can manufacturers take to ensure the security of IoT devices before they are released to consumers? How can IoT devices affect user privacy in terms of data collection and sharing?

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	Challenges in IoT Security **(30 minutes)**
	Insufficient industry leading
	Lack of Skills
	Shadow IoT
	Privacy attack
	Resource storage
	Security & privacy issues
	Abundance of data
	Lack of transparency
	Eavesdropping
	Best practices for IoT security
	Network segmentation
	Password policy
	Visibility of Iot device
	API security
	Secure encryption
	Exercise
	Summarize any practice /measure of IoT security
Closure	Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	Suggested Reading
	K. N. Raja Rao, "Internet of Things" Wiley
	Link: https://www.youtube.com/watch?v=1EgYx2ioNUA
	https://www.youtube.com/watch?v=4XycTona5qI
Evaluation	Reflective Questions (What, Why, Who?). Allow students to answer and discuss.?
	How do I ensure privacy in IoT?
	What is the weakest point of IoT security?