Name of the Programme: MCA
Course code: CSA-613
Title of course: IoT Application Development
Number of Credits: 4 (2L-2T-0P)
Effective from AY: 2022-23

Prerequisites for the course	Programming skills, basic knowledge of electronics, Basics of networking	
Objectives	The basic objectives are: ● To introduce the concept of the Internet of Things and its applications in various domains ● To explore the different protocols and communication methods used in IoT systems ● To provide a working knowledge of Node-RED, a popular programming tool for developing IoT applications ● To equip students with the skills to design and build IoT systems for a variety of use cases	
Content	Fundamentals of IoT ● Understanding IoT and its applications ● IoT architecture and components ● Introduction to sensors and actuators	8 hours
	IoT protocols and communication ● Wired and wireless communication protocols ● Overview of IoT protocols: MQTT, CoAP, HTTP, WebSocket, etc. ● LoRaWAN and its applications	8 hours
	Cloud Computing for IoT ● Cloud computing fundamentals ● Cloud services for IoT ● Cloud platforms for IoT ● IoT data management and storage on the cloud	8 hours
	IoT Security and Privacy ● IoT security risks and challenges ● IoT security protocols and practices ● IoT privacy concerns and regulations	6 hours
	Assignments to be discussed and carried out during the Tutorial Slots	
	Introduction to Node-RED ● features, architecture, and installation ● Building the flow: understanding nodes, messages, and flows ● Debugging the flows: using the debug node, logging, and error handling	6 hours
	Data acquisition and visualization ● Using sensors and actuators in Node-RED ● Connecting to sensors and devices: using input nodes and protocols (MQTT, HTTP, WebSocket, etc.) ● Data processing and manipulation: using function nodes and JavaScript ● Building dashboards: using the Node-RED Dashboard module for data visualization and control ● Using APIs and cloud services in Node-RED	8 hours
	IoT protocols and communication ● Overview of IoT protocols: MQTT, CoAP, HTTP, WebSocket, etc. ● Setting up an MQTT broker: installation, configuration, and security ● MQTT publishing and subscribing: using MQTT nodes in Node-RED	8 hours

	● Building an MQTT-based IoT system: integrating sensors, actuators, and applications	
	Advanced topics in IoT and Node-RED ● Node-RED extensions and plugins ● Deploying and scaling Node-RED: hosting Node-RED flows on cloud platforms like AWS IoT Project Development with Node-RED ● Developing IoT projects using Node-RED and sensors, actuators, and communication protocols	8 hours
Pedagogy	Assignments / tutorials / peer-learning / troubleshooting/ case studies	
References/ Readings	1. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016. 2. Raj, Pethuru, and Anupama C. Raman. The Internet of Things: Enabling technologies, platforms, and use cases. CRC press, 2017. 3. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press) 4. Research papers 5. Hagino, Taiji. Practical Node-RED Programming: Learn powerful visual programming techniques and best practices for the web and IoT. Packt Publishing Ltd, 2021. 6. https://cookbook.nodered.org/	
Course Outcomes	After completion of the course, the learner will be able to: 1. design some IOT-based prototypes 2. understand the various protocols and communication methods used in IoT systems, including MQTT, CoAP, and HTTP. 3. implement various protocols and communication methods used in IoT systems, including MQTT in NodeRED 4. design and build IoT systems for a variety of use cases, including smart home automation,	

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