Government of Karnataka

DEPARTMENT OF TECHNICAL EDUCATION

Program	**Electronics & Communication Engineering**	**Semester**	**V**
Course Name	**Industrial Internet of Things [IIoT]**	**Type of Course**	**Integrated**
Course Code	**25EC52IB**	**Contact Hours**	**8 hours/week 104 hours/ semester**
Teaching Scheme	**L:T:P :: 3:0:4**	**Credits**	**6**
CIE Marks	**50**	**SEE Marks**	**50 (Practice)**

1. Rationale:

Rapidly expanding IoT market is creating a significant demand for skilled professionals who can design, develop, and manage connected devices and systems. Holistic understanding of complex systems by acquiring knowledge of various technical disciplines like embedded systems, sensors, networking, cloud computing, and data analytics. Offers opportunities to work on practical projects with the real-world in diverse sectors like healthcare, manufacturing, smart homes, agriculture, and transportation, etc.

New and innovative products and services can be created by integrating physical devices with the internet, fostering creativity and problem-solving skills. Individuals with IoT expertise will be well-positioned for future career advancements in various technical fields as IoT technology continues to evolve.

2. Course Outcomes: At the end of the Course, the student will be able to:

CO-01	Comprehend foundational knowledge of IoT technologies and components.
CO-02	Utilize IoT sensors and actuators to create practical applications for homes, cities, agriculture, environment, energy, and industry.
CO-03	Apply IoT protocols, networking, and security principles to design and analyze efficient, secure IoT systems for various applications.
CO-04	Create real-world IoT solutions for smart homes, industries, and other sectors.

3. Course Content

WEEK	CO	PO	Theory	Practice
1	1	1	1. Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies. 2. IoT Networking Components, Characteristics of IoT, Things in IoT, IoT Protocols. 3. Logical Design of IoT: Functional blocks Communication models, Communication APl's.	1. Videos on IoT applications and make a report on communication models used in IoT. 2. Videos on IoT applications and make a report on communication protocols used in IoT.
2	1	1,7	1. Industrial Revolutions: Background Industrial Revolution 1.0, 2.0, 3.0, 4.0,5.0.6.0,	1. Video demonstration of maintenance process / Industry

			concepts, applications. Industrial Internet of Things: Concept, definitions. 2. Difference between IoT and IIoT IIoT application in various sectors/industries: Healthcare, Manufacturing, Logistics. 3. Predictive and remote maintenance: concept, implementation use case.	visit for maintenance process.
3	1	1	1. IoT Enabling Technologies: Wireless sensor Networks, Cloud Computing, Big Data Analytics. 2. Introduction to NodeMCU ESP8266, Communication protocols, Embedded Systems. 3. IoT Levels & Deployment Templates: Level – 1 Level – 2 Level – 3 Level – 4 Level – 5 Level – 6	1. Demonstrate videos on IoT Levels 1,2,3. 2. Demonstrate videos on IoT Levels 4,5,6.
4	2	1,3,4	1. IIoT Sensing: Introduction, Sensors, Sensor Characteristics and Categories. 2. Sensorial Deviations, Sensing Considerations. 3. IoT Actuation: Actuators, Actuator Types, Actuator Characteristics.	1. Identification and prepare a report on data sheets about different types of sensors and actuators. 2. Connecting a temperature sensor to a NodeMCU ESP8266/ESP32 to read sensor data and control actuators such as LEDs, motors, and servos based on the sensor inputs.
5	2	2,3,4,5	Domain Specific IIoT's: 1. Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/ Gas detectors. 2. Smart Cities: Smart parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response. 3. Smart Agriculture: Smart irrigation, Greenhouse control.	1. Develop and demonstrate a Smoke detection system using IoT. 2. Develop and demonstrate a smart lighting system using IoT. 3. Develop and demonstrate a smart irrigation system using IoT.
6	2	2,3,4,5	1. Environment: Weather monitoring, Air Pollution monitoring, Noise Pollution monitoring, Forest fire detection, River Floods Detection.	1. Develop and demonstrate a Weather monitoring system using IoT.

			2. Energy: Smart Grids, Renewable Energy Systems, Prognostics. 3. Industry: Machine diagnosis and prognosis, Indoor air quality monitoring.	2. Develop and demonstrate a fire detection system using IoT. 3. Develop and demonstrate air quality monitoring systems using IoT.
7	3	1,3,4	1. IoT Protocols – need of protocols, types. 2. Network Protocols: HTTP, Bluetooth, ZigBee, LoRaWAN, RFID. 3. Data Protocols:MQTT, CoAP, AMQP.	1. Simulate or demonstrate a simple MQTT protocol-based system where a cloud application fetches data from a device using the MQTT protocol. 2. Demonstration of LoRAWAN communication.
8	3	1,2, 3,4	1. Machine to Machine (M2M) networks: SDN, NFV- examples. 2. M2M Value Chains, IoT Value Chains. Comparison between M2M & IoT. 3. Human Machine Interface (HMI) in an automation process – concept, implementation, examples.	1. Demonstrate videos on M2M Networks. 2. Demonstrate videos on HMI using any Wireless devices controlling any Actuator.
9	3	1,2,3 ,4	1. IoT Design Methodology: purpose and Requirements Specifications, Process Specifications, Domain model Specifications. 2. Information model Specifications, Service Specifications, IoT Level Specifications, Functional level Specifications. 3. Operational view Specifications, Divide and component Integration.	1. Case studies on Smart Appliances. 2. Case studies on surveillance systems. 3. Design a simple IoT-based temperature monitoring application using the Blynk IoT platform.
10	3	1,3,4 ,7	1. Cloud service models: Concept of Infrastructure as a service (IaaS) model, Software as a service (SaaS) model. Platform as a service (PaaS) model. 2. Comparison and applications of IaaS, SaaS, and PaaS. 3. Cloud – introduction, cloud computing: concept, benefits, types.	1. Design an IoT system using an ESP8266/ ESP32 and a light sensor to gather data, upload it to the ThingSpeak cloud, and perform data analysis. 2. Develop an IoT-based color sorting machine using ESP8266 and ThingSpeak cloud.

11	3	1,2,3,4,5	1. Cloud storage: working operation, benefits, challenges. 2. Deployment models – Features of private cloud storage, public cloud storage, hybrid cloud storage, Community cloud storage, Comparison, examples. 3. Cloud computing services: Concept, Types, Features of Amazon Web Services (AWS), Azure, Google Cloud Platform(GCP).	1. Develop an IoT-based Alexa Home Automation system/Alexa class room automation system using Arduino IoT Cloud & ESP8266/ ESP32 NodeMCU. 2. Demonstrate and explain AWS services related to IoT, highlighting their functionalities and applications.
12	3	1,3,5,7	1. Overview of Threats in IoT, Vulnerabilities: Device Vulnerabilities, Network Vulnerabilities, Data Vulnerabilities. 2. Encryption Techniques in IoT: Symmetric Encryption and Asymmetric Encryption, Authentication Mechanisms: User Authentication and Device Authentication. 3. Privacy Issues: Concerns related to the collection of personal and sensitive data, Privacy Regulations: GDPR (General Data Protect ion Regulation)	1. Demonstrate cybersecurity awareness in IoT devices through videos and showcase a Cyber-Physical System (CPS) application to highlight security measures. 2. Demonstrate a cyber-threat or hacking scenario in a specific sector or industry and present effective solutions to mitigate it.
13	4	1,2,3,4,5,6,7	Description of developing a home automation system using IoT through the following step-by-step process: 1. Identify the Components. 2. Assemble the Components and integrate them with the Software. 3. Testing and Troubleshooting.	1.Develop and Demonstrate IoT-based home automation system/ IoT-based smart water management system/smart garden system/IoT-based smart door lock system/ any real time application of IoT.

4. References:

1. Misra, Sudip, Mukherjee, Anandarup, Roy, Arijit. "Introduction to IoT." Cambridge University Press, 2021.
2. Bahga, Arshdeep, Madisetti, Vijay. "Internet of Things: A Hands-On Approach."
3. Gilchrist, Alasdair. "Industry 4.0: The Industrial Internet of Things."
4. URLs: https://circuitdigest.com/internet-of-things-iot-projects
5. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.)
6. Industry 4.0 The Industrial Internet of Things by Alasdair Gilchrist

7. CIE Assessment Methodologies

Sl. No	CIE Assessment	Test Week	Duration (minutes)	Max marks	
1.	CIE-1 Theory Test	4	90	50	Average of all CIE=50 Marks
2.	CIE-2 Practice Test	7	180	50	
3	CIE-3 Theory Test	10	90	50	
4.	CIE-4 Practice Test	13	180	50	
5	CIE-5 Portfolio evaluation of all the activities through Rubrics	1-13		50	
				Total	**50 Marks**

8. SEE – Practice Assessment Methodologies

Sl. No	SEE – Practice Assessment	Duration (minutes)	Max marks	Min marks to pass
1.	Semester End Examination-Practice	180	50	20

9. CIE Theory Test model question paper

Program	Electronics & Communication Engineering			Semester - V	
Course Name	Industrial Internet of Things [IIoT]			Test	I/III
Course Code	25EC52IB	Duration	90 min	Marks	50

Name of the Course Coordinator:

Note: Answer any one full question from each section. Each full question carries equal marks.

Q.No	Questions	Cognitive Level	Course Outcome	Marks
	Section - 1			
1	a) Explain the concept of IoT and discuss its various applications across different industries.	L2	1	8
	b) Describe the role of the communication functional block in an IoT system.	L2		10
	c) Identify and analyze different IoT communication models, and provide a detailed explanation of two.	L3		7
2	a) List different types of protocols used in IoT and their applications.	L2	1	5
	b) Describe the features and differences between IoT Level 1 and IoT Level 2.	L2		10
	c) Compare the industrial revolutions from 1.0 to 6.0 and assess how IoT has influenced the 4th and 5th revolutions.	L3		10
	Section - 2			
3	a) List the different types of sensors used in IoT.	L2	2	5
	b) Explain the different types of sensor characteristics.	L2		10
	c) Design smoke detection system using IoT.	L3		10
4	a) List the different types of actuators used in IoT.	L2	2	5
	b) Explain the different types of actuator characteristics.	L2		10
	c) Design smart lighting systems using IoT.	L3		10

Note for the Course coordinator: Each question may have one, two or three subdivisions. Optional questions in each section carry the same weightage of marks, cognitive level and course outcomes.

Signature of the Course Coordinator | **Signature of the HOD** | **Signature of the IQAC Chairman**

10.CIE Practice Test model question paper

Program	Electronics & Communication Engineering			Semester	V
Course Name	Industrial Internet of Things [IIoT]			Test	II/IV
Course Code	25EC52IB	Duration	180 min	Marks	50
Name of the Course Coordinator:					
Questions				CO	Marks
Problem statement: Design an IIoT system for a given application.					
Scheme of assessment: **a) Draw the circuit diagram and specify the required components.** **b) Programming and interfacing.** **c) Conduction and Results.** **d) Viva – voce.**					**10** **10** **20** **10**
				Total Marks	**50**

Signature of the Course Coordinator | **Signature of the HOD** | **Signature of the IQAC Chairman**

11. Suggestive Activities for Tutorials:

The List is an Example and not inclusive of all possible activities of the course. Student and Faculty are encouraged to choose activities that are relevant to the topic

Sl.No.	Suggestive Activities for Tutorials
01	Develop an automatic plant watering system, that waters your plants at specific intervals, or if the soil is dry.
02	Design a system that monitors waste bin levels and sends alerts for collection.
03	Design an IoT-based health monitoring system that tracks vital signs such as heart rate, blood pressure, or temperature.
04	Design a system that detects gas leaks and sends an alert to the user.
05	Develop a system that controls the fan's operation based on humidity levels in a room.

12. Rubrics for Assessment of Activity (Qualitative Assessment)

Sl. No.	Dimension	Beginner	Intermediate	Good	Advanced	Expert	Students Score
		10	20	30	40	50	
1		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	40
2		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	30
3		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	50
4		Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	20
	Average Marks=(40+30+50+20)/4=35						**35**

Note: Dimension and Descriptor shall be defined by the respective course coordinator as per the activities

13. SEE- Model Practice Question Paper:

Program	Electronics & Communication Engineering			Semester	V
Course Name	Industrial Internet of Things [IIoT]				
Course Code	25EC52IB	Duration	180 min	Marks	50

Name of the Course Coordinator:		
Questions	**CO**	**Marks**
Problem statement: Design an IIoT system for a given application.		
Scheme of assessment: a) Draw the circuit diagram and specify the required components. b) Programming and interfacing. c) Conduction and Results. d) Viva – voce.		 10 10 20 10
	Total Marks	**50**

1)Signature of the Examiner **2) Signature of the Examiner**

14. Equipment/software list with Specification for a batch of 30 students.

Sl.No.	Particulars	Quantity
01	Bread Boards	30
02	NODEMCU ESP8266/ ESP32	30
03	Jumper Wires.	As per requirement
04	Related Sensors /components to Practice Exercises	As per requirement
05	Internet facility	As per requirement