<table>
<tr><td colspan="6">Devi Ahilya Vishwavidhyalaya, Indore, India
Institute of Engineering & Technology</td><td>III Year
B.Tech.
(Electronics and Instrumentation Engineering)</td></tr>
<tr><td>Course Code & Name</td><td colspan="5">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="2">5REPE2

IOT Architecture, Protocols and Applications</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">120</td><td rowspan="2">4</td></tr>
<tr><td>20</td><td>10</td><td>20</td><td>70</td></tr>
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Course Learning Objectives:

1. To introduce the fundamentals, evolution, and architecture of IoT systems.
2. To explore IoT hardware, including smart objects, sensors, actuators, and wireless access technologies.
3. To understand the networking and communication protocols used in IoT, including IP, transport, and application layers.
4. To develop an understanding of data analytics, machine learning, and security challenges in IoT systems.
5. To provide hands-on knowledge of IoT devices (e.g., Raspberry Pi) and the design of IoT-based applications like smart cities.

COURSE CONTENTS

Unit I:
IoT Introduction, IoT Challenges, IoT Network Architecture and Design, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Unit II:
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria

Unit III:
IoT PROTOCOLS- IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN,
Network Layer: IP versions, Constrained Nodes and Constrained Networks,
Application Transport Methods: Application Layer Protocols: CoAP and MQTT.

Unit IV:
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Securing IoT, A Brief History of IoT Security, Common Challenges in IoT Security

Unit V:
Case studies/Industrial applications: IoT applications in home, infrastructures,

buildings, security, Industries, Home appliances, other IoT electronic equipments, Industry 4.0 concepts. An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

Course Outcomes:

CO.No.	CO
CO1	Explain the fundamental concepts, architecture, and design principles of IoT systems.
CO2	Identify and describe sensors, actuators, and communication technologies used in IoT.
CO3	Analyze IoT communication protocols and data management layers for efficient connectivity.
CO4	Apply data analytics and security principles to IoT systems and operational environments.
CO5	Design and demonstrate IoT applications using Arduino/Raspberry Pi for real-world scenarios.

Text Books:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
2. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
3. Introduction to Industrial Internet of Things and Industry 4.0 , Sudip Misra, Chandana Roy, Anandarup Mukherjee, 2020
4. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education, 2022

Reference Books:

1. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012.
2. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence",Jan Hooller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
3. Architecting the Internet of Things,Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer,2011.
4. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition,Michael Margolis, Arduino Cookbook and O"Reilly Media,2011.

CO-PO-PSO Relationship

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
5REPE2 .CO1	3	2	2	1	2	1	1	1	0	1	0	2	2	1
5REPE2 .CO2	2	3	2	2	3	1	1	0	1	1	0	2	3	2
5REPE2 .CO3	2	3	3	3	3	1	2	0	1	2	0	3	3	3
5REPE2	1	2	3	3	3	2	2	2	1	2	1	3	2	3

.CO4														
CO5	1	2	3	3	3	1	1	1	3	3	2	3	3	3

LAB EXPERIMENTS

1: Interfacing Light Emitting Diode (LED) - Blinking LED
- Objective: Familiarize students with the GPIO peripheral of the ATmega microcontroller and basic digital output.
- Task: Write a program to blink an LED connected to an Arduino board at a specific frequency.

2: Reading Potentiometer Values and Controlling LED Brightness (Night Lamp)
- Objective: Introduce students to analog input handling and PWM output for controlling LED brightness.
- Task: Interface a potentiometer with Arduino to control the brightness of an LED, simulating a night lamp.

3: Interfacing Temperature and Humidity Sensors
- Objective: Learn to connect environmental monitoring sensors to Arduino and use appropriate libraries.
- Task: Interface a temperature sensor (e.g., LM35) and/or humidity sensor (e.g., DHT11) with Arduino to monitor environmental conditions.

4: Controlling Servo Motors
- Objective: Understand servo motor control using PWM signals.
- Task: Interface a servo motor with Arduino and write a program to control its position.

5: Interfacing with LCD Displays
- Objective: Display sensor data on an LCD screen for local monitoring.
- Task: Interface an LCD display with Arduino and display data generated by a sensor.

6: Bluetooth-based Home Automation
- Objective: Enable IoT capabilities by integrating actuators (relays) with Arduino and remote connectivity via Bluetooth.
- Task: Interface a relay module with Arduino to control home appliances wirelessly using a mobile phone application.

7: Advanced Sensor Integration - Accelerometer and Gyroscope
- Objective: Explore advanced sensor integration for motion sensing applications.
- Task: Interface an accelerometer and gyroscope with Arduino to detect and measure motion.

8: Reading Analog Sensor Values
Objective: Learn to read analog sensor values and convert them to digital format.
Task: Interface analog sensors (e.g., light sensor, temperature sensor) with Arduino and read their values.

9: Interfacing Air Quality Sensor
Objective: Learn to use pollution sensors with Arduino for smart city applications.
Task: Interface an air quality sensor (e.g., MQ135) with Arduino to measure pollution levels and trigger an LED indicator.

10: Interfacing Button and LED
- Objective: Understand GPIO in both input and output modes.
- Task: Interface a button and an LED with Arduino and write a program to blink or glow the LED when the button is pressed.

11: Project Showcase - Mini Smart Home System
- Objective: Apply knowledge and skills acquired in previous labs to design and implement a mini smart home system.
- Task: Design and implement a project integrating multiple sensors, actuators, and communication modules for home automation