

| Devi Ahilya University, Indore, India<br>Institute of Engineering & Technology |                             |   | IV Year B.E. (Electronics and Instrumentation) |         |   |   |       |
|--|-----------------------------|---|--|---------|---|---|-------|
| Subject Code & Name  | Instructions Hours per Week |   |  | Credits |   |   |       |
| 7EIRC5<br>Internet of Things   | L                           | T | P  | L       | T | P | Total |
|  | 3                           | 1 | 1  | 3       | 1 | 1 | 5     |
| Duration of Theory Paper:<br>3 Hours   |                             |   |  |         |   |   |       |

### 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, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, 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, IoT Access Technologies.

#### Unit III:

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

#### Unit IV:

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IoT Security, Common Challenges in IoT Security, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment

#### Unit V:

IoT Physical Devices and Endpoints - Building iot with Arduino: Arduino – Interfaces - Arduino IDE – Programming , RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless

Temperature Monitoring System Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

### Text Books:

- 1 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, 2017.
- 2 Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, VPT (Universities Press India), 2014.
- 3 Raj Kamal, Internet of Things: Architecture and Design Principles, McGraw-Hill Education, 2017.
- 4 James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, Pearson, 2021.

### Reference Books:

1. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley, 2012.
2. Donald Norris, The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black, McGraw-Hill Education, 2015.

### 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. |

### CO-PO-PSO Relationship

| CO  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO 1 | PSO 2 | PSO 3 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|-------|-------|-------|
| CO1 | 3   | 2   | 2   | 1   | 2   | 1   | 1   | 1   | 0   | 1    | 0    | 2     | 2     | 1     |
| CO2 | 2   | 3   | 2   | 2   | 3   | 1   | 1   | 0   | 1   | 1    | 0    | 2     | 3     | 2     |
| CO3 | 2   | 3   | 3   | 3   | 3   | 1   | 2   | 0   | 1   | 2    | 0    | 3     | 3     | 3     |
| CO4 | 1   | 2   | 3   | 3   | 3   | 2   | 2   | 2   | 1   | 2    | 1    | 3     | 2     | 3     |
| CO5 | 1   | 2   | 3   | 3   | 3   | 1   | 1   | 1   | 3   | 3    | 2    | 3     | 3     | 3     |