

Savitribai Phule Pune University, Pune T.Y. B.Sc. (Computer Science) – Semester – V Course Type: Minor Course Code: ELC-341-MN-P Course Title: Lab Course on Electronics		
Teaching Scheme 04 Hours / Week	No. of Credits 2	Examination Scheme IE: 15 Marks UE: 35 Marks
Course Objectives (Practical) The objectives of this laboratory course are to: • To understand the concepts and components of Wireless Sensor Network (WSN) nodes. • To explain WSN topologies, setup procedures, and communication protocols. • To apply sensors in developing WSN-based applications such as fire detection, soil moisture detection, and environmental monitoring. • To develop familiarity with Raspberry Pi hardware and Python programming for IoT applications. • To install and configure various libraries on Raspberry Pi. • To analyze the role of web servers and cloud services in IoT applications.		
Course Outcomes (Practical) On completion of the laboratory course, students will be able to: CO1: Develop a WSN node using an Arduino board. CO2: Implement WSN topologies and communication protocols. CO3: Design wireless sensor nodes for applications such as fire detection, soil moisture detection, and temperature-humidity measurement. CO4: Apply Raspberry Pi and Python programming for IoT-based applications. CO5: Install and configure different libraries on Raspberry Pi. CO6: Analyze and utilize web servers and cloud services in IoT applications.		
Course Contents		
SECTION - I (12 Experiments)		
Group A:	WSN Based Experiments (Using Arduino board)	Any 6
1. To study Point to point communication using ZigBee/LoRa/Rf module. 2. To understand and analyze the use of RFID technology for intruder detection using RFID tags. (with multiple frequencies) 3. To study moisture sensor for soil/room. 4. To study of IR sensor for fire detection. 5. To study the measurement of humidity and Temperature. 6. To analyze different topologies used in Wireless Sensor Networks. 7. To understand the principle and applications of motion detection in WSN environments. 8. To analyze data exchange mechanisms between multiple end nodes and a coordinator node in WSN. 9. To study NFC-Bluetooth Communication. 10. To understand and analyze the MQTT protocol used in Wireless Sensor Networks (WSN)		
Group B:	IoT Based Experiments (Using Raspberry Pi board)	Any 6
11. To study GPIO of Raspberry Pi with interfacing of switch and LED/LED array. 12. To apply Python/GNU Plot programming for plotting graphs such as bar graphs, histograms, line graphs, and pie charts using a given observation table. (Observation table must contain different value) 13. To study installation of various library for different device interfacing for eg. Pi camera.		

14. To design and implement a system to receive data via Bluetooth and display it on an LCD.
15. To design and implement a Bluetooth-based system for controlling a stepper motor.
16. To implement LED switching control using a mobile web server.
17. To design and implement an email alert system for activation and deactivation events of devices using Raspberry Pi.
18. To design and develop an IoT-based smoke detection system for generating security alerts.
19. To interface an LDR with Raspberry Pi using ThingSpeak/Blynk IoT cloud services for data monitoring.
20. To interface a PIR sensor with Raspberry Pi using ThingSpeak/Blynk IoT cloud services for motion detection and monitoring.

SECTION-II: ACTIVITY (Equivalent to 3 Experiment)

“Electronics Hobby Project”

Laboratory Requirements

- Monitor, Keyboard, Mouse, Active Internet Connection
- Arduino boards, Raspberry Pi boards with HDMI cable
- Breadboard, jumper wires
- Sensors, Actuators
- Power supply and basic electronic components

Reference Books

1. Dogan Ibrahim, “Mastering the Arduino Uno R4 Programming and Projects for the Minima and WiFi”, Elektor Publication.
2. Warwick A. Smith, “A Reference and User Guide for the Arduino Uno Hardware and Firmware ULTIMATE Arduino Uno Hardware Manual”, Elektor Publication.
3. Vijay Madisetti and Arshdeep Bahga, — “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
4. David Hanes, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Cisco Press, ISBN-13: 978-1-58714-456-1, ISBN-10: 1-58714-456-5, 2017
5. RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, “Internet of Things”, John Wiley and Sons.
6. Enabling the Internet of Things: fundamentals, design, and applications / Muhammad Azhar Iqbal, Sajjad Hussain, Huanlai Xing, Muhammad Ali Imran., John Wiley & Sons Ltd
7. Simon Monk, “Raspberry Pi Cookbook, Software and Hardware Problems and Solutions,” O’Reilly Media, Inc
8. Wireless Sensor Networks Technology: Protocols and Applications -Kazem Sohraby, Daniel Minoli and Taieb Znati, John Wiley and Sons.