Devi Ahilya University, Indore, India Institute of Engineering & Technology				**III Year B.E. (Information Technology (Full Time)**		
Subject Code & Name	**Instructions Hours per Semester & Credits**					
3RIPC5 IoT Lab	**Classroom Instruction (CI)**		**Lab Instruction (LI)**	**Term Work (TW) and Self Learning (SL)**	**Total no. of Hours Per semeste**	**Total Credits (Total Hours/30)**
Duration of Theory Paper: 3 Hours	**L**	**T**	**P**	**TW+SL**	**60**	**2**
	00	**00**	**40**	**20**		

Learning Objectives:

- To provide knowledge of different smart system applications.
- To develop skills to design and implement various smart system applications.
- To familiarize students with advance features of Arduino and Raspberry pi**,** platforms.
- To familiarize students with the use of Ardinuo and Raspberry Pi platforms in Cloud computing and Machine learning based smart application

Pre requisites: Basic knowledge of C++ Programming, python programming.

Course Outcomes (COs)

1. CO1: Explain fundamentals of Arduino, IoT architecture, protocols, and basic interfacing.
2. CO2: Interface analog/digital sensors and actuators with Arduino.
3. CO3: Implement networking using ESP8266 for wireless communication & data posting.
4. CO4: Use cloud platforms (ThingSpeak/MQTT) for IoT data processing & visualization.
5. CO5: Configure and program Raspberry Pi for IoT applications using Python.

Program Outcomes (POs)

6. PO1: Engineering knowledge
7. PO2: Problem analysis
8. PO3: Design/development of solutions
9. PO4: Investigations of complex problems
10. PO5: Modern tool usage
11. PO6: Engineer and society
12. PO7: Environment and sustainability
13. PO8: Ethics
14. PO9: Individual and teamwork
15. PO10: Communication
16. PO11: Project management and finance
17. PO12: Life-long learning

COURSE CONTENTS

UNIT-I

Introduction to Arduino & IOT

Setup the IDE, Arduino Software ,Arduino Libraries , Basic programming for Arduino , Analog input and analog output on Arduino Mega board using PWM ,Interfacing LED, push button and buzzer with Arduino ,Interfacing Arduino with LCD, Understanding IoT fundamentals, IOT Architecture and protocols,Various Platforms for IoT, Real time Examples of IoT.

UNIT-II

Sensor & Actuators with Arduino

Overview of Sensors working , Analog and Digital Sensors ,Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino , Interfacing of Actuators with Arduino, Interfacing of Relay Switch and Servo Motor with Arduino,DC Motor Control, Stepper Motor Control.

UNIT-III

Basic Networking with ESP8266 WiFi module

Basics of Wireless Networking , Introduction to ESP8266 Wi-Fi Module ,Various Wi-Fi library , Web server- introduction, installation, configuration , Posting sensor data to web server, TV Remote, TV Remote with LCD, Timer Control, Ethernet , Bluetooth & WI-Fi.

UNIT-IV.

Cloud Platforms for IOT

Virtualization concepts and Cloud Architecture ,Cloud computing, Cloud services -- SaaS, PaaS, IaaS ,Cloud providers & offerings ,Study of IOT Cloud platforms , ThingSpeak API and MQTT ,Interfacing ESP8266 with Web services

UNIT-V

Getting Started with Raspberry Pi

Basic functionality of Raspberry pi board its processor, Setting and configuring the board, Setting up the pins, General purpose IO Pins, Protocol Pins, Communication on raspberry pi, GPIO library, Interfacing of sensors and Actuators,Programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow.

Learning Outcomes:

After completing this course, the students should be able to:

- develop smart applications in various domains like smart homes, smart city, agriculture, medical etc. using Arduino and Raspberry Pi boards
- deploy multiple IoT devices that could connect to the gateway.
- Apply machine learning algoriths in developing smart applications
- Use cloud environment for managing data globally for smart applications

List of Practical Assignment.

1) Experiments on analog input and analog output on Arduino Mega board using PWM.
2) Experiment on LCD display:-Print numbers, Name, Time etc.
3) Characters send and received, Read and display voltage using Arduino.
4) Experiments on DC motors to control motor speed and direction of rotation.
5) Experiments on servo Motor to rotate servo motor.
6) Experiments on Stepper Motor to rotate bidirectional.
7) Experiments on TV Remote with LCD.
8) Getting started with Raspberry Pi, Install Raspian on your SD card
9) Linux basic commands.
10) How to use Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device
11) How to have your Raspberry Pi interact with online services through the use of public APIs and SDKs.
12) Develop smart applications in any of the two domains as mentioned in the syllabus (group activity)

BOOKS RECOMMENDED:

[1].Rajkamal, Internet of Things, Architecture and design Principles, Mc Graw Hills, 2017

[2].Hakima Chaouchi, "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications

[3]. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", Wiley Publications

[4].Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.

[5].4. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.

[6]. Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.