GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Internet of Things

Course / Subject Code : ME01062071

Course / Subject Name: Programming Technologies for IoT

w. e. f. Academic Year:	2024-25
Semester:	1st Semester
Category of the Course:	PEC – II

Prerequisite:	Basic knowledge of computer programming and electronics devices
Rationale:	The main objective of this course is to prepare the students for developing the real-world IoT applications and check its performance. They will learn the facilities available in programming languages for interfacing with devices, for establishing the network, reading from the devices etc. They will also learn the IoT communication protocols.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
03	00	02	04	70	30	30	20	150

Course Content:

Sr No	Course Content	No of Hours	% of Weightage
1	UNIT-I: Introducing Python and Raspberry Pi for IoT: Installing python, Setting up python virtual environment, Installing python GPIO packages with pip, Methods for executing python script, Configuring GPIO interface on Raspberry Pi, Creating a breadboard prototype circuit, Reading an electronic schematic diagram, Exploring two ways to flash an LED in python, Exploring two ways to integrate a push-button in python.	06	15

2	UNIT-II: Interacting with Digital Input and Output with Python: Turning on and off an onboard component, Working with schematics to wire digital outputs, Counting from 1 to 9 with LEDs, Python code and mraa library, Object-oriented code to control digital outputs, Isolating PINs to improve wiring, Controlling digital outputs with the wiring-x86 library, Understanding pushbuttons and pull-up resistors, Wiring digital input pins with pushbuttons, Reading pushbutton statuses with digital input and the mraa library, Reading pushbutton statuses and running a RESTful API, Reading digital inputs with the wiring x86 library, Using interrupts to detect pressed pushbuttons.	08	20
3	UNIT-III: Java Programming for IoT Applications: IoT communication protocols: MQTT, CoAP, XMPP, SOAP, REST, Java IoT with Raspberry Pi, Raspberry Pi setup, Java GPIO examples, Running Python programs from Java, Java PWM example, Java PIR and LED example, Java I2C example, Java ADC example, Java MQTT example, Java REST example, An Oracle Java ME embedded client, IBM Watson IoT for Java, Amazon IoT for Java, Microsoft Azure IoT for Java.	08	20
4	UNIT-IV: Networking with Flask: , MQTT, Python and Mosquitto MQTT Broker: Introducing the Flask microservices framework, Creating a RESTful API service with Flast-RESTful, Adding a RESTful API client webpage, Creating a Web Socket service with Flask-SocketIO, Adding a web socket client web page, Comparing the RESTful API and Web Socket server, Installing the Mosquitto MQTT broker, Learning MQTT by example, Introducing the python Paho-MQTT client library, Controlling an LED with Python and MQTT, Building a web-based MQTT client.	08	15
5	UNIT-V: IoT Practical Examples to Interact with the Physical World: Measuring temperature and humidity by creating, running and exploring the DHT11/DHT22 circuit, Creating an LDR light-detecting circuit, Running and configuring LDR code, Detecting moisture, Using PWM to rotate a servo, Using an H-bridge IC to control a motor.	06	15

6	UNIT-VI: Building IoT Applications: a solar powered IoT weather station - data gathering, IoTWatherPi, sizing the solar power system, power up & down, starting the Pi, Connecting and testing the hardware, the software, tweeting, texting and supplying to the World of weather data	06	15

Reference Book:

1. Practical Python Programming for IoT by Gary Smart Packt Publishing
2. Internet of Things with Python by Gaston C. Hillar Packt Publishing
3. Practical Java Programming for IoT, AI and Blockchain by Perry Xiao Wiley publication
4. Raspberry Pi IoT Projects - Prototyping Experiments for Makers by John C. Shovic, Apress, 2016

Course Outcome:

After completion of the Course, Students will be able to:

No	Course Outcomes	RBT Level*
01	Understand the required programming language to construct IoT applications.	UN
02	Use programming language libraries to connect various sensors and actuators.	AP
03	Use programming language libraries for developing IoT applications.	AP
04	Apply programming debugging techniques in the existing IoT applications	AP
05	Analyze of real-time IoT systems based on programming platforms.	AN

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List:

Practicals based on course content are to be performed.

List of Laboratory/Learning Resources Required:

- List of Hardware: Computer systems with the latest configuration and connected in a LAN, Raspberry Pi, sensors and actuators
- List of Software: Windows and Linux latest release, IDE and Interpreter of Python, Java
- List of Open-Source Tools/Simulator:
    - PyTorch (https://pytorch.org/)
    - Flask (https://pypi.org/project/Flask/)
    - Mosquitto MQTT (https://www.mosquitto.org/download/)
- List of Useful websites/MOOCs:
- Learners are advised to opt for NPTEL and SWAYAM courses that are relevant to this course.

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