Technical Examination Board, Gujarat State, Gandhinagar

Python Programming for Raspberry PI

Title	ESDM104: Python Programming for Raspberry PI
Level	Certificate Course
Course Duration	Four Month (Part time) Three Week (Full Time) 120 Hrs (Th. 48 Hrs Pr. 72 Hrs)
Entry Qualification	B.E./B.Tech/Diploma/B.E. Sem.III onward/ Diploma Sem. IV onward (EC/IC/IT/CE or Similar Branch)/ BCA/MCA/B.Sc./M.Sc./Any other graduate(with Physics/IT)

Teaching Scheme:

Sub Code	Subject Name	Teaching Scheme		Examination Scheme				Term Work Marks	Total Marks
		Theory	Practical	Theory Marks	Hrs.	Practical Marks	Hrs.		
ESDM104	Python Programming for Raspberry PI	4	6	50	2	100	4	25	175

Total Week	= 12	Theory	= 1 hour slot
Total Teaching slot/Week	= 04	Practical	= 2 hour slot
Theory Periods	= 48	Total teaching	
		10 hours/week (Part-time)	
		06 hours/day (Full time)	
Practical Periods	= 72		

ESDM104: Python Programming for Raspberry PI

Internet of Things (IoT) is a new paradigm that has changed the traditional way of living into a high-tech lifestyle including Smart city, smart homes, pollution control, energy saving, smart transportation, smart industries. The Internet of Things (IoT) is an emerging paradigm that enables the communication between electronic devices and sensors through the internet in order to facilitate our lives. IoT uses smart devices and the internet to provide innovative solutions to various challenges and issues related to various businesses, governmental and public/private industries across the world. IoT is progressively becoming an important aspect of our life that can be sensed everywhere around us. In whole, IoT is an innovation that puts together an extensive variety of smart systems, frameworks and intelligent devices and sensors.

Course Objectives:

After completion of this course students will be able to

- Test electronics components
- Interface sensors and actuators with IoT Embedded devices
- Write python programs for Raspberry PI and similar boards
- Understand architecture of internet of things
- List applications of Internet of things
- Program embedded device useful for IoT applications
- Understand working of basic electronics components, sensors, actuators
  Solve real life challenges with help of IoT

ESDM104: Python Programming for Raspberry PI	
Unit-1	**Overview of Raspberry PI Board**
1.1	Introduction of Raspberry Pi board, Comparison of various RPI Models, Understanding SoC architecture and SoCs used in Raspberry Pi, Pin Description of Raspberry Pi, On-board components of RPI, Overview of Projects using Raspberry PI
1.2	Linux- Introduction, Architecture, File System, Raspbian O.S.- Introduction, Installing Raspbian on Pi, first boot and Basic Configuration of PI, Using Computer/Laptop keyboard, mouse for RPI, Popular Linux Commands
Unit -2	**Python Programming**
2.1	Installation and working with Python, Variables, and data types in python, perform computations and create logical statements using Python's operators: Arithmetic, Assignment, Comparison, Logical, Membership, Identity, Bitwise operators, list, tuple, and string operations
2.2	Python Decision making and Loops: Write conditional statements using If statement, if …else statement, if statement and Boolean expressions, while loop, for loop, Nested Loop, Infinite loop, break statement, continue statement, pass statement, use for and while loops along with useful built-in functions to iterate over and manipulate lists, sets, and dictionaries. Plotting data, Programs using decision making and loops.
2.3	Defining custom functions, Organising Python codes using functions, Create and reference variables using the appropriate scope, Basic skills for working with lists, tuples, work with dates and times, get started with dictionaries, importing own module as well as external modules, Programming using functions, modules, and external packages
2.4	An introduction to file I/O, use text files, use CSV files, use binary files, Handling exceptions, Micro Python for IoT hardware
Unit -3	**Python programming for Raspberry PI**
3.1	Input-output devices interfacing with Raspberry PI and Python programs for I/O devices
3.2	Sensors Interfacing- Temperature and Humidity Sensor (DHT11), Motion Sensor (PIR), Obstacle detection using Ultrasonic sensor interfacing with Raspberry PI and Python programs for it.
3.3	Micro project

Suggested List of Practicals

Sr. No	Practical Name
1	Installation of OS for Raspberry PI board. Configure Raspberry PI Board to use keyboard and mouse of Laptop or PC. Write and execute basic I/O programs.
2	Demonstrate linux commands on Raspberry PI boards on the terminal window. Become familiar with Raspberry PI OS.
3	Execute basic python commands in Raspberry PI board using Python IDE and write programs for arithmetic and logical operations Run some python programs on Pi like: a) Read your name and print Hello message with name b) Read two numbers and print their sum, difference, product, and division. c) Word and character count of a given string. d) Calculate area of a given shape (rectangle, triangle, and circle) by getting appropriate values from standard input. e) Write a program to convert a list and tuple into arrays. f) Write a program to find common values between two arrays. (As per your creativity and suggestion by faculty)

4	Write and execute python programs using loops and decision-making statements.
	Run some python programs like
	    a) Display all even numbers in specified range given by user
	    b) Print the Fibonacci sequence using while loop
	    c) Print a name 'n' time, where name and n are read from standard input, using for and while loops.
	    d) Perform addition of two square matrices
	    e) Print all prime numbers in each interval (use break statement)
	(As per your creativity and suggestion by faculty)

5	To interface RGB LED with Raspberry PI board. Write python program to glow RED, GREEN, YELLOW, BLUE, MAGENTA, CYAN and WHITE light sequence
6	Interface push-button switch and LED with Raspberry PI board. Write Python program to read status of push-button switch and glow LED accordingly
7	Interface PIR motion sensor with Raspberry PI. Write program to sound buzzer when motion is detected
8	Interface ADC at GPIOs of Raspberry Pi for measuring analog voltage.
9	Write a Python code to merge two given file contents into a third file.
10	Run some python programs on Pi like: a) Read a file line by line and print the word count of each line.
11	Source code for using a PIR Motion Sensor
12	interface a push button to Raspberry Pi's GPIO and detect the press of a button on Python IIDLE's console.
13	How to have your Raspberry Pi interact with online services using public APIs and SDKs.

Reference books:

(1) Internet of Things (IoT) A Quick Start Guide by Lele Chitra, BPB Publications
(2) Principle of Electronics by V K Mehta and Rohit Mehta, S. Chand publication.
(3) Professionalism—Skills for Workplace Success, Lydia E. Anderson and Sandra B. Bolt, 4e, Pearson Education/PHI
(4) Internet of Things with Arduino Cookbook, Macro Schwartz, Packt Publication
(5) Python Programming Fundamentals- A Beginner's Handbook by NischayKumar Hegde
(6) Fundamentals of Python – First Programs, Kenneth A. Lambert, CENGAGE Publication
(7) An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications, Rahul Dubey, Cengage India Publication
(8) Programming the Raspberry Pi: Getting Started with Python, By. Simon Monk
(9) Freeduino.begin() The ultimate beginners guide to Arduino platform, By. Siddharth and BhagyashriSharangpani
(10) Sensors and Transducers by D. Patranabi, PHI Learning publication
(11) Transducers and Instrumentation by Murty, D.V.S., PHI Learning publication
(12) Electronic Instrumentation by H. S. Kalsi, McGraw-Hill publication.

Software list:

- Anaconda Python Development Software
- Arduino IDE
- MIT App Inventor

Websites:

- **https://thestempedia.com/**
- **https://www.arduino.cc/education**
- **https://www.raspberrypi.org/**
- **https://www.arduino.cc/education/explore-iot-kit**
- **https://www.kicad.org/**

Software list:

- Windows OS : 10x or higher
- Linux/Ubuntu/Unix OS
- Network Simulation Tool
- Packet Tracer
- LAN Protocol Simulation & Analyzer Software

Subject Course Committee

Prof. C. H. Vithalani, Prof. P. J. Brahmbhatt, Prof. T. P. Chanpura, Prof. M. S. Dave, Prof. P. B. Bhatt, Prof. J. A. Dhumale, Prof. A. S. Patel, Prof. A. K. Konkani