COURSE CONTENT

APPLIED PYTHON PROGRAMMING LAB								
III Semester: ECE / EEE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
2530576	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	0	2	1	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 30**				**Total Classes: 30**		
Prerequisites: Programming for Problem Solving Lab								

Course Overview:

This course provides hands-on exposure to Python programming, scientific computing, and embedded systems through structured laboratory cycles. In Cycle–1, students learn Python installation, package management, and core programming concepts including functions, file handling, numerical computation using NumPy, data analysis and visualization with SciPy and Matplotlib, and text processing. Practical problems emphasize mathematical modeling, matrix operations, statistical analysis, and real-world data handling. Cycle–2 introduces Raspberry Pi setup, Linux-based system installation, and hardware interfacing. Students gain practical experience in GPIO programming, LED control using PWM, and sensor data acquisition using Python. Overall, the course builds strong foundations in Python-based problem solving, data analysis, and IoT-oriented computing.

Course Objectives:

1. To install and run the Python interpreter
2. To define and use Functions
3. To Handle Strings and Files in Python
4. To install on Raspberry pi and use

Course Outcomes: After completion of the course, student should be able to

1. Develop structured and modular Python programs in efficient problem-solving techniques.
2. Implement programs using Python's built-in data structures as lists, tuples, dictionaries, sets for data storage and manipulation tasks.
3. Illustrate the use of Python libraries and modules through experiments in scientific and business applications.
4. Develop programs incorporating file handling, exception handling, and object-oriented features in robust software solutions.
5. Construct Python-based applications for automation, data processing, and real-world

problem-solving.

LIST OF EXPERIMENTS:

Cycle - 1

5. Downloading and Installing Python and Modules
   a. Python 3 on Linux
      Follow the instructions given in the URL
      https://docs.python- guide.org/starting/install3/linux/
   b. Python 3 on Windows
      Follow the instructions given in the URL
      https://docs.python.org/3/using/windows.html (Please remember that Windows installation of Python is harder!)
   c. pip3 on Windows and Linux
      Install the Python package installer by following the instructions given in the URL https://www.activestate.com/resources/quick-reads/how-to-install-and-use-pip3/
   d. Installing numpy and scipy
      You can install any python3 package using the command pip3 install <packagename>
   e. Installing jupyter lab
      Install from pip using the command pip install jupyter lab
6. Introduction to Python3
   a. Printing your biodata on the screen
   b. Printing all the primes less than a given number
   c. Finding all the factors of a number and show whether it is a *perfect* number, i.e., the sum of all its factors (excluding the number itself) is equal to the number itself
7. Defining and Using Functions
   a. Write a function to read data from a file and display it on the screen
   b. Define a boolean function *is palindrome*(<input>)
   c. Write a function *collatz(x)* which does the following: if x is odd, $x = 3x + 1$; if x is even, then $x = x/2$. Return the number of steps it takes for $x = 1$
   d. Write a function $N(m, s) = exp(-(x-m)^2/(2s^2))/sqrt(2\pi)s$ that computes the Normal distribution
8. The package numpy
   a. Creating a matrix of given order $m \times n$ containing *random numbers* in the range 1 to 99999
   b. Write a program that adds, subtracts and multiplies two matrices. Provide an interface such that, based on the prompt, the function (addition, subtraction, multiplication) should be performed
   c. Write a program to solve a system of n linear equations in n variables using matrix inverse
9. The package scipy and pyplot

a. Finding if two sets of data have the same *mean* value

b. Plotting data read from a file
c. Fitting a function through a set a data points using *polyfit* function
d. Plotting a histogram of a given data set

10. The strings package
a. Read text from a file and print the number of lines, words and characters
b. Read text from a file and return a list of all *n* letter words beginning with a vowel
c. Finding a secret message hidden in a paragraph of text
d. Plot a histogram of words according to their length from text read from a file

Cycle -2

11. Installing OS on Raspberry pi

a. Installation using PiImager
b. Installation using image file
   i. Downloading an Image
   ii. Writing the image to an SD card
      1. using Linux
      2. using Windows
   iii. Booting up

Follow the instructions given in the URL
https://www.raspberrypi.com/documentation/computers/getting-started.html

12. Accessing GPIO pins using Python
a. Installing GPIO Zero library.
First, update your repositories list:
sudo apt update
Then install the package for Python 3:
sudo apt install python3-gpiozero
b. Blinking an LED connected to one of the GPIO pin
c. Adjusting the brightness of an LED
d. Adjust the brightness of an LED (0 to 100, where 100 means maximum brightness) using the in-built PWM wavelength.

13. Collecting Sensor Data
a. DHT Sensor interface
- Connect the terminals of DHT GPIO pins of Raspberry Pi.
- Import the DHT library using *import Adafruit_DHT*
- Read sensor data and display it on screen.

REFERENCE BOOKS:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Sheetal Taneja, Naveen Kumar, Pearson
3. Introduction to Python Programming, Gowrishakar S, Veena A, CRC Press

4. Programming with Python, A User's Book, Michael Dawson, Cengage Learning, India Edition
5. Python for Data Science, Dr. Mohd Abdul Hameed, Wiley publications
6. Core Python Programming, Dr. R. Nageswara Rao, Dreamtech press
7. Introduction to Python, Gowrishankar S, Veena A., CRC Press

ELECTRONIC RESOURCES:

1. https://python-iitk.vlabs.ac.in/exp/built-in-functions/simulation.html
2. https://python-iitk.vlabs.ac.in/exp/loops/simulation.html
3. https://python-iitk.vlabs.ac.in/exp/built-in-modules/simulation.html
4. https://python-iitk.vlabs.ac.in/exp/file-operators/simulation.html
5. https://python-iitk.vlabs.ac.in/exp/strings/simulation.html

MATERIALS ONLINE:

1. Lab Manual
2. Open-ended experiments