

Suggested Teaching Guidelines for
Advanced Programming Using Python
PG-DAI August 2025

Duration: 44 Classroom hours and 46 Lab hours

Objective: To introduce the student to Python Programming

Prerequisites: Knowledge of programming in any language like C, C++ and basic statistical knowledge.

Evaluation method: Theory exam– 40% weightage
Lab exam – 40% weightage
Internal exam– 20% weightage

List of Books / Other training material

Courseware: Python For Everybody: Exploring Data In Python 3, Charles R. Severance,

Reference Book:

1. Data wrangling using python by Jacqueline Kazil, Katharine Jarmul
2. Introduction to Computer Science using Python, Charles/ Wiley
3. Learn Python the Hard Way, Zed A. Shaw, Pearson , 2018
4. Python Crash Course: A Hands-on, Project-Based Introduction to Programming
5. Python Cookbook by David B. Brain K. Jones / Shroff / O'reilly Publisher
6. Head First Python by Paul Barry / Shroff / O'reilly Publisher
7. Beginning Programming with Python for Dummies by John Paul Muller / Wiley

Note:

- ***Each session mentioned is of 2 hours of Theory and 2 hours of Lab unless indicated otherwise. T considered as Theory and L considered as Lab.***
- ***Lab assignments are indicative; faculty shall provide adequate assignments for better practice.***
- ***Faculties are advised to give at least one lab assignment as end-to-end application.***

Session 1 & 2:

Lecture

- Installing Python
- Introduction to Python
- Introduction to different Python IDE
- Basic Syntax
- Data Types, Variables, Operators, Input/output
- Declaring variable, data types in programs

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- Your First Python Program
- Flow of Control (Modules, Branching)
- If, If- else, Nested if-else oLooping, For, While
- Nested loops
- Control Structure
- Uses of Break & Continue

Lab Assignments:

Q.1. Using for loop, write and run a Python program for this algorithm. Here is an algorithm to print out n! (n factorial) from 0! to 10! :

1. Set f = 1
2. Set n = 0
3. Repeat the following 10 times:
 - a. Output n, "! = ", f
 - b. Add 1 to n
 - c. Multiply f by n

Q.2. Modify the program above using a while loop so it prints out all of the factorial values that are less than 2 billion. (You should be able to do this without looking at the output of the previous exercise.)

Session 3**Lecture****Pass, Strings and Tuples**

- Accessing Strings
- Basic Operations
- Assigning Multiple Values at Once
- Formatting Strings
- String slices,
- Historical Note on String Methods

Lab Assignments:

Q.1. Write a program that asks the user how many days are in a particular month, and what day of the week the month begins on (0 for Monday, 1 for Tuesday, etc), and then prints a calendar for that month. For example, here is the output for a 30-day month that begins on day 4 (Thursday): S

```

M T W T F S S
      1 2 3 4
5 6 7 8 9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30

```

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Q. 2. A pangram is a sentence that contains all the letters of the English alphabet at least once, for example: The quick brown fox jumps over the lazy dog. Your task here is to write a function to check a sentence to see if it is a pangram or not.

Session 4

Lecture

Dictionaries

- Introducing Dictionaries
- Defining Dictionaries
- Modifying Dictionaries
- Deleting Items from Dictionaries

Lab Assignments:

Q. 1. In cryptography, a Caesar cipher is a very simple encryption techniques in which each letter in the plain text is replaced by a letter some fixed number of positions down the alphabet. For example, with a shift of 3, A would be replaced by D, B would become E, and so on. The method is named after Julius Caesar, who used it to communicate with his generals. ROT-13 ("rotate by 13 places") is a widely used example of a Caesar cipher where the shift is 13. In Python, the key for ROT-13 may be represented by means of the following dictionary:

```
key = {'a':'n', 'b':'o', 'c':'p', 'd':'q', 'e':'r', 'f':'s', 'g':'t', 'h':'u', 'i':'v', 'j':'w', 'k':'x', 'l':'y', 'm':'z', 'n':'a',
'o':'b',
'p':'c', 'q':'d', 'r':'e', 's':'f', 't':'g', 'u':'h', 'v':'i', 'w':'j', 'x':'k', 'y':'l', 'z':'m', 'A':'N', 'B':'O', 'C':'P', 'D':'Q',
'E':'R',
'F':'S', 'G':'T', 'H':'U', 'I':'V', 'J':'W', 'K':'X', 'L':'Y', 'M':'Z', 'N':'A', 'O':'B', 'P':'C', 'Q':'D', 'R':'E',
'S':'F', 'T':'G', 'U':'H', 'V':'I', 'W':'J', 'X':'K', 'Y':'L', 'Z':'M'}
```

Your task in this exercise is to implement an encoder/decoder of ROT-13. Once you're done, you will be able to read the following secret message:

Pnrfne pvcure? V zhpu cersre Pnrfne fnynq!

Note that since English has 26 characters, your ROT-13 program will be able to both encode and decode texts written in English.

Session 5 & 6

Lecture

Working with Lists

- Introducing Lists
- Defining Lists
- Declare, assign and retrieve values from Lists
- Accessing list oOperations in Lists
- Adding Elements to Lists

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- Searching Lists
- Deleting List Elements
- Using List Operators
- Mapping Lists
- Joining Lists and Splitting Strings

Lab Assignments:

Write programs using lists in python

Q.1. Reverse a given list in Python

= [100, 200, 300, 400, 500] output:

[500, 400, 300, 200, 100]

Q.2. Find the largest and smallest number in the list which taken as input from user using list operations.

Session 7 & 8**Lecture****Function and Methods**

- Defining a function
- Calling a function
- Types of functions
- Function Arguments
- Anonymous functions
- Global and local variables
- Using Optional and Named Arguments
- Using type, str, dir, and Other Built-In Functions
- Regular Expressions Using python

Lab Assignments:

Q1. Given a dictionary of students and their favourite colours: people={'Arham':'Blue','Lisa':'Yellow','Vinod':'Purple','Jenny':'Pink'}

1. Find out how many students are in the list
2. Change Lisa's favourite colour
3. Remove 'Jenny' and her favourite colour
4. Sort and print students and their favourite colours alphabetically by name

Write a function translate() that will translate a text into "rövarspråket" (Swedish for "robber's language"). That is, double every consonant and place an occurrence of "o" in between. For example, translate("this is fun") should return the string "tothohisosisosfofunon".

Q.2. Write a function filter_long_words() that takes a list of words and an integer n and returns the list of words that are longer than n

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Session 9

Lecture

Working with Tuples

- Introducing Tuples
- Accessing tuples
- Operations

Lab Assignments:

Q.1. Swap the following two

tuples tuple1 = (11, 22)

tuple2 =

(99, 88) Expected output:

tuple1 = (99, 88)

tuple2 = (11, 22)

Session 10 & 11 (4T + 6L)

Lecture

Advanced Python:

- Object Oriented Python
- OOPs concept
- What's an Object?
- Native Data types
- Declaring variables
- Referencing Variables
- Object References
- Class and object
- Decorators
- Attributes, Inheritance
- Overloading & Overriding
- Data hiding

Lab Assignments:

Q.1. Write a python program using Object oriented programming for the following:

Accept data in following format for salaried employee objects and contract employee.

employee objects:

Salaried employee

12,kishori,training,Manager,1111

13,rajan,game,game

designer,11111

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```
contractemployee
12,esha,insurance,Manager,12,1000.00
13,revati,ux,ux designer,111,1500.00
```

Using inheritance, Create classes as follows: person
----id,name
employee :dept,desg(*person is a parent class*)
salariedemp :sal, bonus (20% of sal) (*employee is a parent class*)
contractemp: hrs worked , hourly charges (*employee is a parent class*)

Store employee data in a list and perform the following function on it.

- a) Add new Employee
- b) Delete employee
- c) Modify salary of employee
- d) Search employee
- e) Calculate Salary of Employee
- f) Display All
- g) Exit ---

Add calculate Sal function in both classes
Formula for calculate Sal for salariedEmp=

Da=10% of sal

Hra=15% of sal

Pf=8% of sal

Net sal=sal+da+hra-pf

Formula for calculate Sal for contract Emp = hrs_worked * hourly charges

Session 12:

Lecture

Operations Exception

- Exception Handling
- Except clause
- Try finally clause
- User Defined Exceptions

Lab Assignments:

Q1. Create a short program that prompts the user for a list of grades separated by commas. Split the string into individual grades and use a list comprehension to convert each string to an integer. Use a “try” statement to inform the user when the values they entered cannot be converted.

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Q2. Investigate what happens when there is a “return” statement in both try clause and finally clause of try statement.

Q3. Create a file named “data.txt”, Open it for reading using python, use try block to catch exception that arises when file doesn't exist.

Session 13

Lecture

- Libraries and Functionality Programming
- Debugging basics
- Logging using Python

Lab Assignments:

Q.1. Write a program for factorial using recursion.

Q.2. Write a code to check the number is Armstrong or not using Lambda Function.

Session 14, 15 & 16

Lecture

- Working with Numpy, Scipy
- Working with Pandas
- Data wrangling with Pandas

Lab Assignments:

Q.1. Numpy assignments - accept 20 numbers from user and store it in a list1, list2, list3, list4 (5 numbers in each list)

Then convert these list into 2 numpy array (list1, list2 in array1 and list3 and list4 in array2) and find member wise addition, multiplication, subtraction also find exponential of first array

Q.2. Complete following

```
program import pandas as pd
mymoviedata=pd.read_table("http://bit.ly/movieusers",sep="|",header=None)
print(mymovie data.head())
```

```
# add headings to the column- sr.no, age, Gender, profession, Views
```

```
#display only column gender
```

```
#add col6 concatenate values of age and gender and separate them by :
```

```
# retrieve values of age and views display bar graph(hint : agewise grouping and find average views) # retrieve values of profession and views display bar graph (use grouping)
```

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Session 17 & 18**Lecture**

- Working with matplotlib seaborn
- Working with ggplot, plotly

Lab Assignments:

Q.1. #create a list for storing year 2010 to 2014

#create a list for each year for storing sales amount for 5 products in each years #draw pie chart and stack graph to compare sales

1. Yearly comparison

Year and max sale in each year

2. Draw separate graph for each year(5 different pie charts) Product and average sale of that product

Session 19**Lecture**

- DB's in Python
- Working on DB using Python

Lab Assignments:

Q1. Create user table in database to store username, address, mobile and email. Add 10 records in the table Write a python program to accept username and address from user check whether user exists in user table. If exists, then display details of user on the screen and if user not found then accept user details and store it in the table

Session 20 & 21**Lecture**

- Web based frameworks: Flask and Django

Lab Assignments:

Q.1. Create website using Flask and Django frameworks.

Q.2.

Session 22**Lecture**

- Request and URL-Lib
- Working with scrapy

Lab Assignments:

Q.1.Extract any website data using Scrapy.