



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Information & Communication Technology

Subject Code : DI04032031

Subject Name : Advance Python

<b>w. e. f. Academic Year:</b>	2025-26
<b>Semester:</b>	4 <sup>th</sup>
<b>Category of the Course:</b>	Professional Elective - I

<b>Prerequisite:</b>	Basic Python Programming
<b>Rationale:</b>	<p>Advanced Python Programming skills are essential for building robust, scalable, and maintainable applications in the Information and Communication Technology (ICT) domain. As an extension of basic Python knowledge, this course delves into advanced concepts that enable developers to manage complex projects efficiently. Python's versatility makes it ideal for creating modular code, handling errors gracefully, managing data persistence through files, implementing sophisticated object-oriented designs, and developing user-friendly graphical interfaces. These skills are crucial in areas such as software engineering, web development, automation tools, data processing systems, and interactive applications in AI and IoT. The Advanced Python Programming course emphasizes practical application of these features, encouraging students to build real-world projects using tools like PIP for dependency management and Tkinter for GUI development. At the end of the course, students will possess the proficiency to design and implement Python applications, preparing them for industry demands in software development and technology innovation.</p>

### Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Create and import Python modules and packages, and manage external libraries using PIP.	R,U,A
02	Handle errors in Python programs using built-in and user-defined exceptions.	R,U,A
03	Perform file operations and object serialization for text and binary files.	R,U,A
04	Apply advanced OOP concepts including inheritance, polymorphism, and encapsulation.	R,U,A
05	Build interactive GUI applications with Tkinter using widgets and event handling.	R,U,A

\*Revised Bloom's Taxonomy (RBT)



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## Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE(V)	
3	0	2	4	70	30	20	30	150

## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	<b>1. Modules and Packages</b> 1.1.1 Introduction to module 1.1.2 Creating user defined module 1.1.3 Importing a module in python - Normal import - From import - From import with * 1.1.4 Module search path 1.2.1 Introduction to Packages 1.2.2 Creating user defined package 1.2.3 Importing a package in python - Normal import - From import - From import with * 1.2.4 Intra-package References 1.3.2 Installing/uninstalling python packages	09	15
2.	<b>2. Exception handling</b> 2.1.1 Introduction to Exception 2.2.1 Types of Exceptions : - Built-in Exceptions - User defined Exceptions 2.3.1 Raising Exceptions 2.4.1 Handling Exceptions - Try clause - Except clause - Finally clause	08	22
3.	<b>3. Files Handling</b> 3.1.1 Introduction to files and its types.	09	18



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	- Binary files - Text files 3.2.1 Opening and Closing Text File 3.2.2 Reading and Writing Files 3.3.1 Setting Offsets in File 3.4.1 Object Serialization - Pickle Module		
4.	<b>4. Advanced OOP Concepts</b> 4.1.1 Inheritance: Single, multilevel, hierarchical,multiple 4.2.1 Polymorphism 4.3.1 Encapsulation: public, private and protected access modifiers 4.4.1 Decorators, Abstract Base Classes (ABC) 4.4.2 Operator Overloading Implementing methods like <code>__add__</code> , <code>__eq__</code> , <code>__lt__</code> for custom operations	09	20
5.	<b>5. GUI Programming with Tkinter</b> 5.1.1 Introduction to Tkinter 5.2.1 Create First Tkinter GUI Application using Tk() and mainloop methods. 5.3.1 Tkinter Widgets: Label, Button, Entry, CheckButton, RadioButton, Listbox, Scrollbar, Menu, ComboBox, Scale, Message, ProgressBar, SpinBox, Text, Canvas 5.3.2 Color Option in Tkinter, Tkinter Geometry Managers:pack(),grid(), place() 5.4.1 Event Handling in Tkinter: Events and Bindings, Key and Mouse Events	10	25
	<b>Total</b>	<b>45</b>	<b>100</b>

## Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
22	28	50	--	--	--

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



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## References/Suggested Learning Resources:

### (a) Books:

Sr. No	Title of the book	Author	Publication
1	Learn Programming in Python with Cody Jackson	Cody Jackson	Packt Publishing, 2018, ISBN : 9781789531947
2	Python Basics: A Practical Introduction to Python 3	David Amos, Dan Bader et. al.	Real Python, 2021 ISBN : 9781775093329
3	Python Crash Course	Eric Matthes	No starch press, 2019, ISBN: 9781593279288
4	Python GUI Programming Cookbook	Burkhard A. Meier	Packt Publishing, 2015, ISBN: 9781785283758
5	Python GUI Programming with Tkinter	Alan D. Moore	Packt Publishing, 2021, ISBN: 9781801815925

### (b) Open source software and website:

1. [www.python.org](http://www.python.org)
2. <https://realpython.com/>
3. <https://www.geeksforgeeks.org/python-programming-language/>
4. <https://docs.python.org/3/>
5. <https://www.pythontutorial.net/>
6. <https://www.codecademy.com/learn/learn-python-3>
7. <https://nptel.ac.in/courses/106106182>
8. <https://www.geeksforgeeks.org/python/python-gui-tkinter/>

### Suggested Course Practical List:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Create and import user-defined modules using different import methods.	I	2
2	Create and import user-defined packages with intra-package references.	I	2
3	Install and uninstall Python packages using PIP and explore module search path.	I	2
4	Handle built-in exceptions using try-except and finally clauses.	II	2
5	Create and raise user-defined exceptions with appropriate handling.	II	2
6	Implement nested try-except blocks and handle multiple exceptions.	II	2
7	Perform file creation, reading, and writing operations with text files.	III	2



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8	Handle binary files and manipulate file offsets using seek().	III	2
9	Serialize and deserialize objects using the Pickle module.	III	2
10	Implement a class hierarchy using single, multilevel, or hierarchical inheritance.	IV	2
11	Apply polymorphism by implementing method overriding and operator overloading.	IV	2
12	Create a class with encapsulation using private and protected attributes.	IV	2
13	Build a basic GUI application with Tkinter using simple widgets and pack() layout.	V	2
14	Handle mouse and key events in a Tkinter GUI application.	V	2
15	Design complex Tkinter GUI layouts using grid() and advanced widgets like Menu.	V	2
<b>Total</b>			<b>30</b>

## List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Computer system with operating system: Windows 10 or higher Ver., macOS, and Linux, with 4GB or higher RAM, Python versions: 3.8.X or higher	All

## Suggested Project List:

Only one micro-project is planned to be undertaken by each student and should be assigned at the beginning of the semester. During the first four semesters, micro-projects are generally group-based. However, in the fifth and sixth semesters, they should preferably be undertaken individually to enhance problem-solving ability, confidence, and independent learning so that the student can contribute effectively to industry-oriented projects. In exceptional cases, groups may be formed, but the number of students in a group should not exceed three. The micro-project may be industry application-based, internet-based, workshop-based, laboratory-based, or field-based. Each micro-project should integrate two or more Course Outcomes (COs) by combining Practical Outcomes (PrOs), Unit Outcomes (UOs), and Affective Domain Outcomes (ADOs). Each student is required to maintain a dated work diary documenting individual contributions and must give a seminar presentation before the final submission. The duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course. The final submission of the micro-project at the end of the semester is mandatory to ensure the development of industry-relevant COs.



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- A suggestive list of micro-projects is given here. This should be in line with the required competencies and COs. Additional micro-projects may be suggested by the concerned course teacher:
- **Case Study 1:** Create a user-defined Python package with multiple modules, demonstrate different import techniques, and show real-world application.
- **Case Study 2:** Develop a small project that demonstrates raising and handling user-defined exceptions for validating user inputs.
- **Case Study 3:** Implement a file-based application (such as a mini library system) that uses file reading/writing and object serialization with the pickle module.
- **Case Study 4:** Develop a Python application demonstrating advanced OOP concepts, such as a class hierarchy with inheritance, polymorphism, and encapsulation, for a real-world scenario like a banking system or inventory management.
- **Case Study 5:** Build a simple Tkinter-based GUI application (like a calculator or student information form) that uses widgets, geometry managers, and event handling.

### **Suggested Activities for Students:**

- a) Analyze sample Python code for common exception scenarios and propose improved handling strategies using try-except-finally blocks.
- b) Undertake micro-projects in teams, such as developing a modular package for data processing or a Tkinter-based dashboard.
- c) Students are encouraged to register themselves in various MOOCs such as: Swayam, edX, Coursera, Udemy etc. to further enhance their learning on topics like advanced OOP in Python or Tkinter GUI development.
- d) Survey and document real-world applications using Python file handling and serialization, such as in data logging systems or configuration management tools.
- e) Encourage students to participate in different coding competitions like hackathons focused on GUI apps or OOP design challenges on platforms like HackerRank or LeetCode.
- f) Encourage students to form a Python enthusiasts club at institute level, where they can collaborate on peer reviews of exception-safe code or Tkinter prototypes to support slow learners.

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