



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Subject Code: BE04000131

Subject Name: Python for Engineers

WEF Academic Year:	2024 - 2025
Semester:	4
Category of the Course:	Professional Core Course

<b>Prerequisite:</b>	Fundamentals of computer operation, algorithmic thinking, and basic mathematical concepts such as variables, operators, and logical expressions.
<b>Rationale:</b>	Python is a versatile and beginner-friendly programming language widely used in engineering, data science, automation, and web development. Introducing Python at an early stage equips students with essential computational thinking and problem-solving skills, enabling them to design efficient algorithms and develop practical software solutions across various engineering domains.

### Course Outcome:

After Completion of the Course, Student will be able to:

No	Course Outcomes	RBT Level*
01	Understand the basic concepts of Python such as variables, data types, and operators.	RM/UN
02	Understand and apply decision-making statements and loops to solve simple problems.	UN/AP
03	Create and use functions, modules, and packages in Python programs.	CR
04	Understand file handling and write programs to read, write, and handle files and errors.	UN/AP
05	Create programs using Python libraries like Pandas, NumPy, and Matplotlib to work with data and make basic visualizations.	AP/CR

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

### Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
L	T	P	PBL*	TH		Theory		Tutorial / Practical			
						ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
45	0	30	15	90	03	70	30	20	30	50	200

\* Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.



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## Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	<b>Introduction, Data Types and Operators:</b> 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	10	22
2	<b>Python Decision making and Loops:</b> Write conditional statements using If statement, if ...else statement, elif 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.	10	22
3	<b>Python Functions and Modules:</b> Defining custom functions, Organizing 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	10	22
4	<b>Python File Operations:</b> An introduction to file I/O, use text files, use CSV files, use binary files, Handle a single exception, handle multiple exceptions, Illustrative programs, Exercises	5	12
5	<b>Python Libraries:</b> <b>Pandas:</b> Introduction, Data structure- series in pandas- creation of series from dictionary, Accessing elements of series – Indexing & slicing, Mathematical operations on two series- addition, subtraction, multiplication, division. Dataframes- Creation of data frame- empty, from NumPy, from list of dictionaries, from series, from dictionary of series, operations on rows & columns in dataframes. <b>NumPy:</b> Creating NumPy arrays, NumPy array indexing, element wise operations like addition, subtraction, multiplication and division on NumPy arrays. Unary operation, binary operation, NumPy ufuncs, sorting arrays, operation on matrix. <b>Matplotlib:</b> Line plot, Bar chart, scatter plot, plotting images and multiple subplots.	10	22
	<b>Total</b>	<b>45</b>	<b>100</b>



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## Reference Book:

1. “Introduction to Python for Science and Engineering” by David J. Pine, CRC Press.
2. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India
3. Python Programming Fundamentals- A Beginner's Handbook by Nischay Kumar Hegde
4. Kenneth A. Lambert, “Fundamentals of Python – First Programs”, CENGAGE Publication
5. Introduction to Python for Engineers and Scientists, By. Sandeep Nagar, Apress
6. “Python Data Science Handbook”, by Jake VanderPlas, O'Reilly Media

## Suggested Course Practical List:

1. Write a program to demonstrate Python variables, data types, and basic input/output.
2. Write a program to perform arithmetic, logical, relational, identity, membership, and bitwise operations.
3. Write a program to demonstrate list, tuple, and string operations (indexing, slicing, updating, deleting).
4. Write a program using if, if-else, and if-elif statements to check number properties (e.g., even/odd, largest of three).
5. Write a program to demonstrate the use of for loop and while loop with examples like factorial, prime check, etc.
6. Write a program to use break, continue, and pass statements in loops.
7. Write a program to demonstrate functions: with/without arguments, return values, and scope of variables.
8. Create your own module and import it in another Python file.
9. Write a program to demonstrate working with lists, tuples, dictionaries (create, access, modify).
10. Write a program to demonstrate file handling: read/write text files.
11. Write a program to read from and write to a CSV file.
12. Write a program to handle exceptions using try, except, finally, and multiple exceptions.
13. Write a program using NumPy for array creation, indexing, slicing, and basic operations (add, subtract, multiply).
14. Write a program using Pandas to create and manipulate Series and DataFrames.
15. Write a program using Matplotlib to plot line graphs, bar charts, and scatter plots with labels and legends.

## List of Laboratory/Learning Resources Required:

1. Common Lab Manual (DTE)
2. Virtual Laboratory (vLab.co.in)
3. NPTEL Website



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• **Activities suggested under Problem Based Learning:**

Sr. No.	Name of the activity	No. of hours per activity	Evaluation Criteria
1.	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
2.	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
3.	Assignment writing. Numerical based assignment is preferable.	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.
4.	Problem solving/Coding using C, C++, Python, SCILAB, MATLAB, MS-EXCEL or any other relevant software	5 small coding-based assignment of 2h each. Total = 10h	Based on the coding solution submitted.
5.	Self-learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of course. Based on the certificate produced.
6.	Complex problem solving	Maximum 2 problem. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
7.	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
8.	Discussion on research paper based on relevant subject	5 research paper = 20 h	Summarize research paper and evaluation critical parameters
9.	Poster/chart/power point preparation on technical topics	Duration = 6 h	Based on poster/chart preparation and presentation skills
10.	Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation
11.	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/any other issue	Duration = 15 h for industrial exposure  Problem identification and tentative solution = 10 h Total = 20 h	Based on evaluation of critical problems and solutions



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12	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.
13.	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
14.	Application/Software development	Duration = 10 h	Depending on the complexity of the Application/Software
15	Online Technical Quizzes/Simulations	Multiple quizzes summing up to 10h	Based on quiz scores and reflection report after each quiz.
16	Patent Search and Innovation Gap Identification	10h (Search + Report)	Based on number of relevant patents analyzed and identification of innovation scope.

Note:

- All the suggested activities should be related to the subject.
- Subject coordinator shall identify activities from above list as per the subject needs, they also declare list of activities wise hours, evaluation scheme and rubrics to students at the start of semester.
- The number of hours is suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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