Python Essentials Learning Objectives

By the end of this course, students will be able to:

- Apply fundamental Python programming concepts to solve real-world problems.
- Work effectively with various data structures and manipulate data efficiently.
- Utilize Pandas for data analysis and manipulation, including data cleaning, transformation, and aggregation.
- Use SQL to interact with databases and retrieve relevant data.
- Scrape data from websites using Python libraries like BeautifulSoup and Requests.
- Store and retrieve data in different formats, such as databases, CSV, and JSON files.
- Create informative and visually appealing data visualizations using Matplotlib and Seaborn.
- Develop a comprehensive data pipeline to collect, clean, analyze, and visualize data.
- Apply ethical considerations when working with data, including privacy, bias, and fairness.
- Collaborate effectively with others on data-driven projects.

Week	Topic	Learning Objective
1	Intro to Python	Students will learn foundational Python programming skills, including setting up a development environment, writing and executing Python code, and using core programming concepts such as variables, data types, operators, functions, and control flow structures. They will also be introduced to debugging techniques and error handling to help identify and resolve problems in their code.
2	Data Structures and File Handling	Students will explore core Python data structures such as lists, tuples, dictionaries, and sets. They will also learn how to read and write to text and CSV files, use external modules, capture keyboard input, interact with the operating system, and manage project dependencies using virtual environments.
3	Intro to Data Engineering	Students will learn to load, preview, and inspect datasets in Pandas by reading data from common formats (CSV, JSON, dictionaries) and summarizing data structure using Pandas methods to support efficient data analysis.
4	Data Wrangling and Aggregation	Students will learn to manipulate, summarize, and combine datasets in Pandas using selection, aggregation, merging, and transformation methods. They will practice accessing specific data, performing group-level calculations, and combining data from multiple sources.
5	Data Cleaning and Validation I	Students will learn essential data cleaning and transformation techniques in Pandas, including handling missing values, outliers, and duplicates. They will also use pivot tables, the `apply()` method, and column-wise operations to reshape and enrich datasets.
6	Data Cleaning and Validation II	Students will learn to clean and standardize real-world datasets using Pandas. They will handle missing data, outliers, duplicates, inconsistent formatting, and categorical variables, while also applying transformations and basic feature engineering techniques to prepare data for analysis or modeling.
7	Intro to Databases and SQL	Students will gain foundational knowledge of SQL databases using Python and SQLite. They will define relational schemas, insert and query data using SQL, handle many-to-many relationships, and interact with databases directly from Pandas for analysis and reporting.
8	Advanced SQL and Database Integration	Students will deepen their understanding of SQL by learning advanced techniques such as subqueries, complex JOINs, aggregation with functions, and using HAVING for conditional filtering. This lesson also introduces performance optimization techniques, transactions, parameterized queries, window functions, and more.

9	Intro to Web Scraping	Students will gain a comprehensive understanding of web scraping, focusing on the fundamentals such as HTML structure, DOM representation, and using Python libraries like Selenium and WebDriver Manager to scrape and extract data from web pages. Additionally, students will explore the ethical aspects of web scraping, including adhering to guidelines provided by robots.txt and managing server requests responsibly.
10	Data Storage and Retrieval	Students will learn to create and customize both basic and advanced data visualizations using Python libraries such as Matplotlib and Seaborn. By the end of this lesson, students will be able to effectively tell stories with data using visual representation, enhancing their ability to communicate insights.
11	Data Visualization	Students will be able to create both static and interactive data visualizations using Python libraries such as Pandas, Plotly, and Dash. They will practice working in their own repositories, explore key chart types, and build a simple dashboard to support real-time data exploration. Optional materials introduce Streamlit as an alternative dashboarding tool.
12	More Python Skills	Students will learn and apply key advanced Python concepts including decorators, list comprehensions, closures, and custom class definitions. They will learn how to write cleaner, more modular code using these features and gain insight into how such patterns are used in real-world frameworks like Dash.
13	Kaggle Dataset Project	By completing this project, students will demonstrate their ability to load, clean, analyze, and visualize real-world data using Python. They will apply core programming skills, data wrangling techniques, and effective visualization practices to extract and communicate insights. Students will also build fluency with project structure, code clarity, and reproducibility standards in preparation for real-world data work.
14	Final Project Week 1	By completing this project, students will build a complete data pipeline—from extracting raw data via web scraping to delivering an interactive dashboard. They will develop skills in using Selenium for automated data collection, cleaning and transforming scraped data with Pandas, and building user-facing data visualizations with tools like Streamlit or Dash. The project emphasizes robust scraping practices, code clarity, and effective communication of insights through a responsive, well-documented web app.
15	Final Project Week 2	Students will articulate the goals, methods, and insights of their web scraping projects through a presentation, demonstrating both technical understanding and communication skills. They will also complete a summative Python assessment to reinforce core concepts such as functions, data structures, file handling, and data analysis, ensuring readiness for independent work or continued study in data-driven projects.