# Python Data Integration: SQL, SQLite, Pandas & NumPy

**Duration:** 5 Days

## Day 1: SQL Fundamentals

### Module 1: Relational Database and SQL Basics

- Database basics
- Relational database
- Tables
- Rows and columns
- Primary key
- Database connection
- SQL syntax
- CRUD overview
- Basic data types

**Lab Exercises:**

1. Create a simple database and table using basic SQL.
2. Insert and view sample records using basic SQL commands.

### Module 2: SQL CRUD Operations

- CREATE TABLE
- INSERT
- SELECT
- WHERE
- UPDATE
- DELETE
- ORDER BY
- LIMIT
- NULL values

**Lab Exercises:**

3. Perform INSERT, SELECT, UPDATE and DELETE on a sample table.
4. Build a simple CRUD dataset and verify each database operation.

## Day 2: SQLite with Python

### Module 3: Python Database Connectivity

- Database connection
- Connection parameters
- Database driver
- Cursor
- SQL execution
- Query parameters
- Fetch results
- Commit
- Close connection

**Lab Exercises:**

5. Connect Python to SQLite and execute a basic SQL query.
6. Create a reusable Python database connection and fetch records.

### Module 4: CRUD with Python and SQLite

- INSERT from Python
- SELECT from Python
- UPDATE from Python
- DELETE from Python
- WHERE parameters
- Parameterized queries
- CRUD functions
- Error handling
- Transactions

**Lab Exercises:**

7. Build Python functions for INSERT, SELECT, UPDATE and DELETE.
8. Create a simple Python CRUD program using SQLite and SQL queries.

## Day 3: Playing with Data

### Module 5: Multiple Data Handling with Database

- Relational Databases
- CSV
- Web data
- JSON
- Data Serialization
- Data Interchange Formats
- JSON Syntax

**Lab Exercises:**

9. Read sample CSV, JSON and XML data and prepare it for Pandas processing.
10. Combine external data with SQL database data using Pandas and prepare a final dataset.

### Module 6: Advance Data Handling

- JSON Serialization
- JSON Deserialization
- XML
- ElementTree
- XML Processing
- CSV Reading
- CSV Writing
- CSV Best Practices
- Pandas Integration

**Lab Exercises:**

11. JSON & XML Processing: Read, deserialize, and process basic data from JSON and XML files using Python.
12. CSV & Pandas Integration: Read CSV data, perform basic cleaning with Pandas, and export the processed data back to CSV.

# Day 4: Pandas with SQL Databases

## Module 7: Reading SQL Data with Pandas

- Pandas with SQL
- Database connection
- read_sql()
- SQL query to DataFrame
- Table to DataFrame
- Column selection
- Row filtering
- Data inspection
- Basic analysis

**Lab Exercises:**

13. Read SQL query results into a Pandas DataFrame.
14. Filter and analyse database records using Pandas.

## Module 8: Pandas Data Processing and SQL

- DataFrame processing
- Missing values
- Duplicate records
- Column handling
- Data filtering
- Group operations
- Data conversion
- DataFrame to SQL
- to_sql()

**Lab Exercises:**

15. Process database data with Pandas and clean selected records.
16. Update a database table using processed Pandas data.

# Day 5: NumPy with SQL and Data Integration

## Module 9: NumPy with SQL Database Data

- SQL results
- NumPy conversion
- Numeric columns
- Array creation
- Array filtering
- Array calculations
- Database analysis
- Pandas + NumPy

**Lab Exercises:**

17. Convert selected SQL database data into NumPy arrays.
18. Use NumPy for a numeric calculation on database data and review the result.

## Module 10: Aeronautics Data Project

- Aircraft records
- Flight records
- Aircraft ID
- Flight date
- Flight hours
- Fuel usage

**Lab Exercises:**

19. Build a simple Aircraft Flight Log application using SQLite and Python to add, view, update and delete aircraft flight records.
20. Read the flight data into Pandas, calculate basic flight-hour and fuel-usage statistics with NumPy, and generate a simple summary report.