



To discuss this course and customizations:  
Call: 434-509-5680 or Email: [sales@cloudcontraptions.com](mailto:sales@cloudcontraptions.com)

## PostgreSQL for Python Programmers

### Class Duration

14 hours of live training delivered over 2-4 days to accommodate your scheduling needs

### Student Prerequisites

- Experience with Python programming is required
- No prior experience with PostgreSQL is necessary
- Students should have a basic understanding of SQL and relational databases

### Target Audience

Designed for software and data engineers, Python developers, analytics engineers, and DB-adjacent SREs working on production systems. Technical leads and engineering managers evaluating database choices will also benefit. Attendees should be comfortable with programming fundamentals and seek to improve query performance, data modeling, security posture, and Python-PostgreSQL data pipelines to accelerate delivery and impact business KPIs.

### Description

This live, hands-on course equips engineers to deliver fast, reliable, and secure applications on PostgreSQL. Participants progress from setup and architecture to SQL mastery and sound schema design, then dive into query optimization with EXPLAIN/ANALYZE and indexing to cut latency and cost. You'll harden deployments with roles, authentication, and encryption, and master concurrency with ACID, isolation levels, locking, and MVCC. The course finishes by operationalizing PostgreSQL from Python—using psycopg2, SQLAlchemy, and pandas to move data efficiently, manage transactions, work with JSON and vectors, and keep integrity and performance aligned. The result: teams build features faster, ship safer, and turn data into business outcomes.



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## Learning Objectives

- Install PostgreSQL on major operating systems, perform initial configuration, and manage core server settings and tablespaces.
- Write correct, idiomatic SQL in PostgreSQL: data types, DDL (create/alter/drop), and CRUD operations.
- Compose advanced queries using joins, subqueries, CTEs, aggregates, and both built-in and user-defined functions and operators.
- Design robust schemas with ER modeling, applying normalization and strategic denormalization for real-world use cases.
- Diagnose and tune performance with EXPLAIN/ANALYZE, select effective indexing strategies, and apply configuration tuning.
- Manage transactions and concurrency with ACID principles, isolation levels, locks, and MVCC; troubleshoot contention safely.
- Secure databases with roles/RBAC, pg\_hba.conf authentication, and SSL/TLS encryption to meet enterprise standards.
- Build production data workflows in Python: psycopg2 and SQLAlchemy CRUD and transactions, pandas read\_sql/to\_sql at scale, handle JSON and vector data, and align data types and indexes for speed and integrity.

## Training Materials

All students receive comprehensive courseware covering all topics in the course. Courseware is distributed via GitHub in the form of documentation and extensive code samples. Students practice the topics covered through challenging hands-on lab exercises. Students will need a free, personal GitHub account to access the courseware. Student will need permission to install Docker Desktop, Visual Studio Code, and Visual Studio Code Extensions on their computers. If students are unable to configure a local environment, a cloud-based environment can be provided.

## Software Requirements

Students will need a free, personal GitHub account to access the courseware. Student will need permission to install Docker Desktop, Visual Studio Code, and Visual Studio Code Extensions on their computers. If students are unable to configure a local environment, a cloud-based environment can be provided.



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## Training Topics

### PostgreSQL

- Overview of PostgreSQL
- Key Features and Benefits
- Use Cases in the Industry

### Setting Up PostgreSQL

- Installing PostgreSQL on Different Operating Systems
- Basic Configuration and Post-Installation Setup

### PostgreSQL Architecture

- System Architecture and Process Model
- Data Storage and Tablespaces

### Basic SQL with PostgreSQL

- Basic SQL Syntax and Data Types
- Creating, Altering, and Dropping Tables
- CRUD Operations (Create, Read, Update, Delete)

### Advanced SQL Techniques

- Complex Queries: Joins, Subqueries, and Common Table Expressions (CTEs)
- Functions and Operators: Built-in and User-Defined
- Aggregate Functions and Grouping

### Database Design and Modeling

- Normalization and Denormalization
- Entity-Relationship Modeling and Schema Design

### Performance Tuning and Optimization

- Using EXPLAIN and ANALYZE for Query Optimization
- Indexing Strategies and Index Maintenance
- Performance Tips and Configuration Tuning

### Concurrency and Transactions

- Transactions, ACID Properties, and Isolation Levels
- Locking Mechanisms and Concurrency Control
- Multi-Version Concurrency Control (MVCC)



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### Security and Authentication

- User Management and Role-Based Access Control
- Authentication Methods and Configuring `pg_hba.conf`
- Data Encryption Techniques and SSL/TLS Configuration

### Python Programming with PostgreSQL

- Setting Up Psycopg2
- Connecting to PostgreSQL from Python
- Performing CRUD Operations with Python
- Using SQLAlchemy with PostgreSQL
- Handling Transactions in Python
- Working with JSON Data
- Working with Vectors

### Loading Data from PostgreSQL into Pandas

- Writing SQL Queries to Retrieve Data
- Using `pandas.read_sql()` to Load Data
- Handling Large Datasets Efficiently

### Writing Data from Pandas to PostgreSQL

- Creating New Tables from DataFrames
- Inserting and Updating Data in Existing Tables
- Using `pandas.to_sql()` for Efficient Data Transfers

### Handling Data Types and Indexes

- Mapping Data Types Between Pandas and PostgreSQL
- Ensuring Data Integrity and Consistency
- Managing Indexes for Optimized Performance

### Extending PostgreSQL

- Using Procedural Languages: PL/pgSQL, PL/Python, PL/Perl
- Working with Extensions and Modules
- Popular Extensions (PostGIS, hstore, etc.)