TECHNOCATION FREELANCING TRAINING INSTITUTE & SOFTWARE HOUSE

Professional PostgreSQL Course Outline

Module 1: Introduction to PostgreSQL

- Overview of PostgreSQL & Its Features
- Installing & Setting Up PostgreSQL (Windows, macOS, Linux)
- Understanding PostgreSQL Architecture
- PostgreSQL vs. Other Databases (MySQL, SQL Server, Oracle)
- Connecting to PostgreSQL (pgAdmin, psql, DBeaver)

Module 2: Database & Table Management

- Creating & Deleting Databases (`CREATE DATABASE`, `DROP DATABASE`)
- Understanding Schemas & Namespaces
- Creating, Modifying & Dropping Tables (`CREATE TABLE`, `ALTER TABLE`, `DROP TABLE`)
- Understanding Data Types (Numeric, Text, Date/Time, JSON, Arrays)
- Working with Constraints (`PRIMARY KEY`, `FOREIGN KEY`, `CHECK`, `UNIQUE`, `NOT NULL`)

Module 3: Data Manipulation & Querying

- Inserting & Updating Records (`INSERT`, `UPDATE`, `DELETE`)
- Selecting & Filtering Data (`SELECT`, `WHERE`, `ORDER BY`, `LIMIT`)
- Using Aggregate Functions (`COUNT()`, `SUM()`, `AVG()`, `MAX()`, `MIN()`)
- Grouping Data with `GROUP BY` & Filtering with `HAVING`
- Working with Subqueries & Joins (`INNER JOIN`, `LEFT JOIN`, `RIGHT JOIN`, `FULL OUTER JOIN`)

Module 4: Indexing & Query Optimization

- Understanding Indexing in PostgreSQL (`B-Tree`, `Hash`, `GIN`, `BRIN`)
- Creating & Managing Indexes (`CREATE INDEX`, `DROP INDEX`)
- Using EXPLAIN & EXPLAIN ANALYZE for Query Performance Analysis
- Optimizing Queries for Performance (Partitioning, Caching, Indexing)
- Working with Materialized Views

Module 5: Transactions & Concurrency Control

- Understanding ACID Properties in PostgreSQL
- Working with Transactions (`BEGIN`, `COMMIT`, `ROLLBACK`, `SAVEPOINT`)
- Handling Locks (`Row-Level Locking`, `Table-Level Locking`, `Deadlocks`)
- Using Isolation Levels (`READ COMMITTED`, `REPEATABLE READ`, `SERIALIZABLE`)
- Optimistic vs. Pessimistic Concurrency Control

Module 6: Advanced PostgreSQL Features

- Working with JSON & JSONB in PostgreSQL
- Full-Text Search Implementation (`tsvector`, `tsquery`)
- Using Arrays & HStore for Key-Value Storage
- Working with Window Functions (`RANK()`, `DENSE_RANK()`, `ROW_NUMBER()`)
- Implementing Common Table Expressions (CTEs)

Module 7: PostgreSQL Administration & Security

- Managing Users & Roles (`CREATE USER`, `GRANT`, `REVOKE`)
- Securing PostgreSQL with Authentication (`MD5`, `SCRAM-SHA-256`, SSL)
- Configuring PostgreSQL for High Availability & Load Balancing
- Implementing Database Backups & Restorations (`pg_dump`, `pg_restore`)
- Monitoring & Logging PostgreSQL Performance

Module 8: Stored Procedures & Triggers

- Creating & Executing Stored Procedures (`PL/pgSQL`)

- Working with Functions (`CREATE FUNCTION`, `RETURNS`, `LANGUAGE SQL`)
- Implementing Triggers for Automation (`BEFORE`, `AFTER`, `INSTEAD OF`)
- Using Event Triggers for System-Level Actions
- Optimizing Stored Procedures for Performance

Module 9: PostgreSQL for Data Science & Analytics

- Working with PostgreSQL's Statistical & Analytical Functions
- Using PostgreSQL with Python (`psycopg2`, `SQLAlchemy`)
- Handling Time-Series Data in PostgreSQL
- Integration with BI Tools (Power BI, Tableau, Metabase)
- Implementing PostgreSQL for Big Data & ETL Processes

Module 10: PostgreSQL for Web & Application Development

- Integrating PostgreSQL with Django, Flask, and Node.js
- Working with ORMs (SQLAlchemy, Django ORM, Prisma)
- Designing Scalable & Normalized Database Schemas
- Implementing RESTful APIs with PostgreSQL as a Backend
- Deploying PostgreSQL on Cloud Platforms (AWS RDS, Google Cloud SQL, Azure)

Module 11: Replication, Clustering & Scaling PostgreSQL

- Understanding Replication & High Availability in PostgreSQL
- Configuring Streaming Replication (`Primary-Replica Setup`)
- Working with Logical Replication & Foreign Data Wrappers
- Implementing PostgreSQL Clustering Solutions (Patroni, Citus, Pgpool-II)
- Scaling PostgreSQL for Large-Scale Applications

Real-World Projects & Deployment

- Designing a PostgreSQL-Powered E-Commerce Database
- Building a Financial Transactions System with PostgreSQL
- Creating an Analytics Dashboard Using PostgreSQL & Power BI
- Developing a Scalable Microservices Architecture with PostgreSQL

- Deploying a High-Availability PostgreSQL Database in Production