



## Oracle SQL and PL/SQL

Structured Query Language (SQL) and PL/SQL (Procedural Language/Structured Query Language) are used in Oracle Database Management. While SQL is the language used to communicate with a database, PL/SQL is used to combine database and procedural programming language. At run-time, both the languages run within the same server process ensuring optimum efficiency.

### What are the benefits of SQL and PL/SQL?

- SQL makes the complex jobs of modifying tables and index structures, adding or deleting rows of data, etc. a lot easier.
- PL/SQL can be compiled once and stored in executable form, this speeds up the response time of the system.
- The Block Structure, Improved Performance and Error Handling – are the reasons why PL/SQL is heavily relied upon in the IT world.

### Why to learn SQL & PL/SQL?

- SQL is used extensively by database administrators, developers and data analysts.
- SQL and PL/SQL will prepare you to become a programmer by giving you a good solid foundation.
- PL/SQL could be used with PHP, Java, Python, .NET, Hadoop, Node.js etc., thus, giving you a wide choice of technology to opt for.

## Course Syllabus

### 1) Introduction to Oracle Database

- List the features of Oracle Database 11g
- Discuss the basic design, theoretical, and physical aspects of a relational database
- Categorize the different types of SQL statements
- Describe the data set used by the course
- Log on to the database using SQL Developer environment
- Save queries to files and use script files in SQL Developer

## 2) Retrieve Data using the SQL SELECT Statement

- List the capabilities of SQL SELECT statements
- Generate a report of data from the output of a basic SELECT statement
- Select All Columns
- Select Specific Columns
- Use Column Heading Defaults
- Use Arithmetic Operators
- Understand Operator Precedence
- Learn the DESCRIBE command to display the table structure

## 3) Learn to Restrict and Sort Data

- Write queries that contain a WHERE clause to limit the output retrieved
- List the comparison operators and logical operators that are used in a WHERE clause
- Describe the rules of precedence for comparison and logical operators
- Use character string literals in the WHERE clause
- Write queries that contain an ORDER BY clause to sort the output of a SELECT statement
- Sort output in descending and ascending order

## 4) Usage of Single-Row Functions to Customize Output

- Describe the differences between single row and multiple row functions
- Manipulate strings with character function in the SELECT and WHERE clauses
- Manipulate numbers with the ROUND, TRUNC, and MOD functions
- Perform arithmetic with date data
- Manipulate dates with the DATE functions

## 5) Invoke Conversion Functions and Conditional Expressions

- Describe implicit and explicit data type conversion
- Use the TO\_CHAR, TO\_NUMBER, and TO\_DATE conversion functions
- Nest multiple functions
- Apply the NVL, NULLIF, and COALESCE functions to data
- Use conditional IF THEN ELSE logic in a SELECT statement

## 6) Aggregate Data Using the Group Functions

- Use the aggregation functions in SELECT statements to produce meaningful reports
- Divide the data in groups by using the GROUP BY clause
- Exclude groups of data by using the HAVING clause

## 7) Display Data from Multiple Tables Using Joins

- Create a simple and complex view
- Retrieve data from views
- Create, maintain, and use sequences
- Create and maintain indexes
- Create private and public synonyms

## 8) Use Sub-queries to Solve Queries

- Describe the types of problem that sub-queries can solve
- Define sub-queries
- List the types of sub-queries
- Write single-row and multiple-row sub-queries

## 9) The SET Operators

- Describe the SET operators
- Use a SET operator to combine multiple queries into a single query
- Control the order of rows returned

## 10) Data Manipulation Statements

- Describe each DML statement
- Insert rows into a table
- Change rows in a table by the UPDATE statement
- Delete rows from a table with the DELETE statement
- Save and discard changes with the COMMIT and ROLLBACK statements
- Explain read consistency

## 11) Use of DDL Statements to Create and Manage Tables

- Categorize the main database objects
- Review the table structure
- List the data types available for columns
- Create a simple table
- Decipher how constraints can be created at table creation
- Describe how schema objects work

## 12) Other Schema Objects

- Create a simple and complex view
- Retrieve data from views
- Create, maintain, and use sequences
- Create and maintain indexes
- Create private and public synonyms

## 13) Control User Access

- Differentiate system privileges from object privileges
- Create Users
- Grant System Privileges
- Create and Grant Privileges to a Role
- Change Your Password
- Grant Object Privileges
- How to pass on privileges?
- Revoke Object Privileges

## 14) Management of Schema Object

- Add, Modify and Drop a Column
- Add, Drop and Defer a Constraint
- How to enable and disable a Constraint?

- Create and Remove Indexes
- Create a Function-Based Index
- Perform Flashback Operations
- Create an External Table by Using ORACLE\_LOADER and by Using ORACLE\_DATAPUMP
- Query External Tables

## 15) Manage Objects with Data Dictionary Views

- Explain the data dictionary
- Use the Dictionary Views
- USER\_OBJECTS and ALL\_OBJECTS Views
- Table and Column Information
- Query the dictionary views for constraint information
- Query the dictionary views for view, sequence, index and synonym information
- Add a comment to a table
- Query the dictionary views for comment information

## 16) Manipulate Large Data Sets

- Use Sub queries to Manipulate Data
- Retrieve Data Using a Sub query as Source
- Insert Using a Sub query as a Target
- Usage of the WITH CHECK OPTION Keyword on DML Statements
- List the types of Multi table INSERT Statements
- Use Multi table INSERT Statements
- Merge rows in a table
- Track Changes in Data over a period of time

## 17) Data Management in Different Time Zones

- Time Zones
- CURRENT\_DATE, CURRENT\_TIMESTAMP, and LOCALTIMESTAMP
- Compare Date and Time in a Session's Time Zone
- DBTIMEZONE and SESSIONTIMEZONE
- Difference between DATE and TIMESTAMP
- INTERVAL Data Types
- Use EXTRACT, TZ\_OFFSET and FROM\_TZ
- Invoke TO\_TIMESTAMP, TO\_YMINTERVAL and TO\_DSINTERVAL

## 18) Retrieve Data Using Sub-queries

- Multiple-Column Sub queries
- Pairwise and No pairwise Comparison
- Scalar Sub query Expressions
- Solve problems with Correlated Sub queries
- Update and Delete Rows Using Correlated Sub queries
- The EXISTS and NOT EXISTS operators
- Invoke the WITH clause
- The Recursive WITH clause

## 19) Regular Expression Support

- Use the Regular Expressions Functions and Conditions in SQL
- Use Meta Characters with Regular Expressions
- Perform a Basic Search using the REGEXP\_LIKE function
- Find patterns using the REGEXP\_INSTR function
- Extract Substrings using the REGEXP\_SUBSTR function
- Replace Patterns Using the REGEXP\_REPLACE function
- Usage of Sub-Expressions with Regular Expression Support
- Implement the REGEXP\_COUNT function

EXPERIENCE BEYOND IT TRAINING

## Oracle PL/SQL Training Outline

### 1) Introduction

- Course Objectives
- Course Agenda
- Human Resources (HR) Schema
- Introduction to SQL Developer

### 2) Introduction to PL/SQL

- PL/SQL Overview
- Benefits of PL/SQL Subprograms
- Overview of the Types of PL/SQL blocks
- Create a Simple Anonymous Block
- Generate Output from a PL/SQL Block

### 3) PL/SQL Identifiers

- List the different Types of Identifiers in a PL/SQL subprogram
- Usage of the Declarative Section to define Identifiers
- Use variables to store data
- Identify Scalar Data Types
- The %TYPE Attribute
- What are Bind Variables?
- Sequences in PL/SQL Expressions

### 4) Write Executable Statements

- Describe Basic PL/SQL Block Syntax Guidelines
- Comment Code
- Deployment of SQL Functions in PL/SQL
- How to convert Data Types?
- Nested Blocks
- Identify the Operators in PL/SQL

### 5) Interaction with the Oracle Server

- Invoke SELECT Statements in PL/SQL to Retrieve data
- Data Manipulation in the Server Using PL/SQL
- SQL Cursor concept
- Usage of SQL Cursor Attributes to Obtain Feedback on DML
- Save and Discard Transactions

### 6) Control Structures

- Conditional processing Using IF Statements
- Conditional processing Using CASE Statements
- Use simple Loop Statement
- Use While Loop Statement
- Use For Loop Statement
- Describe the Continue Statement

### 7) Composite Data Types

- Use PL/SQL Records
- The %ROWTYPE Attribute
- Insert and Update with PL/SQL Records
- Associative Arrays (INDEX BY Tables)
- Examine INDEX BY Table Methods



- Use INDEX BY Table of Records

## 8) Explicit Cursors

- What are Explicit Cursors?
- Declare the Cursor
- Open the Cursor
- Fetch data from the Cursor
- Close the Cursor
- Cursor FOR loop
- Explicit Cursor Attributes
- FOR UPDATE Clause and WHERE CURRENT Clause

## 9) Exception Handling

- Understand Exceptions
- Handle Exceptions with PL/SQL
- Trap Predefined Oracle Server Errors
- Trap Non-Predefined Oracle Server Errors
- Trap User-Defined Exceptions
- Propagate Exceptions
- RAISE\_APPLICATION\_ERROR Procedure

## 10) Stored Procedures and Functions

- Understand Stored Procedures and Functions
- Differentiate between anonymous blocks and subprograms
- Create a Simple Procedure
- Create a Simple Procedure with IN parameter
- Create a Simple Function
- Execute a Simple Procedure
- Execute a Simple Function

## 11) Create Stored Procedures

- Create a Modularized and Layered Subprogram Design
- Modularize Development With PL/SQL Blocks
- Describe the PL/SQL Execution Environment
- Identity the benefits of Using PL/SQL Subprograms
- List the differences Between Anonymous Blocks and Subprograms
- Create, Call, and Remove Stored Procedures Using the CREATE Command and SQL

- Developer Implement Procedures Parameters and Parameters Modes
- View Procedures Information Using the Data Dictionary Views and SQL Developer

## 12) Create Stored Functions

- Create, Call, and Remove a Stored Function Using the CREATE Command and SQL Developer
- Identity the advantages of Using Stored Functions in SQL Statements
- List the steps to create a stored function
- Implement User-Defined Functions in SQL Statements
- Identity the restrictions when calling Functions from SQL statements
- Control Side Effects when calling Functions from SQL Expressions
- View Functions Information

## 13) Create Packages

- Identity the advantages of Packages
- Describe Packages
- List the components of a Package
- Develop a Package
- How to enable visibility of a Package's components?
- Create the Package Specification and Body Using the SQL CREATE Statement and SQL
- Developer Invoke Package Constructs
- View PL/SQL Source Code Using the Data Dictionary

## 14) Packages

- Overloading Subprograms in PL/SQL
- Use the STANDARD Package
- Use Forward Declarations to Solve Illegal Procedure Reference
- Implement Package Functions in SQL and Restrictions
- Persistent State of Packages
- Persistent State of a Package Cursor
- Control Side Effects of PL/SQL Subprograms
- Invoke PL/SQL Tables of Records in Packages

## 15) Implement Oracle-Supplied Packages in Application Development

- What are Oracle-Supplied Packages?
- Examples of Some of the Oracle-Supplied Packages
- How Does the DBMS\_OUTPUT Package Work?
- Use the UTL\_FILE Package to Interact With Operating System Files
- Invoke the UTL\_MAIL Package
- Write UTL\_MAIL Subprograms

## 16) Dynamic SQL

- The Execution Flow of SQL
- What is Dynamic SQL?
- Declare Cursor Variables
- Dynamically executing a PL/SQL Block
- Configure Native Dynamic SQL to Compile PL/SQL Code
- Invoke DBMS\_SQL Package
- Implement DBMS\_SQL with a Parameterized DML Statement
- Dynamic SQL Functional Completeness

## 17) Design Considerations for PL/SQL Code

- Standardize Constants and Exceptions
- Understand Local Subprograms
- Write Autonomous Transactions
- Implement the NOCOPY Compiler Hint
- Invoke the PARALLEL\_ENABLE Hint
- The Cross-Session PL/SQL Function Result Cache
- The DETERMINISTIC Clause with Functions
- Usage of Bulk Binding to Improve Performance

## 18) Triggers

- Describe Triggers
- Identify the Trigger Event Types and Body
- Business Application Scenarios for Implementing Triggers
- Create DML Triggers Using the CREATE TRIGGER Statement and SQL Developer
- Identify the Trigger Event Types, Body, and Firing (Timing)
- Statement Level Triggers Versus Row Level Triggers
- Create Instead of and Disabled Triggers

- How to Manage, Test, and Remove Triggers?

## 19) Create Compound, DDL, and Event Database Triggers

- What are Compound Triggers?
- Identify the Timing-Point Sections of a Table Compound Trigger
- Compound Trigger Structure for Tables and Views
- Implement a Compound Trigger to Resolve the Mutating Table Error
- Compare Database Triggers to Stored Procedures
- Create Triggers on DDL Statements
- Create Database-Event and System-Event Triggers
- System Privileges Required to Manage Triggers

## 20) The PL/SQL Compiler

- What is the PL/SQL Compiler?
- Describe the Initialization Parameters for PL/SQL Compilation
- List the New PL/SQL Compile Time Warnings
- Overview of PL/SQL Compile Time Warnings for Subprograms
- List the benefits of Compiler Warnings
- List the PL/SQL Compile Time Warning Messages Categories
- Setting the Warning Messages Levels: Using SQL Developer, PLSQL\_WARNINGS, Initialization Parameter, and the DBMS\_WARNING Package Subprograms
- View Compiler Warnings: Using SQL Developer, SQL\*Plus, or the Data Dictionary

## 21) Manage PL/SQL Code

- What Is Conditional Compilation?
- Implement Selection Directives
- Invoke Predefined and User-Defined Inquiry Directives
- The PLSQL\_CCFLAGS Parameter and the Inquiry Directive
- Conditional Compilation Error Directives to Raise User-Defined Errors
- The DBMS\_DB\_VERSION Package
- Write DBMS\_PREPROCESSOR Procedures to Print or Retrieve Source Text
- Obfuscation and Wrapping PL/SQL Code

## 22) Manage Dependencies

- Overview of Schema Object Dependencies
- Query Direct Object Dependencies using the USER\_DEPENDENCIES View
- Query an Object's Status
- Invalidation of Dependent Objects
- Display the Direct and Indirect Dependencies
- Fine-Grained Dependency Management in Oracle Database 11g
- Understand Remote Dependencies
- Recompile a PL/SQL Program Unit

