# Oracle 18c PL/SQL (5 Day)

## Course Summary

### Description

This course provides a complete, hands-on, comprehensive introduction to PL/SQL including the use of both SQL Developer and SQL*Plus. This coverage is appropriate for both Oracle11g and higher.

### Topics

- PL/SQL Program Structure
- PL/SQL Flow Control
- SQL Developer and PL/SQL
- SELECT INTO
- The PL/SQL Cursor
- Optimization
- PL/SQL Exception Handling
- Stored Procedures
- Creating Functions in PL/SQL
- Packages
- Creating DML Triggers
- Advanced Concepts
- File Operations
- Communications
- Security
- Scheduling
- Miscellaneous Packages
- Database Triggers
- Collections
- Bulk Operations
- Cursor Variables
- Dynamic SQL
- Large Objects
- Object-Oriented Programming
- Java and Other Languages

### Audience

This course is appropriate for anyone needing to understand Oracle's proprietary programming language. That would include end users, business analysts, application developers, and database administrators.

### Prerequisites

Before taking this course, Oracle12c SQL or higher or equivalent experience is required.

### Duration

Five days

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## Course Outline

**I. PL/SQL Program Structure**
- A. PL/SQL vs. SQL
- B. PL/SQL Engines Available
- C. Anonymous PL/SQL Block Structure
- D. Object Naming Rules
- E. Variable Declarations
- F. Available Datatypes
  1. Scalar Datatypes
  2. Using Extended Datatypes
  3. Object Types
- G. Executable Statements
- H. Expressions
- I. PL/SQL Qualified Expressions
- J. Block Labeling
- K. Variable Scoping Rules
- L. Comments In Programs And Scripts
- M. Basic Coding Standards

**Lab: PL/SQL Program Structure**

**II. PL/SQL Flow Control**
- A. Conditional Control
- B. Comparison Operators
- C. Logical Operators
  1. Truth Tables
- D. Repetition Control
  1. The Simple Loop
  2. WHILE Loop
  3. FOR Loop
  4. CONTINUE Statements In Loops
  5. Step Loops
- E. The GOTO Statement
- F. Case Expressions / Statements
- G. Bind Variables
- H. Substitution Variables

**Lab: PL/SQL Flow Control**

**III. SQL Developer and PL/SQL**
- A. SQL Developer and PL/SQL
- B. Creating And Executing Scripts

**Lab: SQL Developer and PL/SQL**

**IV. SELECT INTO**
- A. Selecting Single Rows of Data
- B. Anchoring Variables to Datatypes
- C. DML in PL/SQL
- D. RETURNING … INTO
- E. Sequences In PL/SQL
- F. Transaction Control in PL/SQL
- G. Autonomous Transactions

**Lab: SELECT INTO**

**V. The PL/SQL Cursor**
- A. Declaring Explicit Cursors
- B. Opening and Closing Explicit Cursors
- C. Using Explicit Cursors to Retrieve Values
- D. Explicit Cursor Attributes
- E. Using a Loop with an Explicit Cursor
- F. Using %ROWTYPE with Cursors
- G. The Cursor for Loop
- H. DBMS_OUTPUT

**Lab: The PL/SQL Cursor**

**VI. Optimization**
- A. Timing PL/SQL
- B. FOR UPDATE / WHERE CURRENT OF

**Lab: Optimization**

**VII. PL/SQL Exception Handling**
- A. The Exception Section
- B. Oracle Named Exceptions
- C. PRAGMA EXCEPTION_INIT
- D. User Defined Exceptions
  1. The Scope Of User-Defined Exceptions
- E. Raising Named Exceptions
- F. Exception Propagation
- G. Raising an Exception Again
- H. Life After an Exception
- I. When Others
- J. Taking Your Ball and Going Home
- K. DBMS_ERRLOG

**Lab: PL/SQL Exception Handling**

**VIII. Stored Procedures**
- A. Procedures
- B. Benefits of Stored Procedures
  1. Database Security
  2. Performance
  3. Productivity
  4. Portability
- C. Parameters and Stored Procedures
  1. Parameter Notation
- D. Stored Object Creation
  1. Syntax for Creating A Procedure
- E. Compilation Errors
- F. Viewing Compiled Code
- G. Dropping A Procedure
- H. The Alter Command and Stored Procedures

**Lab: Stored Procedures**

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## Course Outline (cont'd)

**IX. Creating Functions IN PL/SQL**
- A. Functions
- B. Purity Levels
- C. Using White Lists
- D. Optimizations
- E. PARALLEL_ENABLE
- F. Deterministic Functions
- G. PL/SQL RESULT CACHE
- H. NOCOPY
- I. DBMS_OUTPUT in Functions
- J. Using the WITH CLAUSE for Functions
- K. PRAGMA UDF
- L. PRAGMA INLINE
- M. The Impact of Data-Bound Collation
- N. Using SQL Developer with Stored Procedures
- O. Debugging

**Lab: Functions**

**X. Packages**
- A. Creating Packages
- B. Package Benefits
  1. Security
  2. Persistent State
  3. I/O Efficiency
- C. A Simple Package
- D. Overloading
- E. Bodiless Packages
- F. Source Code Encryption
- G. Creating Packages from Procedures And Functions

**Lab: Packages**

**XI. Creating DML Triggers**
- A. DML Triggers
- B. DML Trigger Structure
- C. Conditional Triggering Predicates
- D. Triggers For Business Rules Enforcement
- E. Mutating and Constraining Tables
- F. Compound Triggers
- G. Controlling Firing Order
- H. DDL for Triggers
- I. Viewing Trigger Source
- J. INSTEAD OF Triggers

**Lab: DML Triggers**

**XII. Advanced Concepts**
- A. Embedded Procedures
- B. The Optimizing Compiler
- C. PL/SQL Compiler Warnings
- D. Compiling For Debugging
- E. Conditional Compilation / Inquiry Directives
  1. Error Directives
  2. Inquiry Directives
  3. Using Static Constants
- F. DBMS_DB_VERSION
- G. Native Compilation
  1. Recompiling All Database Objects

**Lab: Advanced Concepts**

**XIII. File Operations**
- A. Moving Files Between Databases
- B. Directory Access
- C. File Manipulation
  1. FCLOSE Procedure
  2. FCLOSE_ALL Procedure
  3. FCOPY Procedure
  4. FFLUSH Procedure
  5. FGETATTR Procedure
  6. FGETPOS Function
  7. FOPEN Function
  8. FREMOVE Procedure
  9. FRENAME Procedure
  10. FSEEK Procedure
  11. GET_LINE Procedure
  12. GET_RAW Procedure
  13. IS_OPEN Function
  14. NEW_LINE Procedure
  15. PUT Procedure
  16. PUT_LINE Procedure
  17. PUTF Procedure
  18. PUT_RAW Procedure

**Lab: File Operations**

**XIV. Communications**
- A. DBMS_ALERT
  1. REGISTER Procedure
  2. REMOVE Procedure
  3. REMOVEALL Procedure
  4. SET_DEFAULTS Procedure
  5. SIGNAL Procedure
  6. WAITANY Procedure
  7. WAITONE Procedure
  8. Security
  9. DBMS_ALERT Example
- B. DBMS_PIPE
  1. CREATE_PIPE Function
  2. NEXT_ITEM_TYPE Function
  3. PACK_MESSAGE Procedure
  4. PURGE Procedure

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## Course Outline (cont'd)

5. RECEIVE_MESSAGE Function
6. RESET_BUFFER Procedure
7. REMOVE_PIPE Function
8. SEND_MESSAGE Function
9. UNIQUE_SESSION_NAME Function
10. UNPACK_MESSAGE Procedure
11. DBMS_PIPE Example

C. UTL_SMTP
D. UTL_HTTP
E. UTL_TCP
F. UTL_MAIL
G. DBMS_NETWORK_ACL_ADMIN

**Lab: Communications**

**XV. Security**

A. DBMS_RLS
   1. Implementation Tasks
   2. Our Example Scenario
   3. The Policy Package
   4. The Dynamic Predicate Package
   5. Creating The Context And The Trigger
   6. Using DBMS_RLS
   7. Exempting Policies
B. DBMS_FGA
C. Controlling Column Access with Virtual Columns

**Lab: Security**

**XVI. Scheduling**

A. Oracle Scheduling
B. DBMS_JOB
   1. PROCEDURE BROKEN
   2. PROCEDURE CHANGE
   3. PROCEDURE INSTANCE
   4. PROCEDURE INTERVAL
   5. PROCEDURE ISUBMIT
   6. FUNCTION IS_JOBQ
   7. PROCEDURE NEXT_DATE
   8. PROCEDURE REMOVE
   9. PROCEDURE RUN
   10. PROCEDURE SUBMIT
   11. PROCEDURE USER_EXPORT
   12. PROCEDURE USER_EXPORT
   13. PROCEDURE WHAT
   14. The NEXT_DATE Parameter
   15. The INTERVAL Parameter
   16. The WHAT Parameter
C. DBMS_SCHEDULER
   1. Evaluating Calendaring Expressions
   2. DBMS_SCHEDULER Capabilities

**Lab: Scheduling**

**XVII. Miscellaneous Packages**

A. DBMS_OUTPUT
B. DBMS_RANDOM
   1. STRING Function
   2. VALUE Function
C. DBMS_STATS
   1. GATHER_SCHEMA_STATS
   2. GATHER_TABLE_STATS
D. DBMS_WM
E. DBMS_METADATA
F. DBMS_REDEFINITION
G. Other Notable Packages / Procedures
H. Miscellaneous Changes In 12CR2

**Lab: Miscellaneous Packages**

**XVIII. Database Triggers**

A. Permissions Needed
B. DDL Triggers
C. SERVERERROR Triggers
D. LOGON / LOGOFF Triggers
E. STARTUP / SHUTDOWN Triggers
F. SUSPEND Triggers

**Lab: Database Triggers**

**XIX. Collections**

A. Defining Records
B. Collections
   1. Associative Arrays
   2. Nested Tables
   3. VARRAYs / VARYING ARRAYs
   4. Assignments
   5. Comparing Collections
C. Collection Methods
   1. EXISTS
   2. FIRST
   3. LAST
   4. COUNT
   5. LIMIT
   6. PRIOR
   7. NEXT
   8. DELETE
   9. TRIM
D. Set Theory and Nested Tables

**Lab: Collections**

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## Course Outline (cont'd)

**XX. Bulk Operations**
- A. Bulk Binding
- B. FORALL
- C. SQL%BULK_ROWCOUNT
- D. Save Exceptions / SQL%BULK_EXCEPTIONS
- E. Bulk Collect
  - 1. The Limit Clause
  - 2. FORALL and the Indices of Clause
  - 3. FORALL and VALUES OF
- F. Pipelined Table Functions
- G. Multidimensional Collections

**Lab: Bulk Operations**

**XXI. Cursor Variables**
- A. What Is a Cursor Variable?
- B. Cursor Variable Control
- C. OPEN FOR
- D. FETCH
- E. CLOSE
- F. Cursor Variable Examples
- G. ROWTYPE_MISMATCH

**Lab: Cursor Variables**

**XXII. Dynamic SQL**
- A. Standard Dynamic SQL
- B. New DBMS_SQL Functionality
- C. Native Dynamic SQL (NDS)
- D. Execute Immediate
  - 1. OPEN FOR, FETCH AND CLOSE
  - 2. Additional Rules For Native Dynamic SQL
- E. Bulk Execute Immediate
- F. SQL Injection Attacks
  - 1. SQL Statement Manipulation
  - 2. Additional Statement Insertion
  - 3. The Using Clause vs. Concatenation
  - 4. DBMS_ASSERT
- G. Switching Between NDS and DBMS_SQL

**Lab: Dynamic SQL**

**XXIII. Large Objects**
- A. External vs. Internal Large Objects
- B. Initializing Internal LOB Locators
- C. The DBMS_LOB Package
- D. Inserting Internal Large Objects
- E. Loading Errors
- F. The SECUREFILE Option

**Lab: Large Objects**

**XXIV. Object-Oriented Programming**
- A. Oracle Objects
- B. Ordering Object Types
- C. Object Tables
- D. SQL For Object Tables
- E. Advanced Object Concepts

**Lab: Object-Oriented Programming**

**XXV. Java And Other Languages**
- A. Alternative Languages
- B. Loading Code
- C. Publishing Code
- D. Executing The Code
- E. Interfacing With C
- F. JSON Support
- G. SODA
  - 1. Simple Oracle Document Access For PL/SQL
  - 2. Simple Oracle Document Access For C And C+
- H. Enhanced Language Interface Features

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