

A Relational Database Management System (RDBMS) is a software system that allows you to create and manage a relational database. Minimum requirements for such a system are defined by both ANSI and ISO. PL/SQL is Oracle's Procedural Language for SQL. It is Oracle's database programming language for creating stored procedures, functions, database triggers, and object methods. PL/SQL can be used for implementing business rules, computing algorithms, manipulating data, and for stand-alone programs. The Oracle 11g release has greatly enhanced the features and functionality of PL/SQL.

Students will write stored procedures, functions, packages, and triggers, and implement complex business rules in Oracle. Students will learn programming, management, and security issues of working with PL/SQL program units. Programming topics will include the built-in packages that come with Oracle, the creation of triggers, and stored procedure features.

Course Objectives:

- Create triggers on database tables.
- Use PL/SQL's datatypes for database and program data.
- Use program structure and control flow to design and write PL/SQL programs.
- Create PL/SQL stored procedures and functions.
- Write robust programs that handle runtime exceptions.
- Use PL/SQL's collection datatypes.
- Use cursors to work with database data.
- Use bulk operations for improved performance.
- Use the packages supplied with Oracle.
- Design and write your own packages.
- Maintain and evolve your PL/SQL programs.
- Manage the security of your stored PL/SQL programs.

Audience: Application developers and database administrators.

Prerequisites: *Introduction to Oracle 11g SQL Programming* is required. Programming experience in a high-level language, such as COBOL, Java, or Perl is also required.

Number of Days: 3 days

<p>1. Course Introduction Course Objectives Overview Suggested References</p>	<p>Trigger Conditions Using Sequences Cascading Triggers and Mutating Tables</p>
<p>2. Triggers Beyond Declarative Integrity Triggers Types of Triggers Trigger Sequencing Row-Level Triggers Trigger Predicates</p>	<p>Generating an Error Maintaining Triggers</p>
	<p>3. PL/SQL Variables and Datatypes Anonymous Blocks Declaring Variables Datatypes</p>

- Subtypes
- Character Data
- Dates and Timestamps
- Date Intervals
- Anchored Types
- Assignment and Conversions
- Selecting into a Variable
- Returning into a Variable
- 4. PL/SQL Syntax and Logic**
- Conditional Statements – IF/THEN
- Conditional Statements – CASE
- Comments and Labels
- Loops
- WHILE and FOR Loops
- SQL in PL/SQL
- Local Procedures and Functions
- 5. Stored Procedures and Functions**
- Stored Subprograms
- Creating a Stored Procedure
- Procedure Calls and Parameters
- Parameter Modes
- Named Parameter Notation
- Default Arguments
- Creating a Stored Function
- Stored Functions and SQL
- Invoker’s Rights
- 6. Exception Handling**
- SQLCODE and SQLERRM
- Exception Handlers
- Nesting Blocks
- Scope and Name Resolution
- Declaring and Raising Named Exceptions
- User-Defined Exceptions
- 7. Records and Collections**
- Record Variables
- Using the %ROWTYPE Attribute
- User-Defined Object Types
- VARRAY and Nested TABLE Collections
- Using Nested TABLES
- Using VARRAYS
- Collections in Database Tables
- Associative Array Collections
- Collection Methods
- Iterating Through Collections
- 8. Cursors**
- Multi-Row Queries
- Declaring and Opening Cursors
- Fetching Rows
- Closing Cursors
- The Cursor FOR Loop
- FOR UPDATE Cursors
- Cursor Parameters
- The Implicit (SQL) Cursor
- 9. Bulk Operations**
- Bulk Binding
- BULK COLLECT Clause
- FORALL Statement
- FORALL Variations
- Bulk Returns
- Bulk Fetching with Cursors
- 10. Using Packages**
- Packages
- Oracle-Supplied Packages
- The DBMS_OUTPUT Package
- The DBMS_UTILITY Package
- The UTL_FILE Package
- Creating Pipes with DBMS_PIPE
- Writing to and Reading from a Pipe
- The DBMS_METADATA Package
- XML Packages
- Networking Packages
- Other Supplied Packages
- 11. Creating Packages**
- Structure of a Package
- The Package Interface and Implementation
- Package Variables and Package State
- Overloading Package Functions and Procedures
- Forward Declarations
- Strong REF CURSOR Variables
- Weak REF CURSOR Variables
- 12. Working with LOBs**
- Large Object Types
- Oracle Directories
- LOB Locators

- Internal LOBs
- LOB Storage and SECUREFILES
- External LOBs
- Temporary LOBs
- The DBMS_LOB Package
- 13. Maintaining PL/SQL Code**
- Privileges for Stored Programs
- Data Dictionary
- PL/SQL Stored Program Compilation
- Conditional Compilation
- Compile-Time Warnings
- The PL/SQL Execution Environment
- Dependencies and Validation
- Maintaining Stored Programs
- 14. Appendix A – Dynamic SQL**
- Generating SQL at Runtime
- Native Dynamic SQL vs. DBMS_SQL Package
- The EXECUTE IMMEDIATE Statement
- Using Bind Variables
- Multi-row Dynamic Queries
- Bulk Operations with Dynamic SQL
- Using DBMS_SQL
- DBMS_SQL Subprograms
- 15. Appendix B – PL/SQL Versions, Datatypes, and Language Limits**
- 16. Appendix C – Oracle 11g Supplied Packages**