



Level 6 Advanced Diploma in Computer Science (907)
203 Credits



Unit: Database Technology	Guided Learning Hours: 340
Exam Paper No.: 2	Number of Credits: 34
Prerequisites: Good computing knowledge	Corequisites: A pass or better in Diploma in System Design or equivalence
<p>Aim: This unit covers both theory (Database Technology) and practical (Oracle SQL) sessions.</p> <p><i>Practical (Oracle SQL)</i> Oracle SQL offer learners an extensive introduction to data server technology. The unit covers the concepts of both relational and object relational databases and the powerful SQL programming language. Learners will learn to create and maintain database objects and to store and manipulate data; retrieve data by using advanced techniques such as ROLLUP, CUBE, set operators, and hierarchical retrieval. Learners will also learn to write SQL and SQL*Plus script files using the SQL*Plus tool to generate report-like output. Demonstrations and hands-on practice reinforce the fundamental concepts. Using the Oracle SQL*Plus environment, this computer-based training unit uses Structured Query Language (SQL) to create and populate Oracle database tables. Learners will acquire the skills necessary to create tables and other database objects, maintain and modify these data objects. The program detail processes to follow when inserting, updating and deleting data using SQL's Data Manipulation Language, control database transactions, control both user and object level security in an Oracle database.</p> <p><i>Theory (Database Technology)</i> Theory focuses on relationship implementation of information system development and entity relationship diagrams. Comprehensive coverage of database technology applications, database fundamentals including: relational database systems, data modelling, normalisation and Entity Relationship Diagrams (ERD).</p>	
Required Materials: Recommended learning resources.	Supplementary Materials: Lecture notes and tutor extra reading recommendations.
Special Requirements: This is a hands-on course, hence practical use of computers is essential. Requires intensive lab work outside of class time.	
<p>Intended Learning Outcomes: <i>Oracle SQL (Practical sessions)</i></p> <p>1 The purpose of a database management system (DBMS); distinguishing a field from a record and a column from a row.</p>	<p>Assessment Criteria: <i>Oracle SQL (Practical sessions)</i></p> <p>1.1 Analyse components of a relational model</p> <p>1.2 Describe relational database terminology</p> <p>1.3 Describe the makeup of SQL statements</p> <p>1.1 Explain the purpose of normalization</p> <p>1.2 Describe the role of a primary key</p> <p>1.3 Identify and evaluate partial dependency and transitive dependency in the normalization process</p> <p>1.4 Explain the purpose of a foreign key</p> <p>1.5 Determine how to link data in different tables through the use of a common field</p> <p>1.6 Explain the purpose of a structured query language (SQL)</p> <p>1.7 Identify and examine the basic components of an Entity-Relationship Model.</p> <p>1.8 Define the types of relationships that can exist between entities.</p> <p>1.9 Identify and evaluate the problems associated with many-to-many relationships and the appropriate solutions.</p>

<p>2 Distinguishing between a RDBMS and an ORDBMS; identify keywords, mandatory clauses, and optional clauses in a SELECT statement.</p>	<p>2.1 Describe how to select and view all columns of a table</p> <p>2.2 Describe how to select and view one column of a table</p> <p>2.3 Describe how to display multiple columns of a table</p> <p>2.4 Explain using a column alias to clarify the contents of a particular column</p> <p>2.5 Demonstrate performing basic arithmetic operations in the SELECT clause</p> <p>2.6 Demonstrate removing duplicate lists, using either the DISTINCT or UNIQUE keyword</p> <p>2.7 Analyse how to combine fields, literals, and other data</p> <p>2.1 Analyse components of a basic SELECT statement</p> <p>2.2 Explore rules and guidelines of constructing SQL statements</p> <p>2.3 Investigate different methods of executing SQL statements</p> <p>2.4 Define the keyword * (asterisk)</p> <p>2.5 Define arithmetic expressions in SQL statements</p> <p>2.6 Define NULL values</p> <p>2.7 Define column aliases</p> <p>2.8 Define literal character strings</p> <p>2.9 Define how to suppress duplicate rows</p> <p>2.10 Define SQL file commands</p> <p>2.11 Define SQL editing command</p> <p>2.19 Explain how to format query output results.</p>
<p>3 Using the WHERE clause to restrict the rows returned by a query and creating a search condition using mathematical comparison operators.</p>	<p>3.1 Define how to use the WHERE clause</p> <p>3.2 Define comparison operators</p> <p>3.3 Describe how character strings and dates are used in the WHERE clause</p> <p>3.4 Describe the BETWEEN, IN, LIKE and IS NULL operators</p> <p>3.5 Define SQL wildcard characters</p> <p>3.6 Define logical operators</p> <p>3.7 Define the ORDER BY clause</p> <p>3.8 Demonstrate how to sort in SQL</p> <p>3.9 Demonstrate how to specify a list of values for a search condition using the IN comparison operator</p> <p>3.10 Demonstrate how to search for patterns using the LIKE comparison operator</p> <p>3.11 Identify the purpose of the % and _ wildcard characters</p> <p>3.12 Explain how to join multiple search conditions using the appropriate logical operator</p> <p>3.13 Demonstrate how to perform searches for null values</p> <p>3.14 Explain how to specify the order for the presentation of query results, using ORDER BY, DESC, ASC, and the SELECT clause</p> <p>3.15 Explain how to use SQL*Plus editing commands to edit the contents of the SQL*Plus buffer</p>

<p>4 Creating a Cartesian join and defining how to create an equality join using the WHERE clause.</p>	<p>3.16 Demonstrate how to use the BETWEEN...AND comparison operator to identify records within a range of values</p> <p>4.1 Define case conversion functions</p> <p>4.2 Demonstrate creating an equality join using the JOIN keyword</p> <p>4.3 Demonstrate creating a non-equality join using the WHERE clause</p> <p>4.4 Demonstrate creating a non-equality join using the JOIN...ON approach</p> <p>4.5 Describe how to create a self-join</p> <p>4.6 Distinguish an inner join from an outer join</p> <p>4.7 Describe how to create an outer join using the WHERE clause</p> <p>4.8 Describe how to create an outer join using the OUTER keyword</p> <p>4.9 Demonstrate using set operators to combine the results of multiple queries</p> <p>4.10 Demonstrate joining three or more tables</p>
<p>5 Using the UPPER, LOWER, and INITCAP functions to change the case of field values and character strings; extract a substring using the SUBSTR function and determine the length of a character string using the LENGTH function.</p>	<p>5.1 Explain how use the LPAD and RPAD functions to pad a string to a desired width</p> <p>5.2 Demonstrate using the LTRIM and RTRIM functions to remove specific character strings</p> <p>5.3 Demonstrate rounding and truncating numeric data using the ROUND and TRUNC functions</p> <p>5.4 Explain how to calculate the number of months between two dates using the MONTHS_BETWEEN function</p> <p>5.5 Identify and correct problems associated with calculations involving null values using the NVL function</p> <p>5.6 Describe how to display dates and numbers in a specific format with the TO_CHAR function</p> <p>5.7 Identify and determine the current date setting using the SYSDATE keyword</p> <p>5.8 Explain nest functions inside other functions</p> <p>5.9 Identify when to use the DUAL table</p>
<p>6 Differentiating between single-row, multiple-row functions and outlining how to use the SUM and AVG functions for numeric calculations.</p>	<p>6.1 Demonstrate using the COUNT function to return the number of records containing non-NULL values</p> <p>6.2 Demonstrate using COUNT(*) to include records containing NULL values</p> <p>6.3 Demonstrate using the MIN and MAX functions with non-numeric fields</p> <p>6.4 Identify and determine when to use the GROUP BY clause to group data</p> <p>6.5 Identify when the HAVING clause should be used</p> <p>6.6 Explain the order of precedence for evaluating WHERE, GROUP BY, and HAVING clauses</p> <p>6.7 Evaluate and state the maximum depth for nesting group functions</p>




<p>7 Determining when it is appropriate to use a subquery, identifying which clauses can contain subqueries and distinguishing between an outer query and a subquery.</p>	<p>6.8 Demonstrate how nest a group function inside a single-row function</p> <p>6.9 Describe how to calculate the standard deviation and variance of a set of data, using the STDDEV and VARIANCE functions</p> <p>7.1 Demonstrate using a single-row subquery in a WHERE clause</p> <p>7.2 Demonstrate using a single-row subquery in a HAVING clause</p> <p>7.3 Demonstrate using a single-row subquery in a SELECT clause</p> <p>7.4 Demonstrate using a multiple-row subquery in a WHERE clause</p> <p>7.5 Demonstrate using a multiple-row subquery in a HAVING clause</p> <p>7.6 Demonstrate using a multiple-column subquery in a WHERE clause</p> <p>7.7 Describe how to create an inline view using a multiple-column subquery in a FROM clause</p> <p>7.8 Explain how to compensate for NULL values in subqueries</p> <p>7.9 Explain how to nest a subquery inside another subquery</p> <p>7.10 Distinguish between correlated and uncorrelated subqueries.</p> <p>7.11 Distinguish between single-row and multiple-row comparison operators</p>
<p>8 Creating a new table; the system privilege; the quota for the tablespace that contains the table, or the UNLIMITED TABLESPACE system privilege.</p>	<p>8.1 Define Oracle data types</p> <p>8.2 Describe the components of CREATE TABLE statement</p> <p>8.3 Describe how to INSERT data into a table</p> <p>8.4 Describe the ALTER TABLE statement</p> <p>8.5 Demonstrate how to modify a column</p> <p>8.6 Demonstrate how to drop a column</p> <p>8.7 Demonstrate how to rename a table</p> <p>8.8 Demonstrate how to update rows</p> <p>8.9 Describe how to name a new column or table</p> <p>8.10 Demonstrate how to use a subquery to create a new table</p> <p>8.11 Demonstrate how to add a column to an existing table</p> <p>8.12 Demonstrate how to modify the size of a column in an existing table</p> <p>8.13 Demonstrate how to drop a column from an existing table</p> <p>8.14 Demonstrate how to mark a column as unused, then delete it at a later time</p> <p>8.15 Demonstrate how to rename a table</p> <p>8.16 Demonstrate how to truncate a table</p> <p>8.17 Demonstrate how to drop a table</p>
<p>9 The purpose of constraints in a table, distinguishing among PRIMARY KEY, FOREIGN KEY, UNIQUE, CHECK, and NOT NULL constraints and the appropriate use for each constraint.</p>	<p>9.1 Illustrate how to create and implement a sequence</p> <p>9.2 Describe how to create PRIMARY KEY constraints for a single column and a composite primary key</p>

	9.3	Describe how to create a FOREIGN KEY constraint
	9.4	Describe how to create a UNIQUE constraint
	9.5	Describe how to create a CHECK constraint
	9.6	Describe how to create a NOT NULL constraint, using the ALTER TABLE...MODIFY command
	9.7	Explain how to include constraints during table creation
	9.8	Demonstrate using DISABLE and ENABLE commands
	9.9	Demonstrate using the DROP command
	9.10	Distinguish between creating constraints at the column level and table level
	9.11	Describe data integrity constraints
	9.12	Illustrate how to view constraints
	9.13	Define a sequence
10		Using substitution variables with an UPDATE command, issuing the transaction control statements COMMIT and ROLLBACK.
	10.1	Describe how to add a record to an existing table
	10.2	Describe how to add a record containing a NULL value to an existing table
	10.3	Demonstrate using a subquery to copy records from an existing table
	10.4	Explain how to modify the existing rows within a table
	10.5	Describe how to delete records
	10.6	Describe how to use the SELECT...FOR UPDATE command to create a shared lock
	10.7	Differentiate between DDL, DML, and transaction control commands.
	10.8	Differentiate between a shared lock and an exclusive lock
11		The effect of the WITH READ ONLY option, the implication of an expression in a view for DML operations and inline views and the use of ROWNUM to perform a "TOP-N" analysis.
	11.1	Demonstrate how to create a view, using CREATE VIEW command or the CREATE OR REPLACE VIEW command
	11.2	Explain how to employ the FORCE and NO FORCE options
	11.3	Describe the purpose of the WITH CHECK OPTION constraint
	11.4	Demonstrate how to update a record in a simple view
	11.5	Describe how to re-create a view
	11.6	Demonstrate how to update a record in a complex view
	11.7	Demonstrate how to drop a view
	11.8	Identify problems associated with adding records to a complex view.
	11.9	Identify the key-preserved table underlying a complex view
12		The purpose of a sequence, stating how it can be used by an organisation and why gaps may appear in the integers generated by a sequence.
	12.1	Demonstrate using NEXTVAL and CURRVAL in an INSERT command
	12.2	Explain when Oracle will automatically create an index
	12.3	Explain how to create an index, using the CREATE INDEX command
	12.4	Describe how to delete an index, using

	<p>the DELETE INDEX command</p> <p>12.5 Describe how to create a PUBLIC synonym</p> <p>12.6 Describe how to delete a PUBLIC synonym</p> <p>12.7 Demonstrate how to correctly use the CREATE SEQUENCE command to create a sequence.</p> <p>12.8 Identify which options cannot be changed by the ALTER SEQUENCE command.</p> <p>12.9 Identify the contents of different versions of views used to access the data dictionary, based on the prefix of the view.</p>
<p>13 The concept of authentication, creating a new user account and granting a user the CREATE SESSION privilege.</p>	<p>13.1 Explain how to make a password expire</p> <p>13.2 Describe how to change the password of an existing account</p> <p>13.3 Describe how to create a role; grant privileges to a role</p> <p>13.4 Outline how to assign a user to a role</p> <p>13.5 Demonstrate how to revoke privileges from a user and a role</p> <p>13.6 Describe how to drop a user</p>
<p>14 Adding a column heading with a line break to a report and formatting the appearance of numeric data in a column, specifying the width of a column.</p>	<p>14.1 Demonstrate how to add a multiple-line header to a report</p> <p>14.2 Demonstrate how to display a page number in a report</p> <p>14.3 Demonstrate how to add a footer to a report</p> <p>14.4 Demonstrate how to change the setting of an environment variable</p> <p>14.5 Demonstrate how to suppress duplicate report data</p> <p>14.6 Explain how to clear changes made by the COLUMN and BREAK commands</p> <p>14.7 Describe how to perform calculations in a report</p> <p>14.8 Demonstrate how to substitute a text string for a NULL value in a report</p>
<p>Database Technology (Theory sessions)</p> <p>1 Understand the characteristics of business databases and the features of database management systems.</p>	<p>Database Technology (Theory sessions)</p> <p>1.1 Describe database characteristics.</p> <p>1.2 Describe Database Management System (DBMS) features, architecture and organisational roles.</p> <p>1.3 Appreciate the advances in database technology and the contribution of database technology to modern society.</p> <p>1.4 Define the impact of database management system architectures on distributed processing and software maintenance.</p> <p>1.5 Perceive career opportunities related to database application development and database administration</p>
<p>2 Understand notations (entity types, relationships, attributes), cardinalities and relationship patterns.</p>	<p>2.1 Define entities, attributes and relationships</p> <p>2.2 Describe entity diagrams</p> <p>2.3 Define relationships</p>

	<p>2.4 Draw Entity Relationship Diagrams (ERD)</p> <p>2.5 Define basic notations</p> <p>2.6 Demonstrate relationships, M-N relationships with attributes, self-referencing relationships, M-way relationships, M-N relationships and 1-M relationships</p> <p>2.7 Describe diagram rules: completeness rules and consistency rules</p>
3 Understand data analysis and design concept principles.	<p>3.1 Describe logical database design stages</p> <p>3.2 Define data analysis</p> <p>3.3 Describe top-down and bottom-up analysis</p> <p>3.4 Identify relationships between data items</p> <p>3.5 Identify relationships between entities</p> <p>3.6 Identify relationships between attributes</p> <p>3.7 Describe functional analysis</p> <p>3.8 Apply entity and relationship rules to produce a conceptual model</p>
4 Understand normalization; how to identify modification anomalies and functional dependencies.	<p>4.1 Describe normalisation</p> <p>4.2 Define 1st, 2nd and 3rd normal form</p> <p>4.3 Demonstrate normalising relations to 1NF</p> <p>4.4 Define relation keys and functional dependency</p> <p>4.5 Demonstrate normalising relations to 2NF</p> <p>4.6 Demonstrate normalising relations to 3NF</p>
<p>Methods of Evaluation: A 3-hour written essay examination paper with five questions, each carrying 20 marks. Candidates are required to answer all questions. Candidates also undertake project/coursework in both Database Technology and Oracle SQL, each with a weighting of 50% [making a total of 100% for the two].</p>	

Recommended Learning Resources: Database Technology

Text Books	<p style="text-align: center;">Oracle SQL</p> <ul style="list-style-type: none"> • Mastering Oracle SQL by Sanjay Mishra * Alan Beaulieu. • Mastering Oracle SQL and SQL*Plus (Oaktable Press) by Lex de Haan. • Oracle SQL Interactive Workbook (Interactive Workbook (Prentice Hall)) by Alex Morrison & Alice Rischert. ISBN-10: 0130157457 <p style="text-align: center;">Database Technology</p> <ul style="list-style-type: none"> • Database Concepts by David M. Kroenke 2nd Edition. ISBN 10: 0131451413 • Database Design, Application Development & Administration. Database Management Systems by Jerry Post. ISBN 0072472421 • Database Processing – Fundamentals, Design and Implementation. Relational Database Principles (Paperback) by C. Ritchie (Author). Relational Database Design and Implementation: Clearly Explained 3e: Clearly Explained (Paperback) by Jan L. Harrington. ISBN-10: 0123747309
Study Manuals 	BCE produced study packs
CD ROM 	Power-point slides
Software 	Oracle SQL Plus

Business & Computing Examinations (BCE)