GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering
Level: Diploma
Branch: Information Technology
Subject Code: DI04016061
Subject Name: Database Administration

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	Professional Elective - I

Prerequisite:	Students should have understanding of the fundamental concepts of databases, data models, and DBMS architecture. They possess the ability to design and implement relational databases using the Entity–Relationship (ER) modeling approach and be proficient in writing SQL commands for data definition, manipulation, and control operations. A clear grasp of normalization techniques and transaction management concepts and concurrency control essential to comprehend administrative tasks.
Rationale:	This curriculum is designed to bridge the gap between theoretical database knowledge and practical administrative skills. Competency in database administration is a key requirement for modern information managers. The syllabus transitions students from declarative SQL to procedural implementation (PL/SQL), enabling the automation of business logic and complex tasks. It ensures students can manage database security by mastering User/Role creation and access privileges, and handle transaction processing and concurrency using advanced locking concepts. Finally, the course addresses contemporary industry needs by introducing No SQL systems and Cloud Database services, preparing students for modern IT environments.

Course Outcome:
After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Apply advanced SQL concepts including transactions, views, indexes, sequences, and access control in database application.	A
02	Develop PL/SQL programs, including procedures, functions, packages, triggers, and exception handling.	A
03	Design and implement conceptual, logical, and physical database schemas.	U
04	Execute database administration tasks, including user management, security, backup, recovery, and concurrency control.	A
05	Understand modern databases and cloud platforms.	U

**Revised Bloom's Taxonomy (RBT)*

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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA (M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Advanced SQL** 1.1 Transaction Control ○ 1.1.1 Commit, Savepoint, Rollback 1.2 DCL Commands ○ 1.2.1 Grant and Revoke 1.3 Types of Locks ○ 1.3.1 Row Level Locks ○ 1.3.2 Table Level Locks ○ 1.3.3 Shared Lock ○ 1.3.4 Exclusive Lock ○ 1.3.5 Deadlock 1.4 Synonym ○ 1.4.1 Create Synonym 1.5 Sequences ○ 1.5.1 Create and Alter Sequences 1.6 Index ○ 1.6.1 Unique and Composite 1.7 Views ○ 1.7.1 Create/Replace, Update and Alter Views	08	18
2.	**PL / SQL and Triggers** 2.1 Basics of PL / SQL 2.2 Data Types 2.3 Advantages 2.4 Control Structures ○ 2.4.1 Conditional ○ 2.4.2 Iterative ○ 2.4.3 Sequential 2.5 Exceptions ○ 2.5.1 Predefined Exceptions ○ 2.5.2 User defined Exceptions 2.6 Cursors	12	27

	○ 2.6.1 Static (Implicit & Explicit) ○ 2.6.2 Dynamic 2.7 Procedures and Functions 2.8 Packages ○ 2.8.1 Package Specification ○ 2.8.2 Package Body ○ 2.8.3 Advantages of Package 2.9 Fundamentals of Database Triggers 2.10 Creating Triggers 2.11 Types of Triggers ○ 2.11.1 Before ○ 2.11.2 After ○ 2.11.3 Row ○ 2.11.4 Statement		
3.	**Database Design and Implementation** 3.1 Database Application Life Cycle 3.2 Conceptual Database Application ○ 3.2.1 Design ○ 3.2.2 Retrieve Transaction ○ 3.2.3 Update Transaction ○ 3.2.4 Mixed Transaction 3.3 Logical and Physical Database Design ○ 3.3.1 Response Time ○ 3.3.2 Space Utilization ○ 3.3.3 Transaction Throughput	08	18
4.	**Database Administrator** 4.1 Types of Oracle Database Users 4.2 User Creation and Management 4.3 Tasks of a Database Administrator 4.4 Submitting Commands and SQL to the Database 4.5 About Database Administrator Security and Privileges 4.6 Database Administrator Authentication 4.7 Creating and Maintaining a Password File 4.8 Data Utilities	10	22
5.	**Modern Database & Cloud Database** 5.1 Difference between SQL and NoSQL 5.2 Types of NoSQL databases 5.3 Introduction to MongoDB (basic CRUD operations) 5.4 Advantages, limitations, and use cases of NoSQL 5.5 What is cloud computing and cloud databases 5.6 Types: Database as a Service (DBaaS), managed SQL/NoSQL 5.7 Introduction: Google Firebase, AWS RDS, Azure SQL	07	15
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
15	**25**	**30**	**-**	**-**	**-**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:
(a) Books:

Sr. No.	Title of Books	Author	Publication
1	Database Systems Concepts, design and Applications	Singh, S. K.	Pearson Education, New Delhi, 2012
2	Sql/ Pl/SQL	Bayross, Ivan	BPB
3	An Introduction to Database Systems	Date, C. J.	Pearson Education, New Delhi, 2012
4	Database System Concepts,	Korth, Henry	MGH
5	MongoDB: The Definitive Guide	Kristina Chodorow & Michael Dirolf	O'Reilly Media
6	Cloud Native Data Center Networking	Dinesh G. Dutt	O'Reilly Media

(b) Open source software and website:

Open Source Softwares

1. MySQL/MariaDB
   - Supports transactions, locks, views, indexes, and sequences.
   - Website: https://www.mysql.com/
   - Website: https://mariadb.org/

2. Oracle Express Edition (XE)
   - Free version of Oracle DB for practicing sequences, synonyms, and advanced locks.
   - Website: https://www.oracle.com/in/database/technologies/appdev/xe.html/
3. PostgreSQL (PL/pgSQL)
   - Open-source alternative for procedural SQL, supports functions, triggers, and exceptions.
   - Website: https://www.postgresql.org/

4. SQL Developer (Oracle)
   - Free GUI tool to write, debug, and execute PL/SQL code.
   - Website: https://www.oracle.com/in/database/sqldeveloper/
5. DBeaver
   - Can connect to both SQL and NoSQL DBs & Can also execute procedural SQL code across multiple databases.
   - Website: https://dbeaver.io/

Useful Websites

1. Latest database trends: https://cloud.google.com/blog/products/databases
2. SQL Tutorial: https://www.w3schools.com/sql/
3. PL/SQL Tutorial: https://plsql-tutorial.com/
4. DBMS Course: https://nptel.ac.in/courses/106105175

Suggested Course Practical List:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Implement SQL queries demonstrating COMMIT, ROLLBACK, and SAVEPOINT. Apply GRANT and REVOKE on different users.	1	2
2	Create synonyms, sequences, unique and composite indexes; create and modify views using CREATE OR REPLACE.	1	2
3	Implement PL/SQL blocks using IF-THEN, LOOP, WHILE, and FOR constructs.	2	4
4	Implement programs using explicit cursors and loops to fetch and display data.	2	4
5	Create and execute stored procedures, functions, and packages with specifications and bodies.	2	4
6	Study database application life cycle.	3	2
7	Create multiple **Users** (CREATE USER), create a **Role**, grant specific privileges to the Role, and then grant the Role to the Users.	4	4
8	Demonstrate revoking privileges using the WITH ADMIN OPTION clause.	4	2
9	Install MongoDB and perform CRUD (Create, Read, Update, Delete) operations.	5	4

10	Study cloud concepts, Database-as-a-Service (DBaaS).	5	2
	Total		**30**

List of Laboratory/Learning Resources Required:

Suggested Project List:

1. User and Role Management System
   - Create and manage different types of database users and roles.
     - Create multiple database users with different privileges (SELECT, INSERT, UPDATE, DELETE).
     - Implement role-based access control (e.g., Admin, Manager, Staff).
     - Track and audit user activities in the database.
2. Database Security and Privilege Management
   - Implement security policies and manage privileges.
     - Grant and revoke privileges to users dynamically.
     - Restrict sensitive table access to specific roles.
     - Monitor privilege violations and failed login attempts.
3. Password Management and Authentication System
   - Simulate database authentication mechanisms.
     - Create and maintain a password file or secure password storage.
     - Implement password policies (length, complexity, expiration).
     - Track successful and failed login attempts.
4. Audit Trail and Logging System
   - Implement tracking of database activities for auditing purposes.
     - Log all DML operations (INSERT, UPDATE, DELETE) for critical tables.
     - Track who made changes and when.
     - Generate reports from the audit logs.
5. Database Utility Automation
   - Automate routine DBA tasks.
     - Automate creation of users, tablespaces, and roles.
     - Automate monitoring of database storage and performance.
     - Generate alerts for threshold violations (disk usage, query performance).
6. Multi-User Access Simulation Project
   - Demonstrate locking, concurrency, and deadlock handling.
     - Simulate multiple users accessing and updating the same table.
     - Implement row-level and table-level locks.
     - Demonstrate deadlock detection and resolution.

7. Cloud-based Database Administration
   - Administer databases on cloud platforms.
     - Deploy a managed SQL database (AWS RDS / Azure SQL / Google Cloud SQL).
     - Create users, assign roles, and configure security policies.
     - Implement backup, recovery, and monitoring in the cloud.
8. Automated Banking Transaction System
   - Implement procedures (DEPOSIT, WITHDRAW) that use explicit Cursors to check balance.
   - Ensure transaction atomicity using COMMIT/ROLLBACK logic (Unit I).
   - Create a BEFORE UPDATE trigger to prevent account overdrafts (ensuring balance > withdrawal amount).
   - Demonstrate Deadlock simulation between two accounts and the system's error handling.

Suggested Activities for Students:

Students can undertake Massive Open Online Course for Database management.

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