GANPAT UNIVERSITY

FACULTY OF DIPLOMA ENGINEERING

Programme	Diploma in Computer Engineering/ Information Technology				
Semester	III		Version	1.0.0.0	
Effective from Academic Year		2026-27	Effective for the batch Admitted in		JULY 2025
Course Code	1CEIT3104	Course Name	Database Management System		

I. TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Type	Course code	Course Title	Teaching & Learning Scheme									Examination Scheme							
			Credit				Actual Contact Hrs/week			SLH	Total Learning Hrs/Week	TH			PR			SLA	Total
			CL	TL	LL	Total	CL	TL	LL			CE	SEE	Total	CE	SEE	Total		
DSC	1CEIT3104	DATABASE MANAGEMENT SYSTEM	3	-	2	5	3	-	4	2	9	40	60	100	40	60	100	20	220

Abbreviation:	**CL-** Classroom Learning	**TL -** Tutorial Learning	**LL -** Laboratory Learning
	SLH - Self Learning Hours	**SLA -** Self Learning Assessment	**CE -** Continuous Evaluation
	SEE – Semester End Examination		

II. PRE-REQUISITES

Students that have a basic understanding of computers, data, files, tables, and basic SQL concepts are better able to begin learning database management systems.

III. INDUSTRY /EMPLOYER EXPECTED OUTCOMES

- Understand relational database concepts and design databases using ER models and normalization techniques.
- Interpret requirements and apply SQL for data definition, manipulation, and retrieval.
- Analyse database systems to ensure data integrity, consistency, and security.
- Develop efficient database solutions by analysing real-world business problems.
- Apply DBMS tools and techniques to support business applications and decision-making.

IV. COURSE LEARNING OUTCOMES

At the end of the course, students will be able to achieve the following course learning outcomes:

CO1. Understand the fundamental concepts of database systems, including architectures, data models, and the role of the Database Administrator.
CO2. Apply relational algebra operations and keys to organize and retrieve data logically.
CO3. Construct and execute various SQL queries for data definition, manipulation, and retrieval in relational databases.
CO4. Design effective database schemas using Entity-Relationship modelling to represent real-world entities and relationships.
CO5. Implement data integrity constraints and normalization techniques to ensure database consistency and minimize redundancy.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Name of Unit	Theory Learning outcomes (TLO's) aligned to CO's	Learning Content mapped with Theory Learning outcomes (TLO's)&CO's	Marks	Hours
Unit-1 **Introduction**	**TLO 1.1:** Understand and interpret basic data, information, fields, and records.	**1.1** Data, Information, Fields, and Records. **1.2** Files.	**10**	**07**

to Database System	**TLO 1.2:** Analyse and evaluate different types of files for storing and managing data. **TLO 1.3:** Apply metadata, system catalog, and data dictionary concepts for database management. **TLO 1.4:** Compare and evaluate data warehouses and traditional databases for effective data storage. **TLO 1.5:** Understand and apply the roles and responsibilities of a Database Administrator. **TLO 1.6:** Interpret and apply the functions of a Data Administrator to manage database resources. **TLO 1.7:** Analyse limitations of file-oriented systems and justify the need for DBMS.	**1.3** Metadata, System Catalog, and Data Dictionary. **1.4** Data Warehouse vs. Traditional Databases. **1.5** Database Administration: Roles of DBA. **1.6** Database Administration: Functions of DA. **1.7** System Evaluation: File-oriented Systems vs DBMS.		
Unit-2 **Introduction to SQL**	**TLO 2.1:** Understand and apply basic SQL queries for data retrieval and manipulation. **TLO 2.2:** Interpret and use SQL data types to design appropriate database structures. **TLO 2.3:** Apply DDL commands to create, modify, and manage database objects. **TLO 2.4:** Apply DML commands to insert, update, delete, and retrieve data from tables. **TLO 2.5:** Analyse and apply SQL operators for data manipulation and filtering. **TLO 2.6:** Apply SQL functions to perform calculations, aggregations, and transformations on data. **TLO 2.7:** Apply SQL clauses to organise, filter, and summarise query results effectively. **TLO 2.8:** Interpret and apply set operations to combine and compare SQL query results. **TLO 2.9:** Analyse and develop advanced SQL queries using joins and sub-queries for complex data retrieval.	**2.1** Introduction: Implementing SQL Queries. **2.2** SQL Data Types: Number, Char, Varchar, Date. **2.3** DDL Commands: Create, Alter, Drop, Truncate, Rename. **2.4** DML Commands: Insert, Update, Delete, Select. **2.5** SQL Operators: Arithmetic, Comparison, Logical. **2.6** SQL Functions: Numeric, String, Group, Date. **2.7** Data Organization: Group By, Having, Order By. **2.8** Set Operations: Union, Union All, Intersect, Minus. **2.9** Advanced Retrieval: Joins and Sub-queries.	**18**	**14**

Unit-3 **Relational Algebra**	**TLO 3.1:** Apply selection to retrieve specific data from relations. **TLO 3.2:** Apply projection to extract required attributes from relations. **TLO 3.3:** Apply union and set difference to combine or compare relations. **TLO 3.4:** Apply Cartesian product and rename to manage relation combinations. **TLO 3.5:** Analyse and apply joins to combine relations effectively. **TLO 3.6:** Apply intersection to find common tuples between relations. **TLO 3.7:** Develop relational algebra for real-world queries. **TLO 3.8:** Interpret domains and keys to ensure data integrity.	**3.1** Selection Operation. **3.2** Projection Operation. **3.3** Union and Set Difference. **3.4** Cartesian Product and Rename. **3.5** Joining (Inner, Outer joins). **3.6** Intersection Operation. **3.7** Writing Relational Algebra Expressions. **3.8** Relation Properties: Domains and Keys.	**12**	**10**
Unit-4 **Database Architecture & Models**	**TLO 4.1:** Understand and interpret schemas, sub-schemas, and database instances. **TLO 4.2:** Analyse and apply the three-level ANSI SPARC architecture for effective database design. **TLO 4.3:** Understand and differentiate between physical and logical data independence in DBMS. **TLO 4.4:** Interpret and compare different data models for structured database representation. **TLO 4.5:** Analyse various database system types and apply DBMS structure and functions for data management.	**4.1** Concepts of Schemas, Sub-schemas, and Instances. **4.2** Three-level ANSI SPARC Architecture (Internal, Conceptual, External levels). **4.3** Data Independence: Physical vs. Logical. **4.4** Data Models: Hierarchical, Network, Relational, E-R, and Object-oriented models. **4.5** Database System Types and DBMS Structure/Functions.	**12**	**8**
Unit-5 **Design, Transactions & Modern Trends**	**TLO 5.1:** Understand and apply ER modeling concepts to create ER diagrams for real-world scenarios. **TLO 5.2:** Analyse and interpret different types of relationships in ER models. **TLO 5.3:** Apply advanced ER concepts like specialization and generalization to model complex data. **TLO 5.4:** Understand and analyse the need for normalization to reduce redundancy and improve database design. **TLO 5.5:** Apply domain integrity	**5.1** ER Modeling: Symbols, Entities, Attributes, Relationships, and Cardinality ratios; Drawing ER diagrams. **5.2** Understanding various relationships. **5.3** Advanced ER: Enhanced ER features including Specialization and Generalization. **5.4** Normalization Basics: Understanding the need for normalization.	**8**	**6**

	constraints to ensure data validity in databases. **TLO 5.6:** Apply entity integrity constraints to enforce uniqueness of primary keys. **TLO 5.7:** Apply referential integrity constraints using foreign keys and cascade actions. **TLO 5.8:** Understand and analyse modern database systems, including NoSQL, distributed databases, and data warehousing.	**5.5** Implement domain integrity constraints: NOT NULL, CHECK. **5.6** Implement Entity Integrity constraints. **5.7** Implement foreign key, reference key, on delete cascade. **5.8** Modern Databases: Overview of NoSQL databases, Distributed databases, and Data Warehousing concepts.		

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL			
SR. NO	**PRACTICAL/LABORATORY LEARNING OUTCOME(LLO)**	**PRACTICAL TITLES**	**RELEVANT COs**
1	**LLO 1.1** Understand basic database concepts.	Study and identification of data, information, fields, and records using sample datasets.	CO1
2	**LLO 1.2** Analyse file-based data storage systems.	Comparative study of file-oriented systems and DBMS using examples.	CO1
3	**LLO 1.3** Apply metadata and data dictionary concepts.	Study of metadata, system catalog, and data dictionary in DBMS.	CO1
4	**LLO 1.4** Evaluate traditional databases and data warehouses.	Case study on traditional databases versus data warehouses.	CO1
5	**LLO 1.5** Understand roles of database administrators.	Study of roles and responsibilities of DBA and DA.	CO1
6	**LLO 3.1** Understand and apply basic SQL queries.	Implementation of basic SQL SELECT queries for data retrieval.	CO3
7	**LLO 3.2** Apply SQL data types.	Create tables using SQL data types (NUMBER, CHAR, VARCHAR, DATE).	CO3
8	**LLO 3.3** Implement DDL commands.	Implementation of SQL queries using CREATE, ALTER, DROP, TRUNCATE, RENAME.	CO3
9	**LLO 3.4** Implement DML commands.	Implementation of SQL queries using INSERT, UPDATE, DELETE, SELECT.	CO3
10	**LLO 3.5** Apply SQL operators.	Implementation of SQL queries using Arithmetic, Comparison, and Logical operators.	CO3
11	**LLO 3.6** Apply SQL functions.	Implementation of SQL queries using Numeric, String, Group, and Date functions.	CO3
12	**LLO 3.7** Organize data using SQL clauses.	Implementation of SQL queries using GROUP BY, HAVING, and ORDER BY clauses.	CO3
13	**LLO 3.8** Apply SQL set operations.	Implementation of SQL queries using UNION, UNION ALL, INTERSECT, and MINUS.	CO3

14	**LLO 3.9** Implement advanced SQL queries.	Implementation of SQL queries using joins and sub-queries.	CO3
15	**LLO 5.1** Apply ER modelling concepts.	Design ER diagrams for real-world database applications.	CO5

VII. SUGGESTED MICRO PROJECT/ASSIGNMENTS/ACTIVITIES FOR SELF LEARNING/SKILL DEVELOPMENT (SELF LEARNING)

Micro Projects (Mini Applications / Use Cases)

- **Hospital Management System:** Design a database to manage patient records, doctor schedules, and billing.
  Skills**:** ER Diagramming, Primary/Foreign Key constraints, and Join queries.
- **Library Information System:** Create a system to track books, member issues, and fine calculations.
  Skills**:** DDL/DML commands, Aggregate functions, and Date functions.
- **Student Grade Management System:** Develop a database to store student marks and generate automated result reports.
  Skills**:** SQL Grouping (Group by/Having), Numeric functions, and View creation.
- **Inventory Control System:** Manage product stock levels, supplier details, and purchase orders.
  Skills**:** Normalization (1NF to 3NF), Referential Integrity, and Sub-queries.
- **Simple ATM Simulation Database:** Model account transactions, balance updates, and user authentication.
  Skills**:** Transaction properties (ACID), Integrity constraints, and Update operations

Self-Learning / Skill Building Activities

1. **Local Environment Setup:** Install and configure **MySQL/MariaDB** using XAMPP or WAMP server. Practice starting/stopping services and accessing the database via Command Line (CLI).
2. **Database Schema Mapping:** Identify a manual system (e.g., a local medical store's billing) and map its paper-based records into a relational table structure.
3. **SQL Benchmarking:** Solve the "SQL (Basic)" skill certification on **HackerRank** or **CodeChef** to achieve a badge/certificate for placement readiness.
4. **Normalization Workshop:** Take a complex, "unnormalized" invoice from an e-commerce site and step-by-step decompose it into **3rd Normal Form (3NF)** tables.
5. **ER-Diagramming Tools:** Practice drawing professional ER Diagrams for a "Student Attendance System" using open-source tools like **StarUML** or **Draw.io**.
6. **Security Implementation:** Use GRANT and REVOKE commands to create a "Read-Only" user and a "Super-User," simulating real-world database access control.
7. **Data Migration:** Practice importing and exporting database records between **.sql** files and **.csv** formats to understand data portability.
8. **Query Logic Building:** Formulate complex queries involving **Nested Sub-queries** and **Self-Joins** based on real-world scenarios like finding employees who earn more than their managers.
9. **Case Study Exploration:** Study the database structure of a simple **ATM system**, identifying how Atomicity (from ACID properties) prevents money loss during a crash.
10. **Technical Documentation:** Prepare a "SQL Cheat Sheet" containing syntax for DDL, DML, and DCL commands to be used as a quick-reference guide in the laboratory.

VIII. LIST OF INSTRUMENTS / EQUIPMENT / TRAINER BOARD	
1	Editor: MySQL Workbench or Visual Studio Code (with SQL Extensions)
2	Oracle Database Express Edition (XE)
3	Online Compilers & Simulators SQL Fiddle: https://sqlfiddle.com DB-Fiddle: https://www.db-fiddle.com

	Oracle Live SQL: https://livesql.oracle.com
4	Collaboration / Documentation Tools: Draw.io / Lucidchart: https://app.diagrams.net – Used for drawing ER Diagrams (Entity-Relationship Models) and Schema designs. GitHub / Git: Version control for storing your SQL scripts (`.sql` files) and project schemas. Google Docs / Word: For writing lab manuals, project reports, and documenting database schemas.

IX. LIST OF REFERENCE BOOKS

Sr.No	Title	Author	Publication
1	Database System Concepts	Korth, Silberschatz, Sudarshan	McGraw Hill
2	Fundamentals of Database Systems	Elmasri & Navathe	Pearson Education
3	SQL, PL/SQL: The Programming Language of Oracle	Ivan Bayross	BPB Publications
4	Database Management Systems	Raghu Ramakrishnan	McGraw Hill

X. LINK OF LEARNING WEB RESOURCE

1	W3Schools SQL Tutorial: https://www.w3schools.com/sql/
2	Tutorials Point - DBMS: https://www.tutorialspoint.com/dbms/
3	Oracle Live SQL: https://livesql.oracle.com/ (For practicing online)
4	NPTEL - Introduction to Databases: https://nptel.ac.in/
5	YouTube Channel: Khan Academy - SQL Course

XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	Introduction to Database System	CO1	07	2	6	2	10
2	Introduction to SQL	CO2	14	2	6	10	18
3	Relational Algebra	CO3	10	2	4	6	12
4	Database Architecture & Models	CO4	8	2	4	6	12
5	Design, Transactions & Modern Trends	CO5	6	2	4	2	8
	Grand Total		**45**	**10**	**24**	**26**	**60**

XII. COs AND POs AND PSOs MAPPING

Course Outcome (Cos)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3

CO1	3	1	0	0	0	0	1	2	0	1
CO2	2	3	3	2	0	0	2	0	3	2
CO3	1	2	2	3	0	0	2	2	3	3
CO4	1	2	3	3	0	0	2	2	3	2
CO5	2	1	0	1	3	1	2	0	1	3

Legends: - *3-High; 2-Moderate/Medium; 1-Slight/Low; 0-None*