Course Title: Database Management System			
Course Code: UDS 106	**No. of credits:** 3	**L-T-P:** 20-16-18	**Learning hours: 45**
			L: Lectures**; T:** Tutorials**; P:** Practicals
Pre-requisite Course Code and Title (if any): None			
Department: Natural and Applied Sciences			
Course Coordinator: Dr. Adwitiya Sinha		**Course Instructor:**	
Contact Details:			
Course Type: Major		**Course Offered in:** Semester 2	

Course Description

This course explores the foundational concepts of database system and its components. This includes modelling of real-world systems using Entity Relationship Diagrams (ERDs). Subsequently, the students will learn to transform these ER models into relational logical schemas, by employing diverse mapping algorithms. The practical knowledge of Structured Query Language (SQL) commands and relational algebraic expressions will be emphasized for efficient query processing. Additionally, the curriculum covers the simplification of databases through the normalization process, with keys and functional dependencies. A crucial aspect of the course involves addressing issues related to atomicity, consistency, isolation, durability, transactions, and concurrency within databases. Overall, the course will help the students to acquire the skills for navigating the intricacies of designing databases, implementing, and managing robust systems.

Course Objectives

- To understand the basic concepts of database systems and components
- To learn usage of entity relationship diagrams using various mapping algorithms
- To apply SQL commands and relational algebraic expressions for query processing
- To manage databases using normalization process using functional dependencies
- To address security issues in databases to safeguard against unauthorized access

Course Content

Module	Topic	L	T	P
1	**Introduction to Database Design**			
	The objective of this module is to foster the understanding of database concepts for designing, implementing, and managing relational data effectively. This will help to ensure optimal storage and retrieval, with a structured approach to data organization. The students will learn about features including generalization and specialization for modelling inheritance and aggregation. This will further assist in representing relationships involving part-whole structures, and other advanced concepts for more complex data modelling scenarios. The module will include the following topics: Introduction to databases, physical level of data storage, structure of relational databases, entity type, attributes, relation types, notations, constraints, Entity Relationship Diagrams (ERD), extended ER features	5	4	
2	**Relational Model and Structured Query Language**			
	This module illustrates on the facilitation of creation, management, and querying of relational databases. The relational model establishes relationships between tables using keys, enabling the representation of complex relationships in a structured manner. The learns will acquire knowledge on	5	4	8

	SQL for performing various operations on a database, including data retrieval, insertion, updating, and deletion. The combined proficiency on relational model and SQL will empower students to efficiently design, build queries, and managing relational databases. Following are the topics to be covered in this module: Structured Query Language, relational algebra, data definition, data manipulation, data control			
3	**Database Normalisation**			
	This module will enable the students to learn organizing databases efficiently by eliminating redundancy, while preserving data integrity. The knowledge of normalization will help to reduce data anomalies and improve the overall database structure. The process involves breaking down large tables into smaller, well-organized tables, thereby reducing data duplication, and ensuring that relationships between tables are well-defined. The topics to be covered in this module include: Data Dependencies, 1NF, partial dependencies, 2NF, transitive dependencies, 3NF, BCNF, multi-valued dependencies, 4NF, 5NF, building normalised databases	5	4	4
4	**Database Applications & Transaction Management**			
	This module will highlight the applications of SQL to enhance database capabilities for procedural programming, facilitating complex logic and practical implementation. The learners will acquire the concept of concurrency control manages that are required for database integrity. The module will provide insights on recovery mechanisms to restore database consistency after failures, thereby enhancing robustness. It will also include security measures, encompassing authentication and authorization, thus ensuring data confidentiality and integrity. This module will cover following topics: SQL, introduction to web enabled and multimedia databases, database connectivity, transactions, concurrency, recovery, security	5	4	6
	Total	20	16	18
Practical	Data definition languages, basic SQL commands to create, alter, drop, rename, truncate; data types			4
	Basic data manipulation languages for querying & viewing data, like select, insert, update, delete			4
	Data control languages, join, subqueries, commit, rollback, etc., normalization			4
	Database tools, like MySQL, PostgreSQL, SQLite, etc., Minor Project			6
	Total			**18**

Evaluation criteria

- Minor Test 1: Written test [at the end of teaching of modules 1 and 2] -- 20%
- Minor Test 2: Written test [at the end of teaching of module 3] -- 20%
- Practical: Practical test [including modules 2 and 3] -- 20%
- Minor Project: Project-based learning [at the end of teaching of module 4] -- 10%
- Major Test: Written test [at the end of the semester, full syllabus] -- 30%

Learning outcomes

By the end of the course, students will:

- Develop an in-depth knowledge of the relational model and database design [module 1 and 2; minor test 1]
- Learn the usage of structured query language and database normalisation [module 2 and 3; minor test 2; practical test]
- Attain practical knowhow of managing and manipulating relational databases [module 1, 2, 3, and 4; minor project; major test]

Pedagogical approach

- The course critically evaluates the concepts of database management system and its components through classroom discussions, lectures, tutorials, project-based learning, and case studies.
- The course will allow learners to engage with enough hands-on sessions that will help in bridging the gap between theoretical concepts of database and practical implementation.
- The course will offer in-depth knowhow of SQL programming and diverse database application.

Reading Resources (* = compulsory readings)

- * Date, C.J., Kanman, A., Swamynathan, S. (2000). *An Introduction to Database Systems* Pearson Education, ISBN: 9780201684193, 938 pages
- * Panneerselvam, R. (2018). *Database Management Systems*. PHI Learning Private Limited, ISBN: 9789387472105, 476 pages
- Bush, J. (2020). *Learn SQL Database Programming*. Packt Publishing, ISBN: 9781838981709, 564 pages
- Nield, T. (2016). *Getting Started with SQL*. O'Reilly Media Publishing, ISBN: 9781491938560, 134 pages
- Ramakrishnan, R., Gehrke, J. (2000). *Database Management Systems*. Tata McGraw Hill Education, ISBN: 9780072465358, 906 pages
- Date, C.J. (2012). *SQL and Relational Theory: How to Write Accurate SQL Code*. O'Reilly Media Publishing, ISBN: 9781449316402, 428 pages
- Chopra, R. (2016). *Database Management System: A Practical Approach*. Fifth Edition. S. Chand Publishing, ISBN: 9789385676345, 669 pages

Student Responsibilities

The students are required to come prepared with readings that would be given in the class. The students are required to participate in the class discussions.

Course Designed by:

- Dr. Adwitiya Sinha, Associate Professor, Department of Computer Science & Engineering and Information Technology, Jaypee Institute of Information Technology, Noida-62, Uttar Pradesh – 201309

Course Reviewers:

The course is reviewed by the following reviewers:

- Dr. D. K. Lobiyal, Professor, School of Computer & Systems Sciences, Jawaharlal Nehru University, New Delhi
- Dr. Ela Kumar, Professor, Department of Computer Science and Engineering, Indira Gandhi Delhi Technical University for Women, New Delhi
- Dr. Kapil Sharma, Professor, Department of Information Technology, Delhi Technological University, Shahbad Daulatpur, Main Bawana Road, Delhi