

Department of Computer Science, UET Lahore Course Preparation Report			
Course Code	CS262	Semester	Spring 2024
Course Title	Database Systems		
Subject Teachers	Mr. Samyan Qayyum Wahla Mr. Nazeef ul Haq		
Course Type	Theory		

Course Description

This course covers how to use databases in applications, provides details on fundamentals concepts of database systems covering schemas, structural, storage and their algorithmic details, helps students to write queries using SQL and design good schemas with the help of entity relation modelling and normalization techniques for the development of good applications. Course also aims to expose students to practical data problems using Google Cloud Platform (BigQuery) and SQL+ Python/C# as query and programming language respectively.

Course Learning Outcomes

CLO1	Describe the importance and fundamental concepts of Database Systems using different data models in real world business applications
CLO2	Write a Query to answer real world question related to the data.
CLO3	Design good schemas using ER modelling, dependencies and normal forms to build and evolve good applications
CLO4	Describe the need of optimization, Transaction Management and Concurrency Control for reliable applications.

Text Books

B1	Database Systems -- Design, Implementation and Management by Coronell, Morris, ROB 13 th Edition
B2	Database Systems -- The Complete Book by Ullman 2 nd Edition
B3	Fundamentals of Database Systems by Elmasri, Navathe 7 th Edition

Course Plan

Week wise content with mapping of text book

Week	Content	CLO	Text Book
W1	Introduction to DBMS Data Lake Introduction, Transaction processing and DBMS, Data models	CLO1	B2: 1.1, 1.2, 1.3 B1: Chapter 1
W2	SQL & RA I: Concepts, Schemas , Introduction to Relational Algebra(RA), Projection, Selection	CLO2	B2: 6.1, 6.2, 6.3 B2: 2.1, 2.2
W3	SQL & RA II: Joins, Set operators & sub queries (HW # 1 out)	CLO2	B2: 6.2, 6.3 and 6.4 B2: 2.4
W4	SQL & RA III: Advanced: Grouping, Aggregation & Nested Queries	CLO2	B2: 6.5, 6.6 B2: Chapter 5
W5	E/R Model Quiz # 1 (Introduction & SQL) Lecture: Data Ethics and Open Datasets (HW # 2 out)	CLO3	B3: Chapter 3,4
W6	Design Theory: Functional Dependencies, Keys, Normal Forms (Boyce Codd)	CLO3	B2: 3.1, 3.2, 3.3
W7	Design Theory: MVD, Closure and other properties Quiz # 2 (Design Theory) (HW # 3 out)	CLO3	B2: 3.4, 3.4, 3.6
W8	Design Theory: 1NF, 2NF, 3NF and 4NF Revision for midterm	CLO3	B2: Chapter 3 and Lecture
W9	Mid-semester Examination		
W10	Constraints and Triggers	CLO2	B2: 7.2, 7.3 and 7.4, 7.5
W11	Views and Indexes	CLO2	B2: 8.1, 8.2 and 8.3
W12	Indexing and IO model Searching, Sorting and Hashing Lecture: Attacking Big problems with data Sorting, Building, Indices (B+ trees)	CLO1	B2: 8.4, 8.5 B2: Chapter 14
W13	Query Optimization Transactions Logging Coping with System Failures	CLO4	B2: Chapter 17

W14	Transactions Locking /Concurrency Control Quiz # 3 (Optimization & Indexes & Transactions)	CLO4	Chapter 18
W15	Semi-structure data, JSON, NoSQL and OLAP	CLO1	B2: Chapter 11
W16	Graph Databases Lecture: Data Security	CLO1	Lecture
End Term Examination			

Course Benchmarking

Course is bench marked with the following course

1. Stanford CS145: Fall 2022(<https://cs145-fall22.github.io/>)

Comparison with benchmarked Courses

Week	Content (Our)	Stanford: CS145
W1	Introduction to DBMS Data Lake Introduction, Transaction processing and DBMS, Data models	"Why Databases? Concepts: Data models, DB systems overview"
W2	SQL & RA I: Concepts, Schemas , Introduction to Relational Algebra(RA), Projection, Selection	SQL I: Concepts: Schemas, Systems, Select-From-Where
W3	SQL & RA II: Joins, Set operators & sub queries	SQL II: Concepts: Joins, Set operators, Subqueries
W4	SQL & RA III: Advanced: Grouping, Aggregation & Nested Queries	SQL III, Advanced, Concepts: Grouping, Aggregations, Nested queries
W5	E/R Model	Scale: Indexing and IO Model
W6	Design Theory: Functional Dependencies, Keys, Normal Forms (Boyce Codd)	Sorting, Building Indices Part 1
W7	Design Theory: MVD, Closure and other properties	B+ Trees
W8	Design Theory: 1NF, 2NF, 3NF and 4NF Revision for midterm	Query Optimization Part1
W9	Mid-semester Examination	
W10	Constraints and Triggers	Query Optimization Part2
W11	Views and Indexes	Systems Design: Putting it all together

W12	Indexing and IO model Searching, Sorting and Hashing Sorting, Building, Indices (B+ trees)	Transactions Logging
W13	Query Optimization Transactions Logging Coping with System Failures	Transactions Locking
W14	Transactions Locking /Concurrency Control	Big schemas and Design Theory I
W15	Semi-structure data, JSON, NoSQL and OLAP	Big Schemas and Design Theory II
W16	Graph Databases	Design Theory Continued

Assignments

HW#1: Writing Database Queries for the given schema

HW#2: ER Modeling for real world case study

HW#3: Design Theory

Semester Project

Students are required to pick a real world problem, analyze, apply the design theory, querying the database, visualization of data using templates, solve the issues of system failure, optimize the system using query optimization and indexes. The milestones of project are spread across the semester and synced with Lab.