



COMSATS University Islamabad

Department of Computer Science

Course Syllabus

Course Information

Course Code: **CSC270**

Credit Hours: **4 (3,1)**

Lab Hours/Week: **3**

Course Title: **Database Systems**

Lecture Hours/Week: **3**

Pre-Requisites: **CSC211- Data Structures and Algorithms**

Catalogue Description:

This course introduces the fundamental concepts of database systems. Topics include: Introduction to Databases & Information Systems; Evolution of Database Systems; Components; Architecture; Functions; Relational Model; Relational Algebra; Relational Calculus; Data Modeling; Relational Data Model; Relational Algebra & Calculus; Integrity Constraints; Conceptual Models; Entity-Relationship (E-R) Model; Enhanced E-R Model; Mapping Conceptual Schema to Relational Schema; Functional Dependency & Normalization; Structured Query Language (SQL); Views; Materialized Views; Non-Relational/No SQL Databases; MongoDB as NoSQL Database; Document Model; and Transaction Management.

Text and Reference Books

Text Books:

1. Database systems: A Practical Approach to Design, Implementation, And Management, Thomas Connolly y, Carolyn Begg, Pearson, 2015.
2. MongoDB: The Definitive Guide, Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, O'Reilly Media, 2019.

Reference Books:

1. Fundamentals of Database Systems, Elmasri, R, Navathe, Pearson, 2016.
2. Database System Concepts, Silberschatz, Korth, Sudarshan, McGraw Hill, 2019.

Week wise Plan:

Lecture #	CDF Unit #	Topics Covered	Reading Material
1.	1	Introduction to Databases; Information Systems & their Applications; Evolution of Database Management Systems (DBMS), and Advantages & Disadvantages of DBMS.	Connolly : Ch1
2.	1	Database Approach: Components & Roles in Database Environment.	Connolly : Ch1
3.	1	Database Environment: Database Languages & Functions.	Connolly : Ch2
4.	1	Database Architectures, and Data Independence.	Connolly : Ch2,3
5.	2	Overview of Relational Model, Notion of a Relation, Mathematical & Database Relations; Relation Properties, Attributes & Domains; Relational Keys, and Representing Relational DB Schema.	Connolly : Ch4
6.	2	Integrity Constraints.	Connolly : Ch4
7.	3	Introduction to Relational Algebra, Unary Operations, and Set Operations.	Connolly : Ch5
8.	3	Join & Division Operations in Relational Algebra.	Connolly : Ch5
9.	3	Aggregation & Grouping Operations in Relational Algebra.	Connolly : Ch5

10.	3	Relational Calculus: Tuple & Domain in Relational Calculus.	Connolly : Ch5
11.	4	Data Modeling, Conceptual Models, Logical Models, and Relational Database Design.	Connolly : Ch10
12.	4	Introduction to Entity-Relationship (ER) Model, Entity Types, Relationship Types, Attributes, Strong & Weak Entity Types, Attributes on Relationships, and Structural Constraints.	Connolly : Ch12
13.	4	ER Modeling Issues/Problems.	Connolly : Ch12
14.	4	Enhanced ER (EER) Model: Specialization/Generalization, Aggregation, and Composition.	Connolly : Ch13
15.	4	EER Modeling Case Study.	Connolly : Ch13
16.	4	Mapping EER to Relational Schema.	Connolly : Ch17
17.	Mid Term Exam		
18.			
19.	5	Normalization: Purpose, Normalization Support for DB Design, Data Redundancy & Anomalies, Functional Dependencies & Normalization, Decomposition of a Schema, Lossless-Join, and Dependency-Preservation Properties of a Decomposition.	Connolly : Ch14
20.	5	Normalization Process: First, Second & Third Normal Form.	Connolly : Ch14
21.	5	Advanced Normalization: Inference Rules for Functional Dependencies, Minimal Sets of FDs, and Boyce-Codd Normal Form (BCNF).	Connolly : Ch15, Elmasri : Ch15
22.	5	BCNF Schema Design by Decomposition Algorithm.	Connolly : Ch15, Elmasri : Ch15
23.	5	Multi-Valued Dependencies, and Fourth Normal Form.	Connolly : Ch15
24.	6	Views, and Materialized Views.	Connolly : Ch7
25.	6	Database Authorization.	Connolly : Ch20
26.	6	Indexing Overview, and Primary & Secondary Indexes in Relational Database.	Connolly : Ch18
27.	7	Introduction to NoSQL/Non-Relational Databases.	Shannon : Ch1
28.	7	MongoDB as a NoSQL Database, and Document Model.	Shannon : Ch2
29.	7	MongoDB Sharding and Replication.	Shannon : Ch9, 13
30.	8	Introduction to Database Transactions & its Properties.	Connolly : Ch22
31.	8	Transaction Management: Concurrency Control, and Isolation Levels.	Connolly : Ch22
32.	8	Failure and Recovery in Transaction Management.	Connolly : Ch22
Final Term Exam			
Student Outcomes (SOs)			
S.#	Description		
1	Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements		

2	Identify, formulate, research literature, and solve <i>complex</i> computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines
3	Design and evaluate solutions for <i>complex</i> computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations
4	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to <i>complex</i> computing activities, with an understanding of the limitations
5	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.
9	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional

Course Learning Outcomes (CLO)

Sr.#	Unit #	Course Learning Outcomes	Blooms Taxonomy Learning Level	SO
CLO's for Theory				
CLO-1	1	Explain database concepts and principles.	<i>Understanding</i>	1
CLO-2	2-3	Apply the concept of domain and tuple relational calculus.	<i>Applying</i>	1-2
CLO-3	4-5	Apply data modeling and normalization techniques to design database for small to medium size enterprise	<i>Applying</i>	2-3
CLO-4	8	Describe the principles of transaction management.	<i>Understanding</i>	1
CLO's for Lab				
CLO-5	6-7	Apply data processing operations on both relational and non-relational DBMS.	<i>Applying</i>	4,9
CLO-6	1-8	Develop a database system for medium size enterprise in a team environment	<i>Creating</i>	2,4,5,9

CLO Assessment Mechanism

Assessment Tools	CLO-1	CLO-2	CLO-3	CLO-4	CLO-5	CLO-6
Quizzes	Quiz 1	Quiz 2	Quiz 3	Quiz 4	-	-
Assignments	-	Assignment 1	Assignment 2-4	-	Lab Assignments	-
Mid Term Exam	Mid Term Exam	Mid Term Exam	Mid Term Exam	-	-	-
Final Term Exam	Final Term Exam					-
Project	-	-	-	-	-	Lab Project

Policy & Procedures

- **Attendance Policy:** Every student must attend 80% of the lectures as well as laboratory in this course. The students falling short of required percentage of attendance of lectures/laboratory work, is not allowed to appear in the terminal examination.

- **Course Assessment:**

	Quizzes	Assignments	Mid Term Exam	Terminal Exam	Total
Theory (T)	15	10	25	50	100
Lab (L)	-	25	25	50	100
Final Marks (T+L)	$(T/100) * 75 + (L/100) * 25$				

- **Grading Policy:** The minimum passing marks for each course is 50% (In case of LAB; in addition to theory, student is also required to obtain 50% marks in the lab to pass the course). The correspondence between letter grades, credit points, and percentage marks at CUI is as follows:

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	F
Marks	>= 85	80 - 84	75 - 79	71 - 74	68 - 70	64 - 67	61 - 63	58 - 60	54 - 57	50-53	< 50
Cr. Point	3.67-4.00	3.34-3.66	3.01-3.33	2.67-3.00	2.34-2.66	2.01-2.33	1.67-2.00	1.31-1.66	1.01-1.30	0.10-1.00	0.00

- **Missing Exam:** No makeup exam will be given for final exam under any circumstance. When a student misses the mid-term exam for a legitimate reason (such as medical emergencies), his grade for this exam will be determined based on the Department policy. Further, the student must provide an official excuse within one week of the missed exam.
- **Academic Integrity:** All CUI policies regarding ethics apply to this course. The students are advised to discuss their grievances/problems with their counsellors or course instructor in a respectful manner.
- **Plagiarism Policy:** Plagiarism, copying and any other dishonest behaviour is prohibited by the rules and regulations of CUI. Violators will face serious consequences.