National University of Sciences & Technology (NUST)
School of Electrical Engineering and Computer Science (SEECS)
Department of Computer Science

CS-220 Database Systems

Course Code:	CS-220	**Semester:**	3rd
Credit Hours:	3+1	**Prerequisite Codes:**	CS-101 or Equivalent
Instructor:	Dr. Seema Jehan	**Class:**	BSCS-9C
Office:	B-201, IAEC	**VoIP:**	
Lecture Days:	Mon,Tue	**E-mail:**	seema.jehan@seecs.edu.pk
Class Room:	CR-22	**Consulting Hours:**	By Appointment
Lab Engineer:	Nadeem Nawaz	**Lab Engineer Email:**	Nadeem.nawaz@seecs.edu.pk
Knowledge Group:	Data Management	**Updates on LMS:**	After every lecture

Course Description:

Basic database concepts, Database approach vs. file based system, database architecture, three level schema architecture, data independence, relational data model, attributes, schemas, tuples, domains, relation instances, keys of relations, integrity constraints, relational algebra, selection, projection, Cartesian product, types of joins, normalization, functional dependencies, normal forms, entity relationship model, entity sets, attributes, relationship, entity-relationship diagrams, Structured Query Language (SQL), Joins and subqueries in SQL, Grouping and aggregation in SQL, concurrency control, database backup and recovery, indexes, NoSQL systems.

Course Objectives:

The course objective is that its successful completion should enable students to engineer database system and handle practical problems in modeling and implementation of real-world data repositories.

Course Learning Outcomes (CLOs):		
At the end of the course the students will be able to:	**PLO**	**BT Level***
1. Prepare database schema that incorporates keys and integrity constraints.	3	C-3
2. Analyze database schema for normalization of relations.	10	C-4
3. Design a relational schema using the entity relationship model.	2	C-5
4. Demonstrate SQL queries to retrieve information from a relational database.	9	P-4

* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain

Mapping of CLOs to Program Learning Outcomes

PLOs/CLOs	CLO1	CLO2	CLO3	CLO4	Emphasis Level
PLO 1 (Computing Knowledge)					
PLO 2 (Problem and Requirement Analysis)			X		
PLO 3 (Design, Implementation and Evaluation of Solutions)	X				
PLO 4 (Individual and Team Work)					
PLO 5 (Professional and ethical Responsibility)					
PLO 6 (Communication)					
PLO 7 (Local and Global Computing Impact					

Analysis)					
PLO 8 (Lifelong Learning)					
PLO 9 (Modern tool usage)				X	
PLO 10 (Design Choices and Tradeoffs Analysis)		X			
PLO 11 (Adherence to Design and Development Principles)					

Mapping of CLOs to Program Learning Outcomes

Mapping of CLOs to Assessment Modules and Weightages (In accordance with NUST statutes)

Assessments/CLOs
Theory: 75%
Assignments: 20%
Midterm: 30%
End Semester Exam: 50%
Labs: 25%
Lab Tasks: 70%
Semester Project: 30%
Total: 100 %

Books:

Text Book:

1. R. Elmasri, S.B. Navathe (2016): Fundamentals of Database Systems, 7/E, Addison-Wesley

Reference Material:

1. Carlos Colonel, Steven Morris (2017): Database Systems, Design, Implementation, & management, 13th edition
2. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widon (2008): Database Systems The Complete Book, 2nd Edition
3. Database Systems Concepts and Design, Udacity free online course by Georgia Tech (https://classroom.udacity.com/courses/ ud150/)

	Topic
Week 1	Lecture-1: Introduction to Databases Lecture-2: Data Models Lecture-3: Database System Concept and Architecture
Week 2	Lecture-4: Entity Relationship Model Lecture-5: Data Modeling using ER Model Lecture-6: Case study – ER Model
Week 3	Lecture-7: Data Modeling using EER Model Lecture-8: Data Modeling using EER Model contd.

	Lecture-9: Case Study
Week 4	Lecture-10: Relational Model Lecture-11: Relational Database Constraints Lecture-12: Scalar & Vector Aggregation
Week 5	Lecture-13: Basic SQL Lecture-14: Specifying Constraints in SQL Lecture-15: Basic Retrieval Queries in Database
Week 6	Lecture-16: Insert, Delete & Update Statements Lecture-17: SQL- Insert, Delete & Update Statements Lecture-18: Joins
Week 7	Lecture-19: Joins Contd. Lecture-20: SQL- Join Examples & Exercises Lecture-21: More Complex SQL Queries
Week 8	MIDTERM
Week 9	Lecture-22: Views Lecture-23: SQL Views Lecture-24: Triggers/Transactions
Week 10	Lecture-25: Relational Algebra Lecture-26: Relational Algebra Contd. Lecture-27: Relational Algebra Examples
Week 11	Lecture-28: EER Mapping Lecture-29: EER Mapping contd. Lecture-30: Case Study
Week 12	Lecture-31: Basics of Functional Dependencies – Normalization Lecture-32: Normalization Contd. Lecture-33: Normalization Case Study
Week 13	Lecture-34: Introduction to PHP Lecture-35: Basic features of PHP Lecture-36: Basic features of PHP contd.
Week 14	Lecture-37: Disk Storage Lecture-38: Operations on Files Lecture-39: Hashing Techniques
Week 15	Lecture-40: Introduction to NoSQL Databases Lecture-41: NoSQL Databases contd. Lecture-42: Distributed Database Architectures
Week 16	**ESE**

Lab Experiments	
01	MySQL and Workbench Environment
02	Database Design (ER-Modeling)
03	EER- Modeling
04	Relational Modelling
05	SQL SELECT/ Built in Functions (Single Row & Multiple Row)
06	DDL Statements & Data types
07	Database Constraints
08	SQL Insert, Update, Delete Queries
09	Joins
10	Outer Joins
11	Views
12	Triggers
13	Correlated and Non-correlated sub-queries
14	Querying NoSQL Databases

Tools / Software Requirement:
MySQL Workbench (6.1+), Java SE (JDK 8), Eclipse (Luna 4.4+)

Grading Policy:	
Quiz Policy:	The quizzes may be unannounced and normally last for ten minutes. The question framed is to test the concepts involved in last few lectures.
Assignment Policy:	The course website will be the primary source for announcements and submitting assignments.
Lab Conduct:	The labs will be conducted for three hours every week. A lab handout will be given in advance for study and analysis. The lab handouts will also be placed on LMS. The students are to submit their lab tasks at the end of lab for evaluation. One submission per group will be required. However, students may also be evaluated by oral viva during the lab.
Plagiarism:	Collaboration and group wok is encouraged but each student is required to submit his/her own contribution(s). Your writings must be your own thoughts. You must cite and acknowledge all sources of information in your assignments. Cheating and plagiarism will not be tolerated and will lead to strict penalties including zero marks in assignments as well as referral to the Dean for appropriate action(s).