COURSE DESCRIPTION FORM

INSTITUTION National University of Computer and Emerging Sciences (NUCES-FAST)

PROGRAM (S) TO BE EVALUATED BS(CS)

A. Course Description

(Fill out the following table for each course in your computer science curriculum. A filled out form should not be more than 2-3 pages.)

Course Code	CS-2005
Course Title	Database Systems
Credit Hours	3+1
Prerequisites by Course(s) and Topics	CS-2001 (Data Structures)
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	Mid-I: 15 Mid-II: 15 Assignments/Quizzes: 10 Project: 10 Final: 50
Course Coordinator	Dr. Zulfiqar Ali Memon
URL (if any)	
Current Catalog Description	Basic database concepts, Conceptual modelling, Relational data model, Relational theory and languages, Database design, SQL, Introduction to query processing and optimization, Introduction to concurrency and recovery with advance topics. This course provides students with the essential concepts, principles, and techniques of modern database systems from a user perspective. This means that the lecture focuses on the functionalities that are offered by database systems and not on the methods to implement them. Specifically, the course teaches students the ability to develop a solution for a real-world data management problem that requires the application of the theories and practices developed in class. From a theoretical point of view, this course covers the essential principles for the design, analysis, and use of computerized database systems. The design and techniques of conceptual modeling, database modeling, database system architecture, and user/program interfaces are presented in a unified way.
Textbook (or **Laboratory Manual**	Ramez Elmasri & Shamkant B. Navathe, *Database Systems, Models, Languages, Design and Application Programming,* 7th Edition, 2016.

for Laboratory Courses)	
Reference Material	1) Thomas Connolly, Carolyn Begg, *Database Systems: A practical approach to design, implementation and Management*, 6th Edition, 2015. 2) C.J. Date, *An Introduction to Database Systems*, 8th Edition, 2004
Course Goals	**A. Course Learning Outcomes (CLOs)** 1. Explain fundamental database concepts. 2. Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms, such as a data dictionary. 3. Demonstrate an understanding of normalization theory to normalize the database and formulate, using SQL & relational algebra, solutions to a broad range of query & data problems in a team work.

B. Program Learning Outcomes

For each attribute below, indicate whether this attribute is covered in this course or not. Leave the cell blank if the enablement is little or non-existent.

1. Academic Education:	To prepare graduates as computing professionals	
2. Knowledge for Solving Computing Problems:	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.	
3. Problem Analysis:	Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.	✔
4. Design/ Development of Solutions:	Design and evaluate solutions for complex 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.	✔
5. Modern Tool Usage:	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an	✔

	understanding of the limitations.	
6. Individual and Team Work:	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings.	
7. Communication:	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.	
8. Computing Professionalism and Society:	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.	
9. Ethics:	Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.	
10. Life-long Learning:	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.	

C. Relation between CLOs and PLOs
(CLO: Course Learning Outcome, PLOs: Program Learning Outcomes)

		PLOs									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CLOs	1			✔							
	2				✔						
	3					✔					

Topics Covered in the Course, with Number of Lectures on Each Topic (assume 15-week instruction and one-hour lectures)

1. Topics to be covered:

List of Topics	No. of Weeks	Contact Hours	CLO
Chapter 1 Introduction, Characteristics of Database Approach, Files Vs. Databases, Characteristics of Database approach, Advantages of	**2**	**6**	**1**

using DBMS, When not to use DBMS, Chapter 2 Data Model, Schema and Instance, three schema architecture and data independence, classification of DBMS, database languages & Interfaces, Database systems environment. Chapter 5 Relational Model Concepts, Relational Model Constraints				
Chapter 5 Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations Chapter 6 SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL, Additional Features of SQL	**2**	**6**	**1,2**
Chapter 7 More Complex SQL Retrieval Queries, Views (Virtual Tables) in SQL, Schema Change Statements in SQL	**1**	**3**	**1,2**
========== *MID 1* ==========			
Chapter 3 Using High-Level Conceptual Data Models for Database Design, A Sample Database Application. Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, Refining the ER Design for the COMPANY Database, ER Diagrams, Naming Conventions, and Design Issues, Relationship Types of Degree Higher than Two	**1.5**	**4.5**	**2**
Chapter 8 Unary Relational Operations: SELECT and PROJECT Relational Algebra Operations from Set Theory	**1**	**3**	**2**

	Binary Relational Operations: JOIN and DIVISION Examples of Queries in Relational Algebra			
	Chapter 14 Informal Design Guidelines for Relation Schemas Functional Dependencies/Normal Forms Based on Primary Keys General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form Multivalued Dependency and Fourth Normal Form Join Dependencies and Fifth Normal Form	**2.5**	**7.5**	**3**
	========== *MID 2* ==========			
	Chapter 20 Introduction to Transaction Processing Transaction and System Concepts Desirable Properties of Transactions Characterizing Schedules Based on Recoverability Characterizing Schedules Based on Serializability Transaction Support in SQL, Chapter 21 Two-Phase Locking Techniques for Concurrency Control Concurrency Control Based on Timestamp Ordering Multiversion Concurrency Control Techniques Validation (Optimistic) Concurrency Control Techniques Granularity of Data Items and Multiple Granularity Locking	**2**	**6**	**1,2**
	Chapter 22 Recovery Concepts NO-UNDO/REDO Recovery Based on Deferred Update Recovery Techniques Based on Immediate Update Chapter 24 Introduction to NOSQL Systems Document-Based NOSQL Systems and MongoDB	**1.5**	**4.5**	**1,2**

	NOSQL Key-Value Stores Column-Based or Wide Column NOSQL Systems			
	Review	**0.5**	**1.5**	**1,2,3**
	Project Presentations	**1**	**3**	**1**
	Total	**15**	**45**	

Laboratory Projects/Experiments Done in the Course				
Programming Assignments Done in the Course				
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design**	**Social and Ethical Issues**
	30	10	5	0
Oral and Written Communications	Every student is required to submit at least __1__ written report of typically _2__ pages and to make _1__ oral presentations of typically __10__ minute's duration. Include only material that is graded for grammar, spelling, style, and so forth, as well as for technical content, completeness, and accuracy.			

Instructor Name __Dr. Zulfiqar Ali Memon

Instructor Signature _____

Date __August 22nd, 2022