**COURSE BASICS**

Course Title**: Database Management System**

Course Code**: CSC-220**

Credit Hours**: 3+1**

Prerequisite**: CSC-113 Computer Programming**

Class & Section: **BSE-4 (A&C)**

**Course Objectives and Description:**

The main objective of this course is to provide students with the background to design, implement, and use database management systems. This course shows students how the theory of relational algebra serves as a framework and a foundation for the efficient organization and retrieval of data. It introduces students to some standard notations (for example, SQL) that implement important parts of relational algebra. This course gives students practical experience of the use and limitations of some database notations (such as SQL) that are widely used in industry and business. Transaction processing, concurrency control and recovery techniques, query optimization concepts are also covered.

**Course Learning Outcomes (CLO):**

|  |  |  |
| --- | --- | --- |
| **CLO #** | **CLO Statement** | **Bloom’s Taxonomy** |
| CLO 1: | Define database concepts like Data Models, functional dependencies, transaction processing, concurrency control and recovery techniques etc. | C1 |
| CLO 2: | Explain the concepts and working mechanism related to Data Models, dependencies, normalization, transactions etc. | C2 |
| CLO 3: | Apply appropriate database techniques such as relation algebra, SQL queries, Transaction management, and concurrency management to create solution for different problems | C3 |
| CLO 4: | Design an appropriate database structure for a given business scenario using methods such as:   * Entity relationship diagrams & * Database normalization. | C5 |

**Weekly Breakdown:**

|  |  |
| --- | --- |
| **Week** | **Tentative Course Plan** |
| 1 | Outline of Database-System Studies  Data vs. Information  Introducing the Database and the DBMS  Historical Roots: Files and File Systems  Problems with File System Data Management  Database Systems  DBMS Functions  Introduction to SQL & SELECT Queries  Selecting Rows with Conditional Restrictions  Arithmetic Operators: The Rule of Precedence  Logical Operators: AND, OR, and NOT  Special Operators |
| **Lab1** - Introduction to SQL Server and Select Statements and Where Clause |
| 2 | Business Rules  The Evolution Of Data Models  1. The Hierarchical Model  2. The Network Model  3. The Relational Model  4. The Entity Relationship Model  5. The Object-Oriented (OO) Model  6. The Convergence of Data Models  7. Database Models and the Internet  Degrees of Data Abstraction  Advanced SELECT Queries  Ordering a Listing  Listing Unique Values  Aggregate Functions  Grouping Data |
| **Lab 2** - Order by, Group by and having Clause, Aggregate, Math, String and Data & Time Functions |
| 3 | The Relational Database Model - **Quiz 1**  A Logical View of Data  Keys  Integrity Rules  Relational Set Operators  Relational Algebra |
| **Lab 3** – Relational Set Operators in SQL |
| 4 | Relational Calculus and Query construction  Practice exercise  Relationships within the Relational Database  The Data Dictionary and the System Catalog  SQL Join Operators  Cross Join  Natural Join  Join USING Clause  JOIN ON Clause  Outer Joins |
| **Lab 4** - Joining Queries |
| 5 | Codd’s Relational Database Rules  Entity Relationship (ER) Modeling  The Entity Relationship Model (ERM)  Entities, Attributes, Relationships  Connectivity and Cardinality  Existence Dependence  Relationship Strength  Weak Entities  Relationship Participation  Sub queries and Correlated Queries  1. WHERE Sub queries  2. IN Sub queries  3. HAVING Sub queries  4. Multi-row Sub query Operators: ANY and ALL  5. FROM Sub queries  6. Attribute List Sub queries  7. Correlated Sub queries |
| **Lab 5** - Sub-Queries |
| 6 | Relationship Degree  Recursive Relationships  Associative (Composite) Entities  Developing an ER Diagram  Practice Scenarios for ER Modeling  **Data Definition Commands**  1. The Database Model  2. Creating the Database  3. The Database Schema  4. Data Types  5. Creating Table Structures |
| **Lab 6** - Data Definition Language (DDL) Queries |
| 7 | The Extended Entity Relationship Model  Entity Super-types and Subtypes  Specialization Hierarchy  Inheritance  Subtype Discriminator  Disjoint and Overlapping Constraints  Completeness Constraint  Specialization and Generalization  SQL Constraints  SQL Indexes **Quiz 2** |
| **Lab 7** - Constraints on tables and indexes |
| 8 | Entity Clustering  Entity Integrity: Selecting Primary  The Database Life Cycle (DBLC) |
| **Lab 8** - Data Manipulation Language (DML) Queries |
| **9** | **MID TERM** | |
| 10 | Mid Term Paper Showing  Functional Dependencies  Rules About Functional Dependencies  Functional Dependencies  **Data Manipulation Commands**  1. Adding Table Rows  2. Saving Table Changes  3. Listing Table Rows  4. Updating Table Rows  5. Restoring Table Contents  6. Deleting Table Rows  7. Inserting Table Rows with a Select Subquery |
| **Lab 9** - OEL |
| 11 | Inference Rules  Normalization  1st NF, 2nd NF and 3rd NF  Multivalued Dependencies  Virtual Tables: Creating a View |
| **Lab 10** – Views |
| 12 | Fourth Normal Form (4NF), BCNF & PJNF  Normalization and Database Design  De-normalization - **Quiz 3**  Procedural SQL **(**Triggers) |
| **Lab 11** – Triggers |
| 13 | Transaction Management and Concurrency Control  What Is a Transaction  Procedural SQL(Stored Procedures ) |
| **Lab 12**- Stored Procedures (Control-of-Flow Statements) |
| 14 | Concurrency Control  Concurrency Control with Locking Methods  Concurrency Control with Time Stamping Methods  Procedural SQL(PL/SQL Stored Functions) |
| **Lab 13** - Stored Procedures (Control-of-Flow Statements) |
| 15 | Locks and deadlocks and recovery techniques  Concurrency Control with Optimistic Methods  Database Recovery Management  SQL Fetching Phase  Query Processing Bottlenecks  Indexes and Query Optimization  Query Processing  SQL Parsing Phase  SQL Execution Phase |
| **Lab 14** - Database Connectivity, Transaction and concurrency |
| 16 | DBMS tuning  Query Processing  and Query Optimization |
| **Lab 15-**OEL II |
| 17 | Distributed Databases  Data Fragmentation, Data Replication  Revision |
| **Lab Project Demo and Lab Viva** |
| **18** | **FINAL TERM** | |

***NOTE:***

1. *This schedule is subject to revisions as conditions may warrant.*
2. *Topics will be covered in sequence no matter if city observes any planned or unplanned holidays.*
3. *The information in this course outline is subject to revision as conditions may warrant.*

**Course Assessment Method**

**Method of Evaluation and Structure:**

A student’s grade will be based on multiple measures of performance as mentioned below:

|  |  |
| --- | --- |
| **Evaluation Instruments (EI)** | **Marks** |
| Quizzes (4 Quizzes of 10 Marks) | 10 |
| Assignments (3 Assignments) | 20 |
| Mid Term Examination | 20 |
| Final Examination | 50 |
| **Total** | **100** |

*NOTE: Any change in this scheme/format will be communicated well in time.*

**Mapping of CLOs to PLOs (Program Learning Outcomes)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PLO’s** | **CLO’s** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| PLO:1 (Engineering Knowledge) | x | x |  |  |
| PLO:2 (Engineering Problem Analysis) |  |  |  | x |
| PLO:3 (Designing and Development) |  |  | x |  |
| PLO:4 (Investigation) |  |  |  |  |
| PLO:5 (Modern tool usage) |  |  |  |  |
| PLO:6 (Engineer and Society) |  |  |  |  |
| PLO:7 (Environment and Sustainability) |  |  |  |  |
| PLO:8 (Professionalism and Ethics) |  |  |  |  |
| PLO:9 (Individual and Team Work) |  |  |  |  |
| PLO:10 (Communication) |  |  |  |  |
| PLO:11 (Project Management) |  |  |  |  |
| PLO:12 (Lifelong Learning) |  |  |  |  |

**Mapping of CLOs to Course Evaluation Instruments (EI)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EI** | **CLO’s** | | | |
| **CLO 1** | **CLO 2** | **CLO 3** | **CLO 4** |
| Assignments | x | x | x | x |
| Quizzes | x | x | x | x |
| Midterm Exam | x | x | x | x |
| Final Exam | x | x | x | x |

**Grading System:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Letter Grade *(& meaning)*** | | **Percentage** | **Grade Point** |
| **A** | Outstanding | 87 – 100 | 4.0 |
| **B+** | Very Good | 80 – 86 | 3.5 |
| **B** | Above Average | 72 – 79 | 3.0 |
| **C+** | Satisfactory | 66 – 71 | 2.5 |
| **C** | Barely Acceptable | 60 – 65 | 2.0 |
| **D** | Poor | 50 – 59 | 1.5 |
| **F** | Fail | Below 50 | 0.0 |
| **W** | Withdrawal | | |
| **I** | Incomplete Coursework | | |

**COURSE RESOURCES**

**Instructor:**

Name: Engr. Bushra Fazal Khan

Designation: Assistant Professor

Office: Faculty 8 Iqbal Block

Email: bushrafazal.bukc@bahria.edu.pk

**Counseling Hours:**

Mondays : 12:30 to 2:30

Friday : 12:30 to 2:30

**Text Book:**

1. Carlos Coronel, Steven Morris and Peter Rob. Database Systems: Design, Implementation, and Management, 2016 (12th edition).

**Reference Books:**

1. Abraham Silberschatz, Henry F. Korth S. Sudarshan. “Database System Concepts”.
2. C. J. Date, Database Systems, Addison Wesley Pub. Co.
3. R. Elmasri and S. Navathe. Fundamentals of Database Systems, Benjamin/Cummings.
4. T.Connolly and C.Begg. “Database Systems, a Practical Approach to Design, Implementation and Management”, Pearson education.
5. Philip Greenspun, “[SQL for Web Nerds](http://philip.greenspun.com/sql/)”

**Online References:**

* https://class.stanford.edu/courses/Engineering/db/2014\_1/about
* www.w3schools.com