**COURSE INFORMATION SHEET**

**(For Theory+Lab Based Course)**

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| |  |  | | --- | --- | | **Session:** | Spring Session 2021 | | **Course Title:** | Database Systems | | **Course Code:** | CS-329 | | **Credit Hours:** | 3+1 | | **Semester:** | 5th | | **Pre-Requisites:** | None | | **Instructor Name:** | Mr.Shardha Nand  Ms.Anam Siddiqui  Mr. Asif Raza | | **Email and Contact Information** | [shardhanand@ssuet.edu.pk](mailto:shardhanand@ssuet.edu.pk)  ansiddiqui@ssuet.edu.pk  asif.raza@ssuet.edu.pk | | **WhatsApp Group** | Database Systems Batch 2019 | | **Office Hours:** | 09:00-17:00 | | **Mode of Teaching:** | Synchronous/Asynchronous/ Hybrid/**Blended** | |

**COURSE OBJECTIVE:**

Students will be able to …

* List and explain the fundamental concepts of a relational database system..
* Analyze database requirements and determine the entities involved in the system and their relationship to one another.
* Develop the logical design of the database using data modeling concepts such as entity-relationship diagrams.
* Create a relational database using a relational database package.
* Manipulate a database using SQL.
* Assess the quality and ease of use of data modeling and diagramming tools

**COURSE OUTLINE:**

Basic database concepts; Entity Relationship modeling, Relational data model and Relational algebra, Structured Query Language; RDBMS; Database design, functional dependencies and normal forms; Transaction processing and optimization concepts; concurrency control and recovery techniques; Database security and authorization. Small Group Project implementing a database; Physical database design; Storage and file structure; indexed files; hashed files; Database efficiency and tuning; Data Warehousing and Data Mining, Emerging Database Technologies and Applications.

**COURSE LEARNING OUTCOMES (CLOs) and its mapping with Program Learning Outcomes (PLOs):**

|  |  |  |  |
| --- | --- | --- | --- |
| **CLO No.** | **Course Learning Outcomes (CLOs)** | **PLOs** | **Bloom’s Taxonomy** |
| 1 | **Describe** | PLO\_1  (Engineering knowledge) | C1  (Remembering) |
| 2 | **Explain** | PLO\_1  (Engineering knowledge) | C2  (Understanding) |
| 3 | **Demonstrate** | PLO\_2  (Problem Analysis) | C3  (Applying) |
| 4 | **Follow** | PLO\_5  (Modern Tool Usage) | P3  (Guided Response) |

**COMPLEX ENGINEERING PROBLEM/ACTIVITY:**

|  |  |
| --- | --- |
| **Complex Engineering Problem Details** | **Included: No**  Nature and details of Complex Engineering Problem (CEP): It will be given in Assignment # 0X.  CEP will be based on CLO-X "Students have to develop learning about -------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------.To investigate the problem, students use in-depth knowledge related to the following concepts: --------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------.  **Attributes could be: WP1, WP3, WK5, WK8**  WP1: Depth of knowledge required  WP3: Depth of analysis required  WK5: Engineering Design  WK8: Research Literature  Assessment in: Assignment # 0X |
| **Complex Engineering Activity Details** | **Included: Yes**  Activity: Project Assigned to 2-3 students in a group  Provide the complete details of the Complex Engineering Activity along with the Attributes. |

**RELATIONSHIP BETWEEN ASSESSMENT TOOLS AND CLOs:**

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| --- | --- | --- | --- | --- |
| **Assessment Tools** | **CLO-1(Marks)** | **CLO-2(Marks)** | **CLO-3(Marks)** | **CLO-4(Marks)** |
| **Quizzes** | 10% | 40% | 50% | - |
| **Assignments** | 10% | 40% | 50% | - |
| **Midterm Exam** | 10% | 40% | 50% | - |
| **Final Exam** | 10% | 40% | 50% | - |
| **Lab Assessment** | - | - | - | 100% |

**GRADING POLICY:**

|  |  |
| --- | --- |
| **Assessment Tools** | **Percentage** |
| Quizzes | 5% |
| Assignments | 5% |
| Midterm Exam | 20% |
| Final Exam | 50% |
| Lab Assessment | 20% |
| **TOTAL** | **100%** |

**Recommended Book:**

* Elmasri, Ramez, *Fundamentals of Database Systems*,7th Edition, Pearson India,2017

**Reference Books:**

* C.J.Date: *An Introduction to Database Systems*, 8th Edition
* Coronel,Carlos,*Database Systems: Design, Implementation, & Management,*13th EditionCengage Learning,2018
* Building the Data Warehouse W.H. Inmon, Wiley Publishing Inc., Latest Edition.

*Inmon, Building the Data Warehouse, 4th edition, Indiana,* Wiley Publishing Inc., 2005

* *Data Mining: Concepts and Techniques Book by Jiawei Han*

*Jiawei, Data Mining: Concepts and Techniques, 3rd Edition, San Francisco,ElsevierInc, ,2012*

**COURSE BREAKDOWN WITH LAB SYNCHRONIZATION:**

**- Both sides same Colours:** Lab is synchronized with the topic

**- Red Color:** Lab is not synchronized (*conducted before theory*)

- **No Color:** Lab is to introduce new hardware or software skill **/**

Open Ended Lab / Lab is relevant to a topic taught in

Pre-requisite and required for upcoming labs

|  |  |  |  |
| --- | --- | --- | --- |
| **Week No.** | **Topics** | | **Laboratory Synchronization** |
| 1 | Introduction-The Database Environment  Introduction of Data, Approach of Database system introduction of database management system | | Introduction To Database Management System SQL and is features |
| 2 | Database System Architecture  The three levels of architecture, Data Independence, Centralized and Client/Server Architectures for DBMSs,Database auditing | | Data Definition Operations and to become familiar with data definition language. |
| 3, | Data Models  Using High-Level Conceptual Data Models for Database Design,Data Independence, Relationship Types, Relationship Sets, Roles, and Structural Constraints | | Data Manipulation Operations with Insert/Update and Delete Commands. |
| 4 | Entity-Relational Model  Basic concepts of Entity sets and Attributes and their types, Relationship and Mapping constraints with Maximum and minimum cardinality | | Data RetrievalOperations using SELECT , Relationship among Tables considering constraints. |
| 5 | Total and Partial participation, Keys and their types, Unary, Binary, Ternary relationship sets | | Data Retrieval Operations using Join operations, concept of Unary Binary and Ternary Relationship |
| 6 | Extended E-R Features  Supersets and Subsets of Entity sets with Specialization and Generalization | | Single Row Functions and Aggregation Data Using Group Functions |
| 7 | Design Constraints on Specialization and Generalization, Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with ConstraintViolations | | Implementing Cardinalities(Minimum ,Maximum) and mapping constraints on multiple tables |
| 8 | **MIDTERM** | | |
| 9 | SQL Data Definition and Data Types  INSERT, DELETE, and UPDATE Statements in SQL, Basic Retrieval Queries and Constraints in SQL, Exercises for SQL | Sub-queries and Compound Queries in SQL | |
| 10 | Relational Algebra and Relational Calculus  Introduction of Relational algebra and Relational Operators | Creating Sequences ad Indexes. | |
| 11 | Database Design theory and Normalization  Informal Design Guidelines for Relation Schemas Functional Dependencies Normal Forms Based on Primary Keys General Definitions of Second and Third Normal Forms | Implementing Normalization on tables with mapping and constraints | |
| 12 | Introduction to Transaction Processing Concepts and Theory, Desirable properties of Transactions, | Creating and managing tables and views | |
| 13 | Two - Phase Locking Techniques for Concurrency control | Managing profiles and controlling user access | |
| 14 | Granularity of Data Items, Multiple Granularity Locking, Concurrency Control Issue | SQLAuditing | |
| 15 | Introduction Data Warehousing and Data Mining, The Relational and the Multidimensional Models as a Basis for Database Design | Implementation of Data MiningAlgorithm: Apriori : Association Rule Mining | |
| 16 | Emerging Database Technologies and Applications, Big data | Project Presentation | |

**LECTURE PLAN**

**Course Title: Database Systems**

**Course Code: CS-329**

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| --- | --- | --- | --- | --- |
| **Week No.** | **Week Dates** | **Topics** | **Required Reading** | **Key Date** |
| **1** | 15-02-2021 to  19-02-2021 | Introduction to the Database, what is Data, Information, and Database Information Systems, Actors on the Scene, Workers behind the scene, Advantages of using Database approach, Data Models, Schemas, and Instances, Three-Schema Architecture | RE-Chap 1:  Pg. 4  RE-Chap 1:  Pg. 17  RE-Chap 2:  Pg. 32 |  |
| **2** | 22-02-2021 to  26-02-2021 | * Data Independence * Centralized and Client/Server Architectures for DBMS * Database security * Database Authentication * Database auditing | RE-Chap 2:  Pg. 36,46  CJ-Chap 2  Pg. 49  RE-Chap 30:  Pg.1121  RE-Chap 30:  Pg.1126 |  |
| **3** | 01-03-2021 to  05-03-2021 | * Using High-Level Conceptual Data Models for Database Design * Data Independence * Relationship Types, Relationship Sets, Roles, and Structural Constraints | RE-Chap 2:  Pg. 31  RE-Chap 2:  Pg. 36  RE-Chap 3:  Pg. 63,72 |  |
| **4** | 08-03-2021 to  12-03-2021 | * Weak Entity Types, Total and Partial participation * Existence Dependencies * Associative Entity setsUnary, Binary, Ternary relationship sets, Recursive relationship | RE-Chap 3:  Pg. 72-79 |  |
| **5** | 15-03-2021 to  19-03-2021 | * Subclasses, Super classes, and Inheritance * Specialization and Generalization * Constraints and Characteristics of Specialization and Generalization Hierarchies | RE-Chap 4:  Pg. 107-113 |  |
| **6** | 22-03-2021 to  26-03-2021 | * Relational Model Concepts * Constraints and Relational Database Schemas * Update Operations, Transactions, and Dealing with Constraint violation | RE-Chap 9:  Pg. 290,298  RE-Chap 5:  Pg. 165 |  |
| **7** | 29-03-2021 to  02-04-2021 | * Relational Database Design Using ER-to-Relational Mapping * Mapping EER Model Constructs to Relations * Mapping Super/Sub sets relationships, and Shared Subclasses | RE-Chap 9:  Pg. 290,298  RE-Chap 9:  Pg. 301 |  |
| **8** | **Midterm Examination**  **(05-04-2021 to 10-04-2021)** | | | |  |  | RE-Chap 5:  Pg. 165 |
| **9** | 12-04-2021 to  16-04-2021 | * SQL Data Definition and Data Types * INSERT, DELETE, and UPDATE Statements in SQL * Basic Retrieval Queries and Constraints in SQL, Exercises for SQL * Basic tuning concepts | RE-Chap 6:  Pg. 179  CJ-Chap 4  Pg. 85  RE-Chap 6:  Pg. 198,201  RE-Chap 6:  Pg. 187,205 |  |
| **10** | 19-04-2021 to  23-04-2021 | * Basic SQL Relational Algebra Operations * Unary Relational Operations * Relational Algebra Operations From Set Theory * Binary Relational Operations | RE-Chap 8:  Pg. 239-251 |  |
| **11** | 26-04-2021 to  30-04-2021 | * Functional Dependencies and its types * Normal Forms Based on Primary Keys * General Definitions of first ,Second and Third Normal Forms, Exercises For Normalization, | RE-Chap 15:  Pg. 503  RE-Chap 14:  Pg.471,474  CJ-Chap 11  Pg. 33,349  RE-Chap 14:  Pg. 483,497  CJ-Chap 12  Pg. 357 |  |
| **12** | 03-05-2021 to  07-05-2021 | * Introduction to Transaction Processing Concepts and Theory * Desirable properties of Transactions * 08 different ways for optimization of queries * Two - Phase Locking Techniques for Concurrency control | RE-Chap 20:  Pg.745  RE-Chap 20:  Pg.757  RE-Chap 21:  Pg. 782 |  |
| **13** | 10-05-2021 to  14-05-2021 | * Multiversion Concurrency Control Techniques * Validation (Optimistic) Techniques and Snapshot Isolation Concurrency Control * Recovery Concepts, | RE-Chap 21:  Pg. 795  CJ-Chap 16  Pg. 465  RE-Chap 21:  Pg. 798,800  RE-Chap 22:  Pg. 814 |  |
| **14** | 17-05-2021 to  21-05-2021 | * Granularity of Data Items * Multiple Granularity Locking * Concurrency Control Issue | RE-Chap 21:  Pg. 798,800  CJ-Chap 16  Pg. 466  RE-Chap 21:  Pg. 798,800  CJ-Chap 16  Pg. 466 |  |
| **15** | 24-05-2021 to  28-05-2021 | * Introduction Data Warehousing and Data Mining * The Relational and the Multidimensional Models as a Basis for Database Design * Classification and Prediction * Clustering | WH - Chap:1  Page. N0.1-25  WH - Chap:1  Page. N0.357  JH- Chap:Chap:6  Page. N0.285  JH- Chap:Chap:7  Page. N0.387 |  |
| **16** | 31-05-2021 to  04-06-2021 | * Emerging Database Technologies and Applications * Big Data * Course revision | Research Papers and Latest articles  RE-Chap 25:  Pg. 911 |  |
| **Final Examination**  **(07-06-2021 to 19-06-2021)** | | | | |

**RE:**RamezElmasri**CJ:**C.J.Date**WH** : W.H. Inmon**JH:**Jiawei Han

**LAB PLAN**

**Course Title:**

**Course Code:**

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| **Week No.** | **Lab Date** | **Objective** | **Required Reading** |
| **1** | 15-02-2021 to  19-02-2021 | Introduction To Database Management System SQL and is features | Lab Sheet # 1 |
| **2** | 22-02-2021 to  26-02-2021 | Data Definition Operations and to become familiar with data definition language. | Lab Sheet # 2 |
| **3** | 01-03-2021 to  05-03-2021 | Data Manipulation Operations with Insert/Update and Delete Commands. | Lab Sheet # 3 |
| **4** | 08-03-2021 to  12-03-2021 | Data Retrieval Operations using SELECT, Relationship among Tables considering constraints. | Lab Sheet # 4 |
| **5** | 15-03-2021 to  19-03-2021 | Data Retrieval Operations using Join operations, concept of Unary Binary and Ternary Relationship | Lab Sheet # 5 |
| **6** | 22-03-2021 to  26-03-2021 | Single Row Functions and Aggregation Data Using Group Functions | Lab Sheet # 6 |
| **7** | 29-03-2021 to  02-04-2021 | Implementing Cardinalities(Minimum ,Maximum) and mapping constraints on multiple tables | Lab Sheet # 7 |
| **8** | **Mid Term Examination**  **(05-04-2021 to 10-04-2021)** | | |
| **9** | 12-04-2021 to  16-04-2021 | Sub-queries and Compound Queries in SQL | Lab Sheet # 8 |
| **10** | 19-04-2021 to  23-04-2021 | Retrieving Data from Multiple Tables, Mapping of shared data | Lab Sheet # 9 |
| **11** | 26-04-2021 to  30-04-2021 | Creating Sequences ad Indexes. | Lab Sheet # 10 |
| **12** | 03-05-2021 to  07-05-2021 | Creating and managing tables and views | Lab Sheet # 11 |
| **13** | 10-05-2021 to  14-05-2021 | Managing profiles and controlling user access | Lab Sheet # 12 |
| **14** | 17-05-2021 to  21-05-2021 | SQL Auditing | Lab Sheet # 13 |
| **15** | 24-05-2021 to  28-05-2021 | Implementation of Data Mining Algorithm: Apriori : Association Rule Mining | Lab Sheet # 14 |
| **16** | Project Final Presentation  **Lab Examination**  **(31-05-2021 to 04-06-2021)** | | |