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**School of Computer Engineering**

**KIIT deemed to be University**

**SPRING SEMESTER 2024**

**Course Handout**

1. **Course Code: CS20006**
2. **Course title: Database Management System**
3. **L-T-P Structure: 3-0-0**
4. **Course Instructor: Dr. Minakhi Rout**
5. **Contact hours per week : 3**
6. **Course Objective(s):** Databases are fundamental to much of business and commerce. Database management systems control access to databases. Some people design and build databases. Other people design and build database management systems. People in a third category use database management systems to access the data in databases. The purpose of a database management system is to store and transform data into information to support making decisions.
7. **Course (learning) outcomes:** At the end of the course, the students will get:

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| --- | --- | --- |
|  | **Course Outcomes** | **Modules** |
| CO1 | Ability to apply database systems and its applications | Module#1 |
| CO2 | Ability to conceptualize a database system using ER and EER diagrams. | Module#1 |
| CO3 | Ability to construct the Database using relational algebra, and SQL. | Module#2 |
| CO4 | Ability to identify Primary key and other keys using functional dependencies and design the database using normalization. | Module#3 |
| CO5 | Ability to implement Transaction processing for controlling the concurrent data access and data recovery schemes | Module#4 |
| CO6 | Ability to use database storage access techniques including indexing methods | Module#5 |

1. **Course Contents**

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| **Unit** | **Name** | **Details** |
| **1** | **Introduction and E/R Model** | **Purpose of Database System, Views of data, Data Models, Database**  **Languages, Database System Architecture, Components of DBMS, Entity,**  **Relationship model (E-R model ), E-R Diagram notation, EER notations, Examples.** |
| **2** | **Relational Model** | **Relational Data Model, Concept of relations, Schema-instance distinction,**  **keys, integrity rules, Relational algebra operators, SQL: Data definition, Data**  **manipulation, Aggregate function, Null Values, Nested sub queries, Joined**  **relations.** |
| **3** | **Database Design** | **Dependencies and Normal forms, Dependency theory, Functional dependencies, Armstrong's axioms for FD's, Closure of a set of FD's, minimal covers, Definitions of 1NF, 2NF, 3NF and BCNF, 4NF, 5NF, Decompositions and desirable properties of them.** |
| **4** | **Transaction Management** | **ACID properties, Serializability and concurrency control, Lock based concurrency control (2PL), Timestamp ordering protocol, Database recovery management.** |
| **5** | **Implementation Techniques** | **Overview of Physical Storage Media, RAID, Ordered Indices, primary, Secondary index structures, Multi-level indexes, B trees and B+ trees.** |

1. **Day-wise Lesson Plan**

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| --- | --- | --- | --- |
| **Unit** | **Module** | **Topics** | **days** |
| **1** | **Introduction and E/R Model** | * **General introduction to database systems** * **Database- DBMS distinction, Approaches to building a database** * **Data models** * **Three-schema architecture of a database** * **Challenges in building a DBMS, Various components of a DBMS** * **Conceptual data modeling – motivation** * **Entities, Entity sets, Various types of attributes** * **Relationships, Relationship types** * **Types of Entity sets, Participation Constraints** * **E/R diagram notation, Examples** * **Extended E/R Model, Examples** * **Converting the database specification in E/R and extended E/R notation to the relational schema** * **Activity1** | **13** |
| **2** | **Relational Data Model** | * **Relational Data Model, Concept of relations, Schema-instance distinction,** * **keys, integrity rules, Relational algebra operators,** * **SQL: Data definition, Data manipulation** * **Aggregate function, Null Values, Nested sub queries, join relations.** * **Activity2** | **5** |
| **3** | **Relational Database Design** | * **Dependencies and Normal Forms, Importance of a good schema design, Problems encountered with bad schema designs,** * **Dependency theory – functional dependencies, Armstrong's axioms for FD's,** * **Closure of a set of FD's** * **Minimal covers and example**   **----------MID Term -----------**   * **Motivation for normal forms 1NF, 2NF,** * **3NF** * **BCNF** * **Decompositions and desirable properties of them, Multi-valued dependencies and 4NF,** * **Join dependencies and definition of 5NF, denormalization** * **Activity3** | **10** |
| **4** | **Transaction**  **Processing and Error Recovery** | * **Concepts of transaction processing** * **ACID properties** * **Concurrency control** * **Serializability and types of serializability and practicing problems** * **Locking based protocols(2PL)** * **Time stamp based protocol** * **Error recovery and logging** * **Undo, Redo, Undo-redo logging and recovery methods** * **Activity4** | **9** |
| **5** | **Data Storage and Indexes** | * **Overview of Physical Storage Media, RAID** * **Primary, Secondary Index structures** * **Multi-level indexes, B trees, B+ trees** * **Activity5** | **5** |

1. **Text books**

T1: Fundamentals of Database System By R. Elmasari & S.B. Navathe, 7th Edition, 2018, Pearson

Education.

T2: Database System Concepts by A. Silberschatz, H.F. Korth & S. Sudarshan, 7th Edition, 2019, McGraw- Hill Education.

1. **Reference books**

R1: Database Management Systems by R. RamaKrishna & J. Gehrke, 3rd Edition, 2018, McGraw-Hill

Education.

R2: Database System Concepts by P. Rob & C. M. Coronel, Indian Edition, 2011, Cengage Learning.

R3: Fundamentals of Relational Database management Systems by S. Sumathi & S. Esakkirajan, 2007, Springer.

1. **Assessment components:**

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| **S No.** | **Internal/Sessional** | **Assessment**  **Component** | **Weightage / Marks** |
| **1** | **Internal**  **(50 Marks)** | Activity-1 | 05 |
| Activity-2 | 05 |
| Activity-3 | 05 |
| Activity-4 | 05 |
| Activity-5 | 05 |
| Activity-6 | 05 |
| Mid Semester Exam | 20 |
| **2** | **End Semester**  **(50 Marks)** | End Semester Exam | 50 |

1. **Activity Components (Internal Assessment) and Activity CO Mapping**

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| --- | --- | --- |
| **Act#** | **Details** | **CO#** |
| 1 | MCQ Test on Fundamentals of Database | 1, 2 |
| 2 | E/R Diagram Design Question | 2 |
| 3 | MCQ Test on Querying Languages | 3 |
| 4 | Problem solving on Normalization | 4 |
| 5 | MCQ Test on Normalization, Transaction Processing & Indexing | 4, 5, 6 |
| 6 | Group Projects | 2, 3, 4 |

**14. Attendance:** Every student is expected to be regular (in attendance) in all lecture classes, tutorials, labs, tests, quizzes, seminars etc and in fulfilling all tasks assigned to him / her. Attendance will be recorded and 75% attendance is compulsory.

**15. Additional consultation hour for doubts clarification:** Tuesday (11-12AM), Thursday (11-12AM)

**16. Notices:** All notices regarding the course will be communicated through online systems (email and WhatsApp etc).

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