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| **Course Title** | **Advance Database Management System** | | | | |
| **Course Code** | **CSH304B-T&P** | | | | |
| **Credits** | Lecture : 3 ; Lab:2 (TOTAL:5) | | | | |
| **Course Coordinator/ Instructor(s):** | Dr. Hardeo Kumar Thakur | | | | |
| **E-mail ID** | [**hkthakur@mru.edu.in**](mailto:hkthakur@mru.edu.in) | | | | |
| **Course type:** | Lecture/Tutorial/Lab/Outcome (3-0-2-0) | | | | |
| **Core or Elective:** | Domain Elective/ Hard | | | | |
| **Term Offered:** | Odd Semester (5th semester) | | | | |
| **Course Schedule:** | **Lecture:**  3 per week. | | **Tutorial:**  NA | | **Lab:**  2 per week hands-on session. |
| **Hours for Appointment** | 11:30 AM -12:30 PM (All working days except Friday) | | | | |
| **Course Assessment:** | **Formal Assessment:**  **Theory, Practical :**2 mid-term and 1 end semester test | | | **Informal Assessment**  **Theory:** Assignments, Class tests, Quiz  **Practical:** Viva, Lab Participation | |
| **Relationship to other courses** | **Course Prerequisites** | RDBMS | | | |
| **Assumed Knowledge** | SQL | | | |
| **Following Courses** | NoSQL, DDBMS, Multimedia DBMS | | | |
| **Objective** | Student would be able to **Grasp advanced data management techniques to manage optimize and utilize the database efficiently.** | | | | |
| **Course Outcomes (COs)** | Students will have the Ability to:  CSH304.1: Analyze different Data Model techniques e.g. RDBMS, OODBMS, ORDBMS, ERD  CSH304.2: Apply basic and Advanced SQL query and other emerging DBMS techniques  CSH304.3: Demonstrate the understanding of Database Transactions and Recovery Procedures  CSH304.4: Analyze different advanced /emerging database management System  CSH304.5: Apply acquired knowledge for design efficient solution based on database system /database techniques | | | | |

**Syllabus**

**Section-A**

**Overview of basic concepts of DBMS:**

Formal review of ERD, relational database and FDs Implication, Closure, its correctness. Data Models: EER model and relationship to the OO model, Object Oriented Databases, Overview of concepts: object identity, object structure, type constructors, encapsulation of operations, methods and persistence, type hierarchies and inheritance, complex objects, overview of Object model of ODMG, object Relational databases, Databases design for an ORDBMS, Nested relational Model, storage and access method. Query Optimization, Cost Estimation in Query Execution, Semantic Query Optimization.

**Section-B**

**Database Transactions and Recovery Procedures:**

Transaction Processing Concepts, Transaction and System Concepts, Desirable Properties of a Transaction, Schedules and Recoverability, Serializability of Schedules, Transaction Support in SQL, Recovery Techniques, Database Backup, Concurrency control, locking techniques for Concurrency Control, Concurrency Control Techniques, Granularity of Data Items. Client Server Computing: Client Server Concepts, 2-Tier and 3-Tier Client Server Systems, Client/Server Architecture and the Internet, Client /Database Server Models, Technology Components of Client Server Systems, Application Development in Client Server Systems.

**Section-C**

**Distributed and Parallel Databases:**

Reliability and Commit protocols, Fragmentation and Distribution, View Integration, Distributed database design, Distributed algorithms for data management, Heterogeneous and Federated Database Systems. Parallel database Architectures and their merits and demerits. Deductive and Web Databases: Recursive Queries, Prolog/Datalog Notation, Basic inference Mechanism for Logic Programs, Deductive Database Systems, Deductive Object Oriented Database Systems; Web or Internet Databases: Introduction, uses, Building blocks of Web, tools, advantages and disadvantages.

**Section-D**

**Emerging Databases:** Multimedia database: Definition, need of Multimedia databases, MDBMS, Multimedia database components and structure, Multimedia database queries and applications; Mobile database: definition, their need, Characteristics, architecture, uses and limitations of mobile databases; Digital libraries: Introduction, Objectives, types, components, myths, services, advantages, limitations, and comparison with traditional libraries; Spatial databases: Basic concepts, need, types and relationships, architecture, queries, indexing techniques, advantages and disadvantages of spatial databases; Temporal database: basic concepts, characteristics, components, merits and demerits.

**Text Book:**

1. Fundamentals of Database Systems (3 edition), Elmasri R. and Navathe S.B., 2000, Addison Wesley, Low Priced Edition.

**Reference Book:**

1. Database System Concepts by A. Silbershatz, H.F. Korth and S. Sudarshan, 3rd edition, 1997, McGraw-Hill, International Edition.

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| --- | --- | --- | --- | --- |
| **Topic**  **Layout** | **Topic** | **L** | **T** | **P** |
| Section A:  **Basic concepts of DBMS** | 14 | NA | 8 |
| Section B: **Database Transactions and Recovery Procedures** | 10 | NA | 6 |
| Section C: **Distributed and Parallel Databases** | 9 | NA | 8 |
| Section D: **Emerging Databases** | 9 | NA | 6 |
| **TOTAL (Hours)** | | **42** | **NA** | **28** |

**LESSON PLAN**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Week** | **Lect. no** | **Lecture Topics** | **Laboratory** | **Course outcome** | **Blooms Taxonomy** | **Program Outcome** |
| **1** | 1 | Overview of DBMS | **Lab 1:** SQL DDL /DML Review | **CO1 & CO2** | BT1, BT2, BT3 | PO1,PO2,PO3, PO4,PO5 |
| **2** | Revisited ER model |
| **3** | Introduction to EER Model: Subclasses, Super classes, Inheritance,Specialization and Generalization |
| **2** | 1 | FDs Implication, Closure, its correctness | **Lab 2:SQL Query** | **CO1 & CO2** | BT1, BT2, BT3 | PO1,PO2,PO3, PO4,PO5 |
| 2 | Object Oriented Model |
| 3 | Modeling of UNION Types of EER model,  Type Hierarchies, Inheritance and Complex objects of Object Oriented Databases |
| **3** | 1 | Object Identity, Object Structure, Type Constructor and Encapsulation of Operations | **Lab 3:** SQL Advance Query | **CO1 & CO2** | BT1, BT2, BT3 | PO1,PO2,PO3, PO4,PO5 |
| 2 | Object Relational Databases |
| 3 | Overview of Object Model of ODMG |
| **4** | 1 | Database Design of ORDBMS and Nested Relational Model | **Lab 4:** SQL Advance Query/Assertion/Trigger/View | **CO1 & CO2** | BT1, BT2, BT3, BT4 | PO1,PO2,PO3, PO4,PO5 |
| 2 | Storage and Access method of ORDBMS |
| 3 | Query Optimization |
| **5** | 1 | Cost Estimation in Query Execution | **Lab 5:PT1** | **CO2&**  **CO3** | BT1, BT2, BT3, BT4 | PO1,PO2,PO3, PO4,PO5 |
| 2 | Semantic Query Optimization |
| 3 | Transaction Processing and System Concepts |
| **6** | 1 | ACID Properties, Schedules | **Lab 6: Query Optimization/Cost Optimization exercise** | **CO2&**  **CO3** | BT1, BT2, BT3 | PO1,PO2,PO3, PO4,PO5 |
| 2 | Serializability of Schedules |
| 3 | Recovery Techniques |
| **7** | 1 | Concurrency Control Techniques | **Lab7: OQL** | **CO2&**  **CO3** | BT1, BT2, BT3 | PO1,PO2,PO3, PO4,PO5 |
| 2 | Granularity of Data Items |
| 3 | Client Server Concepts:2-Tier and 3-Tier Architecture |
| **8** | **1** | Client/Database Server Models and Components of Client Server Systems | **Lab 8: Transaction Management in SQL** | **CO2&**  **CO3** | BT1, BT2, BT3 | PO1,PO2,PO3, PO4,PO5 |
| **2** | Client/Database Server Models and Components of Client Server Systems |
| **3** | Application Development in Client Server Systems |
| **9** | , 1 | Distributed and Parallel Databases: Reliability and Commit protocols | **Lab 9:Distributed Database** | **CO2&**  **CO4** | BT1, BT2, BT3 | PO1,PO2,PO3, PO4,PO5 |
| 2 | Basic Techniques: Fragmentation and Distribution, View Integration |
| 3 | Distributed database design and Distributed algorithms for data management |
| **10** | **1** | Heterogeneous and Federated Database Systems | **Lab 10: PT2** | **CO2&**  **CO4** | BT1, BT2, BT3 | PO1,PO2,PO3, PO4,PO5 |
| 2 | Parallel database Architectures and their merits and demerits |
| 3 | Prolog/Datalog Notation, Basic inference Mechanism for Logic Programs |
| **11** | 1 | Deductive Database Systems, Deductive Object Oriented Database Systems | **Lab11: Parallel Database/XML Schema** | **CO2&**  **CO4** | BT1, BT2, BT3 | PO1,PO2,PO3, PO4,PO5 |
| 2 | Web or Internet Databases |
| 3 | Building blocks of Web, tools, advantages and disadvantages |
| **12** | .1 | Overview of Mobile database, Architecture, Uses and limitations | **Lab 12:Mini Project** | **CO4 & CO5** | BT2, BT3, BT4 | PO1,PO2,PO3,PO4,PO5, PO8,PO9,PO10,PO12 |
| 2 | Mobile Database |
| 3 | Overview of Multimedia database and its Need |
| **13** | 1 | Multimedia database components and its Structure | **Lab 13: Mini Project** | **CO4 & CO5** | BT2, BT3, BT4 | PO1,PO2,PO3,PO4,PO5, PO8,PO9,PO10,PO12 |
| 2 | Multimedia database queries and applications |
| 3 | Digital Libraries |
| **14** | 1 | Digital Libraries | **Lab 14: Mini Project** | **CO4 & CO5** | BT2, BT3, BT5 | PO1,PO2,PO3,PO4,PO5, PO8,PO9,PO10,PO12 |
| 2 | Spatial databases |
| 3 | Temporal database |

**PROGRAM EDUCATIONAL OBJECTIVES:**

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| --- | --- | --- | --- | --- | --- |
| **Advance Database Management System** |  | | | | |
| **Preparation** | **Core Competence** | **Breadth** | **Professionalism** | **Learning Environment** |
| **√** | **√** | **√** | **√** | **√** |

**Teaching Methodologies:**

1. Lectures will be delivered in interactive mode. Using well designed Power point presentation
2. Students will work individually and also in groups to solve different kinds of problems.
3. Home assignments will help the learners in keeping abreast with the lecture modules.
4. Short test from time to time will help the learners to study and clear the concepts.

**Evaluation scheme:**

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| --- | --- | --- | --- | --- | --- |
| **Theory(Formal: Informal)** | |  | **Lab (Formal: Informal)** | | |
| **Evaluation criteria (formal)** | **Marks** |  | **Evaluation criteria** | **Marks** | |
| Test 1 (T1) | 30 |  | Test 1 (PT1) | 10 |
| Test 2 (T2) | 30 |  | Test 2 (PT2) | 10 | |
| Test 3 (T3) | 100 |  | Test 3 (Minor Project) | 20 | |
| **Evaluation criteria (Informal)** | **Marks** |  | **Evaluation criteria (Informal)** | **Marks** | |
| Assignments | 20 |  | Lab Record | 10 | |
| Class Tests/Quiz | 10 |  |
| Minor Project | 10 |  |
| **Total** | **200** |  |  | **50** | |

**Bloom’s Taxonomy (BTs)**

**BT1- Remember:** Knowledge involves recognizing or remembering facts, terms, basic concepts, or answers without necessarily understanding what they mean.

**BT2-Understand:** Comprehension involves demonstrating understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating the main ideas.

**BT3-Apply:** Applying involves using acquired knowledge—solving problems in new situations by applying acquired knowledge, facts, techniques and rules. Learners should be able to use prior knowledge to solve problems, identify connections and relationships and how they apply in new situations.

**BT4-Analyze:** Analyzing involves examining and breaking information into component parts, determining how the parts relate to one another, identifying motives or causes, making inferences, and finding evidence to support generalizations.

**BT5-Evaluate:** Synthesizing involves building a structure or pattern from diverse elements; it also refers to the act of putting parts together to form a whole.

**BT6-Create:** Evaluating involves presenting and defending opinions by making judgments about information, the validity of ideas, or quality of work based on a set of criteria.

**Program Outcomes (POs)**

PO1.Engineering Knowledge: Apply the knowledge of mathematics, science , engineering fundamentals and computer engineering specialisation to the solutions of complex engineering problems

PO2. Problem Analysis: Identify, formulate, do research literature and analyze engineering problems to arrive at substantiated conclusions using the fundamental principles of mathematics, natural and engineering sciences

PO3. Design/development of solutions: Design Computer Engineering solutions for core and interdisciplinary problems and design system components, processes to meet the specifications wilth consideration for the public health and safety, cultural, societal and environmental aspects

PO4. Conduct investigation of complex problems: Use research-based knowledge including design of experiments, analysis and the interpretation of data, and sythesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to varied engineering activities with an understanding of the limitations

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the Computer Engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively with the Engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects in multidisciplinary environments.

PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Programme Specific Outcomes (PSOs)**

PSO1:    Attain the ability to design and develop computer programs and possess acquaintance with emerging technologies and open source platforms in the area of mobile app development, artificial intelligence, machine learning, web development, data analytics, cloud computing and networking to build effective computer based systems

PSO2:  Acquire technical competency  to deliver computer based innovative and effective solutions to tackle  business and societal challenges, for pursuing successful career , entrepreneurship,  research and  higher studies.

**Mapping of Course Outcomes and Program Outcomes**

**“X“ :No Mapping 1: Low Mapping 2: Medium Mapping 3: High Mapping**

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| **Course Outcomes** |  | | | | | | | | | | | | PSO1 | PSO2 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| CO1: Acquire knowledge and analyze different Data Model techniques e.g. RDBMS, OODBMS, ORDBMS, ERD | 2 | 3 | 2 | 2 | 2 | X | X | X | X | X | X | X | 2 | 3 |
| CO2: Acquire knowledge and apply basic and Advanced SQL query and other emerging DBMS techniques | 3 | 2 | 3 | 2 | 3 | X | X | X | X | X | X | X | 3 | 3 |
| CO3: Demonstrate the understanding of Database Transactions and Recovery Procedures | 2 | 1 | 2 | 1 | 2 | X | X | X | X | X | X | X | 2 | 2 |
| CO4: Acquire knowledge and analyze different advanced /emerging database management System | 2 | 3 | 2 | 3 | 2 | X | X | X | X | X | X | X | 3 | 3 |
| CO5: Apply acquired knowledge for design holistic solution based on database system /database techniques | 2 | 3 | 3 | 2 | 3 | X | X | X | 1 | 1 | X | X | 3 | 3 |