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**COURSE HAND OUT**

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| **School:** | School of Computing | **Dept.:** | Data Science |

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| **Course Code** | **:** | 22CS102005 | | | | | |
| **Course Title** | **:** | DATABASE MANAGEMENT SYSTEMS | | | | | |
| **Course Credit Structure** | **:** | L | T | P | S | C |
| 3 | - | 2 | - | 3 |
| **Semester** | **:** | IV Semester | | | | | |
| **Contact Hours** | **:** | 45 | | | | | |
| **Instructor** | **:** | Mr.M. Chiranjeevi | | | | | |
| **Instructor’s Email** | **:** | Chiranjeevi.m@mbu.asia | | | | | |
| **Office Hours** | **:** | All working Days with prior Appointment | | | | | |
| **Academic Year** | **:** | 2024-25 | | | | | |
| **Date of Issue** | **:** | 16.12.2024 | | | | | |

**PROGRAM OUTCOMES**

On successful completion of the Program, the graduates of B. Tech. CSE(DS) Program will be able to:

**PO1. Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2. Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3**. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4**. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis 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 complex 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 engineering practice.

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

**PO10**. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design 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 and in multidisciplinary environments.

**PO12**. **Life-long learning**: 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.

**PROGRAM SPECIFIC OUTCOMES**

On successful completion of the Program, the graduates of B.Tech. CSE(DS) program will be able to:

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| **PSO1:** | Apply appropriate data analytical techniques for building effective decision making systems. |
| **PSO2:** | Develop intelligent systems using novel Machine Learning and Artificial Intelligence techniques. |
| **PSO3:** | Design and develop efficient software systems using modern tools, techniques, and platforms to meet societal needs. |
| **PSO4:** | Apply suitable tools and techniques to build secure distributed systems. |

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| **Pre-Requisite** | | - |
| **Anti-Requisite** | | - |
| **Co-Requisite** | | - |
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| **COURSE DESCRIPTION:** Introduction to database systems; Database design; Relational model; Relational algebra; SQL queries; Constraints and triggers; PL/SQL; Schema refinement and normal forms; Transaction management; Concurrency control; Overview of storage and indexing. | | |
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| **COURSE OUTCOMES:** After successful completion of the course, students will be able to: | | |
|  | Apply the concepts of ER-modeling and normalization to design viable data models for a given problem. | |
|  | Formulate relational database schemas, apply suitable integrity constraints, for querying databases. | |
|  | Use SQL to store, query, and manipulate data in relational databases. | |
|  | Develop PL/SQL blocks to centralize database applications for maintainability and reusability. | |
|  | Analyze transaction processing, concurrency control and storage methods for database management. | |

**CO-PO-PSO Mapping Table:**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | | **Program Specific Outcomes** | | | |
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| **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO3** | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO4** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 3 | - | - | - |
| **CO5** | 3 | 2 | 3 | 2 |  |  |  |  |  |  |  |  | 3 |  |  |  |
| **Average** | 3 | 3 | 3 | 2 |  |  |  |  |  |  |  |  | 3 |  |  |  |
| **Level of correlation of the course** | 3 | 3 | 3 | 2 |  |  |  |  |  |  |  |  | 3 |  |  |  |

*Correlation Levels: 3: High; 2: Medium;1: Low*

**COURSE CONTENT:**

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| **Module 1:** | **INTRODUCTION TO DATABASE SYSTEMS AND DATABASE DESIGN** | ***(09 Periods)*** |
| **Introduction to Database Systems**: Database system applications, Purpose of database systems, View of data - Data abstraction, Instances and schemas, Data models; Database languages - Data Definition Language, Data Manipulation Language; Database architecture, Database users and administrators. | | |
| **Introduction to Database design**: Database design and ER diagrams, Entities, attributes and entity sets, Relationships and relationship sets, Additional features of ER model, Conceptual Design with ER model. | | |
| **Module 2:** | **RELATIONAL MODEL, RELATIONAL ALGEBRA AND TUPLE CALCULUS** | ***(08 Periods)*** |
| **Relational Model**: Creating and modifying relations, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design, Introduction to views, Destroying/altering tables and views. | | |
| **Relational Algebra and Tuple calculus**: Preliminaries, Relational Algebra operators and tuple calculus. | | |
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| **Module 3:** | **SQL AND PL/SQL** | ***(09 Periods)*** |
| **SQL**: Form of basic SQL query, Nested queries, Aggregate operators, Null values, Complex integrity constraints in SQL, Triggers and active databases.  **PL/SQL**: Generic PL/SQL block, PL/SQL data types, Control structure, Procedures and functions, Cursors, Database triggers. | | |
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| **Module 4:** | **SCHEMA REFINEMENT AND TRANSACTIONS** | ***(10 Periods)*** |
| **Schema Refinement**: Problems caused by redundancy, Decompositions, Problems related to decomposition, Functional dependencies, Reasoning about FDs, First normal form, Second normal form, Third normal form, Boyce-Codd normal form, Multivalued dependencies, Fourth normal form, Join dependencies, Fifth normal form.  **Transactions**: Transaction concept, Transaction atomicity and durability, Concurrent Executions – Serializability, Recoverability, Implementation of isolation, Testing for serializability. | | |
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| **Module 5:** | **CONCURRENCYCONTROL,STORAGE AND INDEXING** | ***(09 Periods)*** |
| **Concurrency Control**: Lock Based Protocols, Timestamp Based Protocols, Validation Based Protocols, Multiple Granularity, Deadlock Handling.  **Storage and Indexing**: Data on external storage, File organizations and indexing – Clustered indexes, Primary and secondary indexes; Index data structures – Hash based indexing, Tree based indexing; B and B+ Trees, Comparison of file organizations. | | |
| ***Total Periods: 45*** | | |

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| **TEXT BOOKS:** |
| 1. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill, 3rd Edition, 2014. |
| **REFERENCE BOOKS:** |
| 1. Ivan Bayross, “SQL, PL/SQL: The Programming Language of Oracle”, BPB publications, 4th Edition, 2017. |
| 1. R2. RamezElmasri, ShamkantB.Navathe, “Fundamentals of Database Systems”, 7th Edition, Pearson, 2015. |
| **VIDEO LECTURES:** |
| 1. https://elearn.nptel.ac.in/shop/nptel/data-base-management-system/ |
| 1. https://www.youtube.com/playlist?list=PLYp4IGUhNFmw8USiYMJvCUjZe79fvyYge |
| 1. https://www.freecodecamp.org/news/sql-and-databases-full-course/ |
| 1. https://www.youtube.com/watch?v=c5HAwKX-suM |
| 1. https://www.youtube.com/playlist?list=PLxCzCOWd7aiFAN6I8CuViBuCdJgiOkT2Y |
| **WEB RESOURCES:** |
| 1. https://www.geeksforgeeks.org/dbms/ |
| 1. https://www.tutorialspoint.com/dbms/ |
| 1. https://www.w3schools.com/sql/ |
| 1. https://www.studytonight.com/dbms/ |
| **PEDAGOGY:** |
| The following pedagogy methods will be used to deliver the course.   1. Chalk and Board 2. Videos 3. PPT 4. Flipped Classroom |

**COURSE DELIVERY SCHEDULE:**

| **S. No.** | **Topic** | **Contact Hours** | **CO Mapping** | **Pedagogy** | **Resources** |
| --- | --- | --- | --- | --- | --- |
| **Unit-I: INTRODUCTION TO DATABASE SYSTEMS AND DATABASE DESIGN(9 Hours)** | | | | | |
| 1 | Introduction to Database Systems: Database system applications, Purpose of database systems | 1 | CO1 | PPT | T1 |
| 2 | View of data -Data abstraction, Instances and schemas, Data models | 1 | CO1 | PPT | T1 |
| 3 | Database languages -Data Definition Language, Data Manipulation Language | 1 | CO1 | PPT | T1 |
| 4 | Database architecture | 1 | CO1 | PPT | T1 |
| 5 | Database architecture, Database users and administrators | 1 | CO1 | PPT | T1 |
| 6 | Introduction to Database design: Database design and ER diagrams | 1 | CO1 | PPT | T1 |
| 7 | Entities, attributes and entity sets | 1 | CO1 | PPT | T1 |
| 8 | Relationships and relationship set, Additional features of ER model | 1 | CO1 | PPT | T1 |
| 9 | Conceptual Design with ER model | 1 | CO1 | PPT | T1 |
| **MODULE -II: RELATIONAL MODEL AND RELATIONAL ALGEBRATUPLE CALCULUS(8 Hours)** | | | | | |
| 10 | Conceptual Design with ER model | 1 | CO2 | PPT | T1 |
| 11 | Integrity constraints over relations | 1 | CO2 | PPT | T1 |
| 12 | Enforcing integrity constraints, Querying relational data | 1 | CO2 | PPT | T1 |
| 13 | Logical database design | 1 | CO2 | PPT | T1 |
| 14 | Introduction to views | 1 | CO2 | PPT | T1 |
| 15 | Destroying/altering tables and views | 1 | CO2 | PPT | T1 |
| 16 | Relational Algebra: Preliminaries, Relational Algebra operators | 1 | CO2 | PPT | T1 |
| 17 | Tuple calculus | 1 | CO2 | PPT | T1 |
| **MODULE -III: SQL AND PL/SQL (9 Hours)** | | | | | |
| 18 | SQL: Form of basic SQL query | 1 | CO3 | PPT | T1 |
| 19 | Nested queries | 1 | CO3 | PPT | T1 |
| 20 | Aggregate operators, Null values | 1 | CO3 | PPT | T1 |
| 21 | Complex integrity constraints in SQL | 1 | CO3 | PPT | T1 |
| 22 | Triggers and active databases | 1 | CO3 | PPT | T1 |
| 23 | Generic PL/SQL block, PL/SQL data types | 1 | CO4 | PPT | T1 |
| 24 | Control structure | 1 | CO4 | PPT | T1 |
| 25 | Procedures and functions | 1 | CO4 | PPT | T1 |
| 26 | Cursors, Database triggers | 1 | CO4 | PPT | T1 |
| **MODULE -IV: SCHEMA REFINEMENT AND TRANSACTIONS (10 Hours)** | | | | | |
| 27 | Schema Refinement: Problems caused by redundancy, Decompositions | 1 | CO5 | PPT | T1 |
| 28 | Problems related to decomposition, Functional dependencies | 1 | CO5 | PPT | T1 |
| 29 | Reasoning about FDs, First normal form, Second normal form, Third normal form | 1 | CO5 | PPT | T1 |
| 30 | Boyce-Codd normal form, Multivalued dependencies | 1 | CO5 | PPT | T1 |
| 31 | Fourth normal form, Join dependencies, Fifth normal form | 1 | CO5 | PPT | T1 |
| 32 | Transactions: Transaction concept, Transaction atomicity and durability | 1 | CO5 | PPT | T1 |
| 33 | Concurrent Executions – Serializability | 1 | CO5 | PPT | T1 |
| 34 | Recoverability | 1 | CO5 | PPT | T1 |
| 35 | Implementation of isolation | 1 | CO5 | PPT | T1 |
| 36 | Testing for serializability | 1 | CO5 | PPT | T1 |
| **MODULE-V: NETWORK PROTECTION SYSTEMS (7 Hours)** | | | | | |
| 37 | Concurrency Control: Lock Based Protocols | 1 | CO5 | PPT | T1 |
| 38 | Timestamp Based Protocols | 1 | CO5 | PPT | T1 |
| 39 | Validation Based Protocols, Multiple Granularity | 1 | CO5 | PPT | T1 |
| 40 | Deadlock Handling | 1 | CO5 | PPT | T1 |
| 41 | Storage and Indexing: Data on external storage | 1 | CO5 | PPT | T1 |
| 42 | File organizations and indexing –Clustered indexes | 1 | CO5 | PPT | T1 |
| 43 | Primary and secondary indexes | 1 | CO5 | PPT | T1 |
| 44 | Index data structures – Hash based indexing | 1 | CO5 | PPT | T1 |
| 45 | Tree based indexing, Comparison of file organizations | 1 | CO5 | PPT | T1 |

**COURSE EVALUATION:**

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| --- | --- | --- | --- | --- | --- |
| **Evaluation Type** | **Syllabus** | **Duration**  **in Minutes** | **Marks for Evaluation** | **Marks to be Scaled to** | **Max. Marks** |
| Mid Term Exam -1 | Module - I & II | 90 Minutes | 50 | 30 | 30\* |
| Mid Term Exam -2 | Module – III, IV&V | 90 Minutes | 50 | 30 |
| End Term Exam | All Modules | 180 Minutes | 100 | 50 | 50 |
| **Total Marks** | | | | | **100** |

\* For a total of 30 marks, 80% of better one of the two CIAT and 20% of the other one are added and finalized, any fraction shall be rounded off to the higher integer number.