

Amrita School of Engineering, Chennai

**Course Delivery Plan**

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| **Name of the Course / Code** | | 19CSE202: DATABASE MANAGEMENT SYSTEMS | | | **Department** | **CSE** | | |
| **Credit** | | 4 | | | **Semester / Year** | **II/III** | | |
| **Name of the Faculty** | | Dr S Sathya / Dr A Padmavathi /  Dr Dhavakumar | | | **Pre-requisite** | **19CSE101 COMPUTER SYSTEM ESSENTIALS** | | |
| **Designation / Dept** | | Assistant Professor/ CSE | | | **Academic Year** | **2022-2023** | | |
| **Course Overview** | | This course aims to understand the concepts of database design, database languages, database-system implementation and maintenance. It allows to design and build Database design at higher level. | | | | | | |
| **Course Objective** | | | **Course Outcomes** | | | | **BTL** | **Weightage** |
| 1 | To understand the concepts of database design, database languages, database-system implementation, and maintenance. | | **CO 1** | Formulate and apply relational algebraic expressions, SQL and PL/SQL statements to query relational databases. | | | **3** | **0.3** |
| 2 | To understand the concepts of database languages | | **CO 2** | Design and build ER models for real world databases. | | | **4** | **0.125** |
| 3 | To understand the concepts of database-system  implementation | | **CO 3** | Design and build a normalized database management system for real world databases. | | | **4** | **0.33** |
| 4 | To understand the concepts of maintenance | | **CO 4** | Understand and apply the principles of transaction processing and concurrency control. | | | **3** | **0.25** |
|  |  | | **CO 5** | To learn different high level databases and selection of right database. | | | **2** | **0.125** |
|  |  | | **Course BT Level** | | | | **3.72** | |

# Course Syllabus

## Unit 1

Introduction: Overview of DBMS fundamentals – Overview of Relational Databases and Keys. Relational Data Model: Structure of relational databases – Database schema – Formal Relational Query Languages – Overview of Relational Algebra and Relational Operations. Database Design: Overview of the design process - The E-R Models – Constraints - Removing Redundant Attributes in Entity Sets - E-R Diagrams - Reduction to Relational Schemas - Entity Relationship Design Issues - Extended E-R Features – Alternative E-R Notations –

Overview of Unified Modeling Language (UML).

## Unit 2

Relational Database Design: Features of Good Relational Designs - Atomic Domains and 1NF - Decomposition using Functional Dependencies: 2NF, 3NF, BCNF and Higher Normal Forms. Functional Dependency Theory - Algorithm for Decomposition – Decomposition using multi-valued dependency: 4NF and 4NF decomposition. Database designprocess and its issues. SQL: review of SQL – Intermediate SQL – Advanced SQL.

## Unit 3

Transactions: Transaction concept – A simple transaction model - Storage structure - Transaction atomicity and durability - Transaction isolation -Serializability – Recoverable schedules, Casecadeless schedules. Concurrency control: Lock-based protocols – Locks, granting of locks, The two-phase locking protocol, implementation of locking, Graph-based protocols. Deadlock handling: Deadlock prevention, Deadlock

detection and recovery.

**Case Study:** Different types of high-level databases – MongoDB, Hadoop/Hbase, Redis, IBM Cloudant, DynamoDB, Cassandra and CouchDB Etc. Tips for choosing the right database for the given problem.

**Textbooks**

Silberschatz A, Korth HF, Sudharshan S. Database System Concepts. Sixth Edition, TMH publishing company

limited; 2011.

**References**

1. Garcia-Molina H, Ullman JD, Widom J. Database System; The complete book. Second Edition, Pearson Education India, 2011.
2. Elmasri R, Navathe SB. Fundamentals of Database Systems. Fifth Edition, Addison Wesley; 2006.
3. Ramakrishnan R, Gehrke J. Database Management Systems. Third Edition, TMH; 2003.

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| **Concept Map**  CO 1    CO 2  **Database Fundamentals**  **Database Designn**  **Database Management System**  CO 4  **Nnormalization**  CO 5  **Transaction Controln**  CO 3  **High Level Databases**  **COURSE SUMMARY**  **Academic Year: 2021- 2022**   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Level of Attainment (2021-2022)** | | | | | | | | Threshold (%) | Target (%) | | Percentage of Students | | | | | Level1 | Level 2 | Level 3 |  | | 50 | 60 | | 50 | 60 | 70 |  | | Level of Attainment (2022-2023) | | | | | |  | | 50 | 65 | | 50 | 60 | 70 |  | | Weightage Components(2022-2023) | | | | | | | | Components/CO | CO1 | CO2 | | CO3 | CO4 | CO5 | | P1 (10) | 6 | 4 | | 0 | 0 | 0 | | P2 (10) |  | 5 | | 3 | 2 | 0 | | CA(45) | 15 | 8 | | 10 | 10 | 2 | | ESE(35) | 10 | 8 | | 10 | 5 | 2 | | Total | 31 | 25 | | 23 | 17 | 4 |   **Number of students registered:155**  **Name of the Faculty: Dr Karpagam**    **CO ATTAINMENT:**     |  |  |  | | --- | --- | --- | | **COs** | **Target Achieved** | **Measures to be taken irrespective of target achieved or not** | | **CO1** | **Yes** | **Target achieved. Suggested to revise the threshold next year.** | | **CO2** | **Yes** | **Target achieved. As this is Application based course ,suggested to revise Suggested to revise the threshold next year..** | | **CO3** | **Yes** | **Target achieved. Suggested to revise the threshold next year.** | | **CO4** | **Yes** | **Target achieved. Since this topic is based on the application in signal processing domain, students expressed more interest on learning this topic. Suggested to revise the threshold next year.** | | **CO5** | **Yes** | **Target achieved. Since this topic is based on the application in Research related to DBMS, students expressed more interest on learning this topic. Suggested to revise the threshold next year.** | | | | | | |
| **Evaluation and Grading** | | | | | |
|  | | **Internal (65)** | | **External (35)** | **Total (100)** |
| **Components** | | **Marks** | |  |  |
| PT | PT1 | 10 | **20** | End Semester (35) | Internal (65)+ External (35) = 100 Marks |
| PT2 | 10 |
| Continuous Assessment  **(Theory)** | Assignments (2) | 5 | **15** |
| Quiz(1) | 10 |
| Continuous Assessment  **(Lab)** | Project and Report | 10 | **30** |
| End Semester Lab Exam | 10 |
| Lab Evaluations | 10 |  |

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| **Programme Outcome (PO)** | |
| **PO 1** | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. |
| **PO 2** | **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO 3** | **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. |
| **PO 4** | **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. |
| **PO 5** | **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. |
| **PO 6** | **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. |
| **PO 7** | **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. |
| **PO 8** | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **PO 9** | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **PO 10** | **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. |
| **PO 11** | **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. |
| **PO 12** | **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. |
| **PSO 1** | Ability to design and engineer, innovative, optimal and elegant computing solutions to interdisciplinary problems using standard practices, tools and technologies. |
| **PSO 2** | Ability to learn emerging computing paradigms for research and innovation |

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| **CO – PO Affinity Map** | | | | | | | | | | | | | | |
| **PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO2** |
| **CO** |
| **CO1** | 3 | 3 | 2 | 3 | 3 |  |  |  |  |  |  |  | 3 | 2 |
| **CO2** | 1 | 3 | 3 | 3 | 3 |  |  |  |  |  |  |  | 3 | 2 |
| **CO3** | 2 | 3 | 2 | 3 |  |  |  | 2 | 2 | 2 | 2 |  | 3 | 2 |
| **CO4** | 1 | 1 | 1 | 2 |  |  |  |  |  |  |  |  | 3 | 2 |
| **CO5** | 1 | 1 |  |  |  |  |  |  |  |  |  |  | 3 | 2 |

3 – Strong, 2 – Moderate, 1 – Weak

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| **Class** | **Topics to be covered** | **Mode of Teaching** | **In-Class Activities** | **Out- Class Activities (E – Ref.)** | **CO**  **Mappi ng** | **Reference** |
| 1-2 | Introduction: Overview of DBMS fundamentals | Smart Board and Presentation | Self- Assessment and Group Discussions | <https://www.w3schools.in/dbms/intro> | CO1 | T1,R1 |
| 3-4 | Overview of Relational Databases and Keys. | Smart Board and Presentations | Student Centric Approach | <https://www.youtube.com/watch?v=eLJW_TJbzuw> | CO1 | T1,R1  Practice Sets |
| 4-5 | Relational Data  Model: Structure of relational databases – | Smart Board and Presentations | Problems and Proofs Discussion | www2.cs.sfu.ca/CourseCentral/354/zaiane/material/notes/Chapter3/node13.html | CO1 | T1,R1 |
| 5-7 | Database schema – Formal Relational Query Languages | Smart Board and Presentation | POGIL approach | <https://www.youtube.com/watch?v=iHrvzgQxybY> | CO1 | T1,R1  Practice Sets |
| 8 | Overview of  Relational Algebra and Relational Operations | Presentations, Smart board and flipped class room | Problems and Proofs Discussion | <https://www.youtube.com/watch?v=4YilEjkNPrQ> | CO1 | T1, R1  Practice Sets |
| 9 | Database Design: Overview of the design process | Smart Board | Discussions, Problems and Proofs | <https://www.youtube.com/watch?v=WL6xEuE7d4k> | CO3 | T1,R1 |
| 10-14 | E-R Models –  Constraints - Removing Redundant Attributes in Entity Sets - E-R Diagrams | Presentations, Smart board and flipped class room | Problems and Proofs Discussion | <https://www.youtube.com/watch?v=Wv1c9K4788A>  <https://opentextbc.ca/dbdesign01/chapter/chapter-8-entity-relationship-model/> | CO2 | T1,R1 |
| **QUIZ I (2nd week of September)**  **Assignment1(2nd Week of September)** | | | | | | |
| 15-16 | Reduction to Relational Schemas -  Entity Relationship Design Issues  Extended E-R Features – Alternative E-R Notations | Presentations and online videos | POGIL Approach | <https://www.youtube.com/watch?v=NBVxkkVwRF4&list=PLEbnTDJUr_Ic_9b4PcKmlae41cyxEefot&index=15>  <https://www.cse.iitb.ac.in/~cs317/Resources/lectures/lec02-ER%20Models-handout.pdf> | CO2 | T1,R1 |
| 17 | Overview of Unified  Modeling Language (UML). | Presentations and online videos | POGIL Approach | <https://www.youtube.com/watch?v=7BSBWhGFmJ0> | CO2 | T1, R1  Practice Sets |
| **Periodical 1**  **Collaborative Learning(Dr.Vinata Sai October 5 )** | | | | | | |
| 18-23 | Relational Database Design: Features of Good Relational Designs  Atomic Domains and 1NF –  Decomposition using Functional Dependencies: 2NF, 3NF,  BCNF and Higher Normal Forms | Smart Board | Discussions, Problems and Proofs | <https://www.youtube.com/watch?v=xoTyrdT9SZI&list=PLLGlmW7jT-nTr1ory9o2MgsOmmx2w8FB3>  <https://www.simplilearn.com/tutorials/sql-tutorial/what-is-normalization-in-sql>  <https://gatecse.in/demystifying-database-normalization/>  <http://cs.iit.edu/~cs425/slides/ch08-design-NF-handout.pdf> | CO3 | T1,R1 |
|  | Revision | Smart Board | Discussions, Problems and Proofs | Resources and Questions will be provided in Class |  |  |
| 24-26 | Functional Dependency Theory – Algorithm for Decomposition – Decomposition using multi-valued dependency: | Presentations | Problems and Proofs Discussion | <https://www.youtube.com/watch?v=ddOP5D4fagg> | CO3 | T1,R1 |
| 27 | 4NF and 4NF decomposition | Presentations, Smart board | Problems and Proofs Discussion | <https://www.youtube.com/watch?v=OTCuykFHBeA> | CO3 | T1,R1 |

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| 28-30 | Database design process and its issues. SQL: review of SQL – Intermediate SQL – Advanced SQL. | Presentation and Flipped Classroom approach | Discussions | <https://www.youtube.com/watch?v=2Fn0WAyZV0E> | CO1 | T1,R1 |
| Periodical 2 | | | | | | |
| 31-33 | Transactions: Transaction concept – A simple transaction model - Storage structure - Transaction atomicity and durability - Transaction isolation | Online tools, presentations, smart board and discussions | Discussions, Proofs | <https://www.youtube.com/watch?v=oCo50GwMEDc> | CO4 | T1,R1 |
| **Assignment II (3rd Week of Oct) 2 weeks’ time for submission** | | | | | | |
| 34-35 | Serializability – Recoverable schedules, Casecadeless schedules | Presentations and online videos | Group Discussions | <https://www.youtube.com/watch?v=jEqnfpaEO6M> | CO4 | T1,R1 |
| 36-40 | Concurrency  control: Lock-based protocols – Locks, granting of locks, The two-phase locking protocol, implementation of locking,  Graph-based protocols. | Smart board | POGIL approach | <https://www.youtube.com/watch?v=1pUaEDNLWi4>  <http://cs.iit.edu/~cs425/previous/14fall/slides/ch09-transactions.pdf> | CO4 | T1,R1 |
| **QUIZ II (1st week of Nov)** | | | | | | |
| 41-42 | Deadlock handling: Deadlock prevention, Deadlock detection and recovery | Presentations and online videos | Group Discussions | <https://www.youtube.com/watch?v=HaZ6opVzggQ>    <https://cse.iitkgp.ac.in/~ksrao/caos2018files/deadlock.pdf> | CO4 | T1, R1 |
| 43-45 | Different types of high level databases – MongoDB, Hadoop/Hbase, Redis | Presentations and online videos | Group Discussions | <https://www.tutorialspoint.com/mongodb/index.htm>  <https://www.tutorialspoint.com/hbase/hbase_overview.htm>  <https://www.tutorialspoint.com/hadoop/index.htm>  <https://www.tutorialspoint.com/redis/index.htm> | CO5 | T1, R1 |
| 46-47 | IBM Cloudant, DynamoDB,  Cassandra and CouchDB etc | Presentations and online videos | Group Discussions | <https://www.tutorialspoint.com/ibm_cloudant_nosql_database/index.asp>  <https://www.tutorialspoint.com/dynamodb/index.htm>  <https://www.tutorialspoint.com/cassandra/cassandra_introduction.htm>  <https://www.tutorialspoint.com/couchdb/index.htm> | CO5 | T1, R1 |
| 48 | Tips for choosing the right database for the given problem. | Presentations and online videos | Group Discussions | <https://towardsdatascience.com/how-to-choose-the-right-database-afcf95541741> | CO5 | T1, R1 |
| **Capstone Evaluation (Dec2nd week)** | | | | | | |

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|  | Revision | Smart Board | Discussions, Problems and Proofs | Resources and Questions will be provided in Class |  | T1,R1 |
| **END SEMESTER EXAM(Dec 3rd week)** | | | | | | |

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| **UNIT** | **Major Topics** | **Skill Set** | **CO** | **BTL** | **Weightage** |
| 1 | Overview of Relational Databases and Keys. Relational Data  Model: Structure of relational databases –Formal Relational Query Languages-E-R Models | Ability to understand the Relational Database and keys , Relational DataModel: Structure of relational databases – | 1  2 | 3  4 | 0.8  0.4 |
| 2 | 1NF - Decomposition using Functional Dependencies: 2NF, 3NF, BCNF and Higher Normal Forms. SQL: review of SQL – Intermediate SQL – Advanced SQL. | Ability to solve the problems that can be solved by analysis of Normal Forms and SQL. | 1  4 | 3  4 | 0.8  0.5 |
| 3 | Transactions: Transaction concept, Serializability Lock-based protocols – Locks, The two-phase locking protocol, Deadlock handling | Ability to solve the problems that can be solved using Transactions, Locking protocols and Deadlock Handling | 4  5 | 3 | 0.7  0.6 |
| Course BT Level:3.72 | | | | | |

# Faculty CourseMentor AcademicIn-charge Principal

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| **Questions for Student Survey on Learning Outcomes**  (Upon completing the module, I am able to:) | | | | | | |
| **CO. No** | **Questions** | **Strongly Disagree**  **(1)** | **Disagree**  **(2)** | **Neutral**  **(3)** | **Agree**  **(4)** | **Strongly Agree**  **(5)** |
| CO1 | Did you learn to Formulate and apply relational algebraic expressions? |  |  |  |  |  |
| CO2 | Did you able to design and build ER models for real world databases. |  |  |  |  |  |
| CO3 | Did you able to design and build a normalized database management system for real world databases? |  |  |  |  |  |
| CO4 | Did you able to understand and apply the principles of transaction processing and concurrency control |  |  |  |  |  |
| CO5 | Did you learn different high level databases and selection of right database? |  |  |  |  |  |
| Analytical Assignments | | | | | | |
| PO8 | Able to apply ethical principles and commit to professional ethics and responsibilities? |  |  |  |  |  |
| PO9 | Able to function effectively as an individual in multidisciplinary settings? |  |  |  |  |  |
| Capstone Projects | | | | | | |
| PO8 | Able to apply ethical principles and commit to professional ethics and responsibilities while preparing the report? |  |  |  |  |  |
| PO9 | Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings? |  |  |  |  |  |
| PO10 | Communicate effectively on complex engineering activities with the engineering community? |  |  |  |  |  |
| Guest Lecture | | | | | | |
| PO7 | Understand the impact of the professional engineering solutions in societal and environmental contexts through the lecture? |  |  |  |  |  |
| PO8 | Able to apply ethical principles and commit to professional ethics and responsibilities while preparing the guest lecture report? |  |  |  |  |  |
| Student presentation skills | | | | | | |
| PO7 | Understand the impact of the professional engineering solutions in societal and environmental contexts through the lecture? |  |  |  |  |  |
| PO8 | Able to apply ethical principles and commit to professional ethics and responsibilities while doing the case studies for your presentation? |  |  |  |  |  |
| PO9 | Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings?. |  |  |  |  |  |
| PO10 | Communicate effectively on complex engineering activities with the engineering community? |  |  |  |  |  |

**Mapping with Indirect Assessment Activities**

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| **S.No** | **List of Indirect Assessment Activities** | **CO** | **POs mapped with correlation level in bracket** | **Documents required** |
|  | Class room activities |  |  | Student Feedback at end of semester specifically on activities conducted, Photos of activity, brief write up on each activity and methodology of delivery |
|  | Research Based assignment |  |  | Copies of assignment, consolidated table of topics and assessment, student feedback in semester end for course |
|  | Analytical/case study-based assignments | All Cos | PO8, PO9 | Copy of QP, consolidated assessments, few typical assignment copies, Feedback at end of semester – question to be included in end semester course feedback |
|  | Capstone projects | CO3 & CO4 | PO8, PO9 | Reports/videos, list of projects, team members, innovation and learning outcomes |
|  | Team projects |  |  | Details, report, photos, consolidated sheet showing assessment and learning outcomes for each project, end semester feed back |
|  | Industrial/Field visit |  |  | Invitation Letter from company, list of students, photo at site, typical report of visit by students, student feedback |
|  | Guest Lectures | CO3, CO4 | PO7& PO8 | Invitation letter, flyer, attendance list, report with photos, student feedback |
|  | Student presentations/talks | All Cos | PO7, PO8, PO9 & PO10 | Consolidated list of topics, names, dates and outcomes, copy of presentation, Student feedback |
|  | Seminars/workshops related to course |  |  | Brochure, participation certificate, photo, report, learning outcome as approved by faculty |

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| **Revised CO – PO Affinity Map** | | | | | | | | | | | | | | |
| **PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO2** |
| **CO** |
| **CO 1** | **3** | **3** | **2** | **3** | **3** |  |  | 1 | 1 |  |  |  | **3** | **2** |
| **CO 2** | **1** | **3** | **3** | **3** | **3** |  |  | **1** | **2** | **1** |  |  | **3** | **2** |
| **CO 3** | **2** | **3** | **2** | **3** | **3** |  |  | **2** |  |  | **2** | **2** | **3** | **2** |
| **CO 4** | **1** | **1** |  | **2** | **2** |  |  | **1** | **1** | **1** |  |  | **3** | **2** |
| **CO5** | **1** | **1** |  |  |  |  |  | **1** |  | **1** | 1 | 1 |  |  |