| **Course Code** | **CS222** |
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| **Course Title** | **Database Concepts** |
| **Cr Hrs** | 4 (3+1) |
| **Pre-requisite** | CS211 (Data Structures & Algorithms) |
| **Recommended Texts** | 1. Fundamentals of Database Systems, Ramez Elmasri, 2015, 7th Edition, Pearson publishers, ISBN-10: 0133970779, ISBN-13: 978-0133970777<br>2. Database Systems: Design, Implementation, & Management, Carlos Coronel; Steven Morris, 2018, 13th Edition, Cengage Learning, ISBN-10: 1285196147, ISBN-13: 978-1337627900<br>3. Database Systems: A Practical Approach to Design, Implementation, and Management, Thomas Connolly, Carolyn Begg, 2014, 6th Edition, ISBN-10: 0132943263, ISBN-13: 978-0132943260<br>4. Learning SQL: Generate, Manipulate, and Retrieve Data, Alan Beaulieu (Author), O'Reilly Media; 3rd edition (April 7, 2020), ISBN-13 : 978-1492057611 |
| **Course Description** | Investigates how database management system techniques are used to design, develop, implement and maintain modern database applications in organizations. |
| **Course Objectives** | The main objective of this course is to<br>• Introduce students to fundamentals of database technology by studying databases from three viewpoints: those of the database user, the database designer, and the database administrator.<br>• It teaches the use of a database management system (DBMS) by treating it as a black box, focusing only on its functionality and its interfaces. |

| **Course Outline** | • Introduction to database systems.<br>• Conceptual database modeling using the entity-relationship<br>• The SQL language, Database application development.<br>• Integrity constraints and database anomalies<br>• Schema quality through the study of functional dependencies and normalization.<br>• Transaction Management, Concurrency and Serializability.<br>• NoSQL |
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**Week Wise Distribution of the Contents**

| **Week Number** | **Topic** |
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| W1 | Course Introduction: Data and information, Database definitions, The concept of a shared organizational database, Traditional File Processing System, Database Management Systems |
| W2 | Advantages of DBMS, Levels of Data, Database Users, Database Administrator, Data Model and DBMS<br>The three level architecture: External, Conceptual and Internal Levels |
| W3 | Data independence: Logical Data Independence, Physical Data Independence, Functions of DBMS, DBMS Environment<br>Evolution of Data Models, Hierarchical, Network, Relational and Object Oriented |
| W4 | Conceptual, Logical and Physical Designs. Entity-Relationship Data Model, Constructs of E-R Data Model: Entity, Attributes and Relationships, Entity type, Entity Instance, Entity Set, Entity types, their properties and Instances, Naming Entity Types, types of attributes, domain of an attribute, Examples |
| W5 | Key Attributes, Simple or Composite Key, Super Key, Candidate Key, Primary Key, Alternate Key, Relationships, Unary, Binary and Ternary Relationship, Naming Relationships |
| W6 | Cardinality and Modality, Integrity Constraints, Types of Integrity Constraints: Domain, Entity Integrity, Referential and Key Constraints |
| W7 | Introduction to MYSQL WORKBENCH/MS SQL SERVER<br>Intro to SQL, DDL, DML, DCL, TCL, |
| W8 | SQL-DCL: SELECT, with various clauses such as WHERE, IN, LIKE, GROUP BY, DISTINCT, ORDER BY etc.<br>SQL-DML: INSERT, UPDATE, DELETE |
| **MID EXAM / MID OF SEMESTER** | |
| W9 | Joins: cross, inner, natural, left outer, right outer, full outer,<br>SQL-DCL: GRANT, REVOKE |
| W10 | SQL-DDL: CREATE, ALTER, DROP, TRUNCATE, COMMENT and RENAME<br>VIEW Management, Indexing |
| W11 | Functions, Stored procedure, Triggers, Backup management, Partitioning |
| W12 | Anomalies and Types: Update, Delete, Insert, Functional Dependency, Inference Rules: Reflexivity, Augmentation, Transitivity, Additivity or Union, Projectivity or Decomposition, Pseudo transitivity |
| W13 | Normalization, 1NF, 2NF, 3NF, Loss of Information in Decomposition, Boyce-Codd Normal Form (BCNF) |

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| W14 | 4NF, 5NF, Domain Key Normal Form (DKNF), Normalization: Revision with practical Examples |
| W15 | Transaction Management and Concurrency Control, Evaluating Transaction Results, Transaction Properties: Atomicity, Concurrency, Isolation, Durability, Transaction Management with SQL, Scheduler, Deadlocks |
| W16 | Bigdata, Scaling, NOSQL, Types of NOSQL Database, Features of NOSQL databases, Uses of NOSQL, Advantages/Disadvantages, CAP Theorem, NOSQL vs RDBMS |