COURSE TEMPLATE

1. **Department:**	**Department of Computer Science and Engineering**		
2. **Course Name:** Database Management Systems	3. **Course Code**	4. **L-T-P**	5. **Credits**
	CSL214	3-0-2	4
6. **Type of Course (Check one):**	Programme Core ✓	Programme Elective ☐	Open Elective ☐
7. **Prerequisite(s), if any:** None			
8. **Frequency of offering (check one):** Odd ☐	Even ✓	Either semester ☐	Every semester ☐
9. **Focus:** Employability ✓	Entrepreneurship ☐	Skill Development ☐	Basic Knowledge ✓

10. **Brief Syllabus:**

Databases form the core of all major applications – finance, social, administrative, education etc. Organizations work on large volumes of data every day, introducing the need of database management systems to easily identify, extract, store and transform details in the database. This course will explore concepts and principles of DBMS, database design, data modeling, database implementation, and database management through various assignments and experiments. By the end of this course, the student will be able to work as a database engineer by designing, developing and maintaining the database for any project application.

Total Lecture, Tutorial and Practical Hours for this course (Take 15 teaching weeks per semester): 75

	Practice	
Lectures: 45 hours	**Tutorial:** 0 hours	**Lab Work: 30** hours

11. **Course Outcomes (COs)**
Possible usefulness of this course after its completion i.e. how this course will be practically useful to him once it is completed.

CO 1	Identify contrast between traditional and modern Database Systems, thereby recognize their applications through case studies.
CO 2	Develop conceptual database design for any real time project by defining the relationship, constraints etc. on entities.
CO 3	Apply appropriate design techniques and design a good database that meets the user requirement and enhance back-end skill set.
CO 4	Create a database and devise queries for extracting information from the database using Relational Algebra and SQL.
CO 5	Apply the concepts of DBMS for developing backend of a project using NoSQL.
CO 6	Improvise data fetching time and apply indexing concepts.

CO 7	Illustrate the concepts of end-to-end transaction processing in a database.

12. **UNIT WISE DETAILS** **No. of Units: 7**

Unit Number: 1	Title: Introduction to Database Systems	No. of hours: 4

Content Summary:
Overview of Database Management Systems, Advantages of DBMS over File Processing Systems, DBMS Vs. RDBMS, DBA roles and responsibilities, Data Independence, Architecture of Database(3-Schema Architecture, Complete architecture), Database Query Languages (DDL, DML, DCL), Relational Model Concepts: Primary Key, Unique key, Foreign key, Super Key, Alternate key, Candidate key, Constraints used in Relational Data Model including integrity constraints.

Unit Number: 2	Title: Conceptual Database Design	No. of hours: 8

Content Summary:
Data Modeling Using the Entity Relationship (ER) Model, The Enhanced Entity-Relationship (EER) Model: Entity Set, attributes and their types, Relationship Constraints (including Participation constraints and cardinality ratio), ER Diagrams, constraints and design issues, Reduction of ER and EER diagram to relational schemas.

Unit Number: 3	Title: Relational Database Design	No. of hours: 8

Content Summary:
Relational database design, Functional dependencies: Fully functional dependency, partial FD, trivial, non-trivial FD, inference rules, canonical cover, lossless join, dependency preservation, multivalued dependency, Normal Forms: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF, Normalization and denormalization process

Unit Number: 4	Title: Query Languages	No. of hours: 8

Content Summary:
Relational Algebra: relational operators (projection, selection, union, intersection, set difference, division, rename, Cartesian product, generalized relational algebra operators, cross product, join operators: inner vs. outer join, theta join, outer join, natural join, equijoin, self-join, complete set of relational algebra operations.
SQL- Queries, Constraints, Form of SQL query, UNION, INTERSECT and EXCEPT, Nested queries, Aggregate Operators, Null values.

Unit Number: 5	Title: Introduction to NoSQL (MongoDB)	No. of hours: 4

Content Summary:
Introduction to MongoDB, Data Types, Document Data Model-Creating, Inserting, Updating and Deleting Documents, MongoDB Query Language, Sorting, Join Operations.

Unit Number: 6	Title: File Organization & Indexing	No. of hours: 6

Content Summary:
Disk Storage, Basic File Structures and Hashing: Unordered, ordered and hashed files of records, Single and multilevel indexes: primary index, secondary index, clustered, multilevel indexes.

Unit Number: 7	Title: Transaction Management & Concurrency Control	No. of hours: 7

Content Summary:
Introduction to transaction processing, ACID Properties, Concurrency control mechanisms: serializability, two phase locking protocol, basic concept of deadlock, deadlock handling, timestamp-based protocols, precedence graph to ensure serializability, different protocols in concurrency control.

13. **Brief Description of Self-learning components by students (through books/resource material etc.):**
    - Aggregation and Pagination in MongoDB

- **Books Recommended:**

Textbooks:
- Elmasri R. and Navathe S.B., Fundamentals of Database Management Systems. 6th ed. Pearson, 2010.
- Silberschatz A., Korth H.F. and Sudarshan S., Database System Concepts. 6th ed. Mc.Graw Hill, 2010.
- Chodorow K., MongoDB: The Definitive Guide. 2nd ed. O'Reilly Media, 2013.

Reference Books:
- Ramakrishnan R. and Gehrke J., Database Management Systems. 3rd ed. McGraw-Hill Education, 2003.
- Suehring S., My SQL Bible. Wiley Publishing, 2002.

Reference Websites: (nptel, swayam, coursera, edx, udemy, lms, official documentation weblink)
- https://nptel.ac.in/courses/106106220
- https://docs.mongodb.com/

Practical Content

Sr. No.	Title of the Experiment	Software/ Hardware Based	Unit Covered	Time Required
1	Design an ER diagram for the COMPANY database for the following set of requirements.	erdplus.com	2	3 hours
2	Design a Relational Database Design for the COMPANY database from the ER/EER diagram.	erdplus.com	2	2 hours
3	To apply SQL integrity constraints as per the DDL statements given below for COMPANY database.	MySQL	4	3 hours
4	To familiarize with SELECT-FROM-WHERE SQL simple queries on the COMPANY database.	MySQL	4	3 hours
5	To familiarize with different JOIN operations in SQL on the COMPANY database.	MySQL	4	3 hours
6	To understand Aggregate functions and Group by Clause using SQL queries on the COMPANY database.	MySQL	4	3 hours
7	To familiarize with nested SQL queries on the COMPANY database.	MySQL	4	3 hours
8	Identifying contrast between Relational Databases and NoSQL, thereby recognizing their applications.	mongodb.com	5	2 hours
9	Create a COMPANY database using NoSQL database - MongoDB.	MongodbShell	5	3 hours

10	Retrieve data from NoSQL database - MongoDB.	Mongodb Shell	5	3 hours
Value Added Experiments				
1	Sorting and Indexing of Data in COMPANY Database	Mongodb Shell	5	2 hours

Project (To be done as individual/in group): No

Evaluation Scheme

TYPE OF COURSE	PARTICULAR	ALLOTTED RANGE OF MARKS	PASS CRITERIA
Theory+ Practical (L-T-P/L-0-P)	Minor Test	15%	Must Secure 30% Marks Out of Combined Marks of Major Test Plus Minor Test with Overall 40% Marks in Total.
	Major Test	35%	
	Continuous Evaluation Through Class Tests/Practice/Assignments/ Presentation/Quiz	10%	
	Online Quiz	5%	
	Lab Work	35%	

Mapping of PO's and CO's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	-	1	1	1	2	1	3	2	1	1
CO2	2	3	3	3	3	2	-	2	2	3	3	3	2	2	3
CO3	2	2	3	2	3	2	1	2	2	3	2	3	3	2	3
CO4	3	2	3	3	3	3	1	2	2	3	3	3	3	2	3
CO5	3	2	3	3	3	3	1	2	2	3	3	2	3	2	3
CO6	2	2	2	2	3	2	-	-	1	1	2	2	2	2	1
CO7	2	2	2	3	2	2	1	1	1	2	3	3	3	2	2