PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
Autonomous
Siddhartha Nagar, Vijayawada–520010
Re-accredited at 'A+' by the NAAC

Course Code				23DSMAL232			
Title of the Course				**Document Oriented Databases**			
Offered to:				B.Sc. Honours (Data Science)			
L	**4**	**T**	**0**	**P**	**0**	**C**	**3**
Year of Introduction:	**2024-25**			**Semester:**			**3**
Course Category:	**Major**			**Course Relates to:**	Local, Regional, National, Global		
Year of Revision:	**-**			**Percentage:**	**-**		
Type of the Course:				**SKILL DEVELOPMENT**			
Crosscutting Issues of the Course :				**-**			
Pre-requisites, if any				**Basic of Excel and Data handling**			

Course Description:

This course provides a comprehensive overview of database management systems, focusing on both traditional SQL databases and modern NoSQL solutions like MongoDB. Starting with foundational concepts, it covers the roles and advantages of DBMS, data models, and SQL commands for database creation and manipulation. Students will explore entity relationships, normalization processes, and SQL constraints. The course then transitions to NoSQL databases, specifically MongoDB, addressing its features, installation, and operations such as CRUD, indexing, and sharding. The final unit emphasizes data modeling and aggregation techniques in both SQL and MongoDB, equipping students with skills to design and manage robust databases effectively.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	To educate student regarding databases and how to manage databases.
2	To handle the large amount of data handling demands of business.
3	To implement a data store that provides high performance, high availability, and automatic scaling
4	To Process an immense diversity of data that needs to be stored and processed.
5	To make use of features and functionalities to work on NO SQL Data Base Mongo DB

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Recap of the data handling about database. DBMS Architecture	K1	PO3 PO5 PO6	-
CO2	Understand databases, various features of Database , the installation procedure of Oracle.	K2	PO3 PO5 PO6	PSO2
CO3	Apply Query on Mongo DB's rich query language to support Create, Read, Update, and Delete (CRUD) operations.	K3	PO3 PO5 PO6	PSO1 PSO2
CO4	Analyze the aggregation framework to perform aggregation operations.	K4	PO3 PO5 PO6	PSO1 PSO2
CO5	Evaluate the performance of both SQL and No Sql Databases.	K5	PO3 PO5 PO6	PSO1 PSO2

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX									
CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	-	-	2	-	2	2	-	-	-
CO2	-	-	2	-	3	3	-	-	1
CO3	-	-	2	-	3	3	-	2	1
CO4	-	-	2	-	3	3	-	2	1
CO5	-	-	2	-	3	3	-	2	1

Use the codes 3,2,1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Course Structure:

Unit – 1 : Overview of Database Management Systems: (12Hrs)

Introduction to Data, information, data vs. information –database and DBMS Role and advantages of DBMS – types of databases –problems with file system data management.

Data Models:

The importance of Data models –The evolution of Data Models-Degrees of data abstraction Introduction to Sql-Data Definition Commands – Data Types - Creating Table Structures - advanced data definition commands - alter – drop

Examples/Applications/Case Studies:

- Library database for book and member management.
- Customer relationship management (CRM) system for tracking customer interactions.

Exercises/Projects:

- Design a database for a small retail store.
- Implement a student information system using SQL.

Specific Resources: (web)

W3Schools SQL Tutorial

Unit –2 :Entity Types and SQL constraints: (12Hrs)

Entity Super types and Subtypes- entity integrity - selecting primary keys - Natural Keys and Primary Keys - The need for normalization – The normalization process – converting to first normal form – conversion to second normal form – conversion to third normal form – higher level normal forms.
SQL Constraints Adding Table Rows Saving Table Changes - Updating Table Rows - Restoring Table Contents - Deleting Table Rows

Examples/Applications/Case Studies:

- Employee database with Person as supertype, Employee and Manager as subtypes.
- Employee database with Person as supertype, Employee and Manager as subtypes.

Exercises/Projects:

- Design a normalized school administration database with entity integrity.
- Implement entity integrity and constraints in a hospital management system using SQL.

Specific Resources: (web)

W3Schools SQL Constraints

Unit – 3 :Data Manipulation Language: (12Hrs)

Select Queries: Selecting Rows with Conditional Restrictions – operators - advanced select queries – SQL functions

Mongo DB Features and Installation, The Need for No SQL Databases, What Are No SQL Databases?
CAP Theorem, BASE Approach, Types of NoSQL Databases, MongoDB Features, Document Database MongoDB Is Schemaless MongoDB Uses BSON , Rich Query Language, Aggregation Framework Indexing, GridFS, Replication, Sharding The mongo Shell , Terms Used in MongoDB, Data Types in MongoDB, Working with Database Commands, Create Database, Drop Database , Display List of Databases, Display the Version of MongoDB, Display a List of Commands.

Examples/Applications/Case Studies:

- Installing configuring running of Mongo db
- Working with data base commands in mongo db

Exercises/Projects:

- Working with crud operations in mongo db

Specific Resources: (web)

MongoDB Official Documentation

Unit – 4 :Mongo DB Operations: (12Hrs)

MongoDB CRUD Operations,Collections, Create a Collection, Create Capped Collections, Create Operations, Insert Documents, Read Operations, Query Documents, Update Operations, Update Documents, Delete Operations, Delete Documents, Working with Arrays, Working with Arrays, Query for Null or Missing Fields, To Query Null or Missing Fields, Working with the limit() and skip() Methods, limit() and skip() Methods.

Examples/Applications/Case Studies:

- Implementing aggregation operations in mongo db
- Implementing index operations

Exercises/Projects:

- Working with replication in mongo db
- Working with sharding in mongo db.

Specific Resources: (web)

MongoDB Documentation

Unit – 5 : [Data Modelling and Aggregation] (12Hrs)

Data Modelling and Aggregation, Data Models, Embedded Data Models, Normalized Data Models
Data Model Relationship Between Documents, Data Model Using an Embedded Document, Data Model Using Document References, SQL Aggregation Terms and Corresponding MongoDB, Aggregation Operators, Matching SQL Aggregation to MongoDB, Aggregation Operations.

Examples/Applications/Case Studies:

- Working with multi document transactions in mongo db

Exercises/Projects:

- Working with multi document transactions with conflicts in mongo db

Specific Resources: (web)

MongoDB Aggregation Documentation

Text Books:

1. "Fundamentals of Database Systems" by R.Elmasri and S.Navathe, Pearson Education; Seventh edition
2. "Database System Concepts" by Abraham Silberschatz, Henry Korth, and S. Sudarshan, McGrawhill, Seventh edition
3. MongoDB Recipes: With Data Modeling and Query Building Strategies By Subhashini Chellappan, Dharanitharan Ganesan , Publisher : Apress

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SEMESTER -END QUESTION PAPER STRUCTURE

Course Code & Title of the Course:	23DSMAL232 **Document Oriented Databases**
Offered to:	B.Sc. Honours (Data Science)
Category: MAJOR	**SEMESTER: 3**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A: Short Answer Questions (20 Marks)

Answer All questions. Each question carries 4 Marks.

Q1 (a) Explain the Three-Level Architecture?(K1)

OR

(b) Explain the advantages of DBMS approach?(K1)

Q2 (a) Discuss the fundamental operations in Relational algebra?(K2)

OR

(b) Discuss about union, intersect and minus in SQL?(K2)

Q3 (a) List any five data types in MongoDB? (K3)

OR

(b) Write Create, Drop, List Database in MongoDB.(K3)

Q4 (a) Define CRUD . Write about MongoDB Query Language.(K2)

OR

(b) What are different types of NoSQL?(K2)

Q5 (a) How does MongoDB Aggregation differ from SQL aggregation?(K2)

OR

(b) List and explain four MongoDB aggregation operations.(K2)

Section B: Long Answer Questions (50 Marks).

Answer All questions. Each question carries 10 Marks.

Q6 (a) Explain the ER diagrams indetail and explain the notations which are used in ER diagrams? (K3)

OR

(b) Describe the structure of DBMS with Neat Diagram? Compare and contrast file systems with database Systems?(K3)

Q7 (a) Define normalization? Explain briefly about 1NF,2NF, 3NF BCNF,4NF and 5NF with suitable examples?(K2)

OR

(b) Explain the role of functional dependencies in normalization with suitable Example?(K2)

Q8 (a) Explain in detail about CAP Theorem. (K2)

OR

(b) Define MongoDB.Is MongoDBSchemaless, Explain with an example(K2).

Q9 (a) Define CRUD . Explain CRUD Operations in detail.(K3)

OR

(b) What is an Array? How it is implemented in MongoDB.(K3)

Q10 (a) Discuss the advantages and challenges of Data Model Relationships in MongoDB. Include examples.(K4)

OR

(b) Compare and contrast Embedded and Normalized Data Models in MongoDB with real-world examples.(K4)