

COURSE TITLE	NOSQL DATABASE
COURSE CODE	05CA0403
COURSE CREDITS	4

Objective:

- 1 Understand the core principles of non-relational (NoSQL) database management systems.
- 2 Identify the differences between relational and non-relational data storage
- 3 Analyze the benefits of schema-less database design for agile and rapid application development
- 4 Apply non-relational databases to build flexible data models tailored to specific application requirements

Course Outcomes: After completion of this course, student will be able to:

- 1 Describe fundamental database concepts and differentiate between SQL and NoSQL databases.
- 2 Explain the core features and architecture of MongoDB as a NoSQL database
- 3 Apply CRUD (Create, Read, Update, Delete) operations using MongoDB
- 4 Develop database solutions using MongoDB to address real-world data handling requirements.

Pre-requisite of course:NA

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Introduction to NoSQL Database What is NoSQL? Difference between NoSQL and RDBMS, Benefits of NoSQL , Objectives, Design Goals, The Mongo Shell, JSON Introduction, JSON Structure	10
2	MongoDB Installation Installing Tools, Overview of Blog Project, Swig, Express, Node Packaged Modules (npm), CRUD (Creating, Reading & Updating Data) Mongo Shell, Query Operators, Update Operators and a Few Commands	10
3	Data Modeling Schema Design Pattern, Case Studies & Tradeoffs, Automatic Storage Class, Static Storage Class, External Storage Class, Register Storage Class	12

Contents : Unit	Topics	Contact Hours
4	Indexing and Performance Considerations & Aggregation Performance Using Indexes, Monitoring And Understanding Performance In Shared Environments, Aggregation Framework Goals, The Use Of The Pipeline, Comparison With SQL Facilities	13
Total Hours		45

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Unit 1 Install MongoDB and run the MongoDB shell., Create a JSON document and insert it into a MongoDB collection, Compare and explain NoSQL vs. RDBMS with practical queries, Demonstrate basic CRUD operations (Insert, Read, Update, Delete) in MongoDB, Write and execute queries using different data types in MongoDB	15
2	Unit 2 Install MongoDB and Node.js, set up Express, and initialize an npm project, Create a MongoDB database and collection, and insert sample data using the shell, Perform update operations using \$set, \$inc, and \$rename, Use MongoDB query operators (\$gt, \$lt, \$eq, \$in, \$and, \$or) to filter documents, Implement CRUD operations using Node.js and MongoDB with Express	15
3	Unit 3 Design a schema for an e-commerce application in MongoDB. Create embedded documents and perform queries on nested data, Demonstrate document referencing using ObjectId, Implement automatic and manual indexing for optimized queries, Compare and implement different storage classes in MongoDB	15
4	Unit 4 Create indexes on fields and compare query performance with and without indexes, Monitor query execution time using explain() in MongoDB, Implement an aggregation pipeline to group and filter data, Use \$match, \$group, \$sort, and \$project operators in an aggregation query., Compare MongoDB aggregation vs SQL queries for performance efficiency	15
Total Hours		60

Textbook :

- 1 MongoDB: The Definitive Guide, Kristina Chodorow, O'Reilly Media, 2019
- 2 MongoDB in Action, Kyle Banker, Manning Publications, 2016

References:

- 1 NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pramod J. Sadalage, Martin Fowler, Addison-Wesley, 2012
- 2 The Little MongoDB Book, The Little MongoDB Book, Karl Seguin, Open Source (Self-published), 2011

Suggested Theory Distribution:

The suggested theory distribution as per Bloom’s taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
20.00	30.00	25.00	15.00	10.00	0.00

Instructional Method:

- 1 Board Work
- 2 PPT
- 3 Demo

Supplementary Resources:

- 1 <https://www.geeksforgeeks.org/introduction-to-nosql>
- 2 <https://www.npmjs.com/package/nosql>
- 3 <https://www.mongodb.com/resources/languages/mongodb-and-npm-tutorial>
- 4 https://aws.amazon.com/dynamodb/?trk=41b8b74a-12a8-4611-911d-bba45e8a1420&sc_channel=ps&ef_id=Cj0KCQjwj47OBhCmARIsAF5wUEEEtu1DgInLlamOenIw3ETVoptnKHf-ozZQt3F1GBN24ObXtgiHMwaAvYGEALw_wcB:G:s&s_kwid=AL!4422!3!798628397231!e!!g!!base%20nosql!23600692257!193209777786&gclid=Cj0KCQjwj47OBhCmARIsAF5wUEEEtu1DgInLlamOenIw3ETVoptnKHf-ozZQt3F1GBN24ObXtgiHMwaAvYGEALw_wcB
- 5 <https://www.geeksforgeeks.org/dbms/introduction-to-nosql/>
- 6 <https://en.wikipedia.org/wiki/NoSQL>