INTRODUCTION TO NOSQL DATABASE
COMP438

Course Objective:

To provide students with an understanding of non-structured databases, their types, use cases, and how they differ from traditional relational databases. Students will gain practical experience with various NoSQL databases, and learn how to implement and query them effectively.

This outline provides a balanced mix of theory and hands-on practice. It covers both the fundamental concepts and practical applications of non-structured databases, ensuring students gain both conceptual understanding and technical skills.

Prerequisite:

Relational Database Design

Topics: -

1- Overview of Databases

 - Traditional Relational Databases (RDBMS)

 - Structured vs. Unstructured Data

- Challenges of Relational Databases in the Modern Era

- Introduction to NoSQL Databases

 - Definition and Key Concepts

 - When to Use NoSQL vs. SQL Databases

 2-: NoSQL Data Models and Types

- Document-Oriented Databases

 - Overview (e.g., MongoDB, CouchDB)

 - Use cases and benefits

3: NoSQL vs. SQL: Comparisons and Tradeoffs

- Differences in Schema Design

 - Schema flexibility in NoSQL

- Traditional SQL queries vs. JSON/other query languages in NoSQL

4: Introduction to into MongoDB (Document Database)

- Introduction to MongoDB
  - Features and Architecture
- Data Modeling in MongoDB
  - Documents, Collections, and Databases
  - Designing schemas for scalability and flexibility
- CRUD Operations in MongoDB

5: Introduction to Cassandra (Column-Oriented Database)

- Introduction to Cassandra
  - Distributed, fault-tolerant, and scalable database
- Data Model
  - Partitions, columns, and clustering
- Query Language (CQL)
  - Cassandra Query Language vs. SQL

6: Best Practices and Use Cases

- Choosing the Right NoSQL Database for Your Application
  - Understanding the requirements and constraints
  - Factors like scalability, consistency, and data structure
- Real-world Case Studies
  - Social media platforms
  - E-commerce sites
  - Internet of Things (IoT)

9: Hands-On Project

- Design and Implement a NoSQL Database Solution
  - Choose a project (e.g., building a social media backend, IoT data storage)
  - Define the requirements and select the appropriate NoSQL model
  - Design schema, set up the database, and perform CRUD operations
  - Implement indexing, querying, and scaling strategies
  - Present the final project

Assessment:
- Quizzes or assignments
- Final project presentation
- Class participation and engagement