

★ **MongoDB**

Module 1: Introduction to NoSQL & MongoDB

- ✓ What is NoSQL?
- ✓ SQL vs NoSQL
- ✓ **Types of NoSQL databases**
 - Document
 - Key-value
 - Graph
 - Columnar
- ✓ **Introduction to MongoDB**
 - Advantages
 - Document-based model
 - BSON
- ✓ **MongoDB Ecosystem**
 - Mongo Shell
 - MongoDB Server
 - MongoDB Compass
 - MongoDB Atlas (Cloud)

Module 2: Installation & Setup

- ✓ Installing MongoDB Community Server
- ✓ Mongo Shell Basics
- ✓ Connecting with MongoDB Compass
- ✓ Setting up MongoDB Atlas Cloud Database

Module 3: MongoDB Basics

- ✓ **Understanding Collections & Documents**
- ✓ **JSON vs BSON**
- ✓ **Inserting Data**
 - insertOne()
 - insertMany()
- ✓ **Querying Data**
 - find()
 - findOne()
 - Comparison Operators
 - Logical Operators
- ✓ **Projections**
 - Including fields
 - Excluding fields

Module 4: CRUD Operations (Detailed)

- ✓ **Insert operations**
- ✓ **Read operations**
- ✓ **Update operations**
 - \$set
 - \$unset
 - \$inc
 - \$push, \$pull
- ✓ **Delete operations**
 - deleteOne()

- deleteMany()

Module 5: Data Modeling in MongoDB

- ✓ Document structure
- ✓ Embedded Documents
- ✓ Referenced Documents
- ✓ One-to-One, One-to-Many, Many-to-Many
- ✓ When to Embed vs When to Reference
- ✓ Schema Design Best Practices
- ✓ CAP Theorem in MongoDB

Module 6: Schema Validation

- ✓ **Data Types**
- ✓ **Validators**
 - \$jsonSchema
 - Required fields
 - Enum validations
- ✓ **Strict vs Flexible schema**

Module 7: Indexing (Performance Optimization)

- ✓ What is an Index?
- ✓ Single-field Index
- ✓ Compound Index
- ✓ Text Index
- ✓ Unique Index
- ✓ Partial Index
- ✓ TTL Index
- ✓ How Indexing Works Internally
- ✓ Query Optimization with explain()

Module 8: Aggregation Framework (Very Important)

- ✓ **What is Aggregation?**
- ✓ **Pipeline Stages**
 - \$match
 - \$group
 - \$project
 - \$sort
 - \$limit
 - \$lookup (joins)
 - \$unwind
 - \$addFields
 - \$count
 - \$facet
- ✓ **Use Cases**
 - Reporting
 - Analytics
 - Data transformations
- ✓ **Building complex pipelines**

■ **Module 9: MongoDB Relationships**

- ✓ Embedding relationships
- ✓ DBRef
- ✓ Manual referencing
- ✓ Simulating joins with \$lookup
- ✓ Cascading deletes & updates (manually)

■ **Module 10: MongoDB Advanced Concepts**

- ✓ **Transactions**
 - Multi-document ACID transactions
 - startSession()
 - Commit & rollback
- ✓ **Sharding**
 - Shard keys
 - Config servers
 - Query routing
- ✓ **Replication**
 - Replica sets
 - Failover
 - Read preference
- ✓ **Change Streams**
 - Real-time notifications

■ **Module 11: MongoDB Security**

- ✓ Role-based Access Control (RBAC)
- ✓ Creating users & roles
- ✓ Authentication & authorization
- ✓ IP whitelisting in Atlas
- ✓ Data encryption

■ **Module 12: MongoDB with Node.js (Mongoose ORM) (Optional)**

- ✓ What is Mongoose? (ODM)
- ✓ Connecting MongoDB with Node.js
- ✓ Creating schemas & models
- ✓ CRUD with Mongoose
- ✓ Validation in Mongoose
- ✓ Middleware (Pre/Post hooks)
- ✓ Virtuals
- ✓ Population (populate())
- ✓ Aggregation with Mongoose

■ **Module 13: MongoDB Atlas Cloud**

- ✓ Creating an Atlas cluster
- ✓ Connecting with Compass, Shell, Node.js
- ✓ Database users & network access
- ✓ Performance Analyzer
- ✓ Backup & Restore
- ✓ Atlas Search (Full-text search)

■ **Module 14: Real-World Use Cases**

- ✓ **Using MongoDB for:**
 - Social media apps
 - E-commerce product catalogs
 - Chat apps (real-time)
 - IoT data
 - Analytics dashboards

■ **Module 15: Admin Tools & Operations**

- ✓ **Backup & Restore**
- ✓ **Export & Import**
 - mongoexport
 - mongoimport
- ✓ **Monitoring Tools**
 - mongostat
 - mongotop
- ✓ **Logging & Performance tuning**

■ **Module 16: Mini Projects**

- ✓ Student Record System
- ✓ Task Manager App
- ✓ Blog Database
- ✓ Product Inventory System

■ **Module 17: Major Projects**

- ✓ E-commerce Database with Analytics
- ✓ Real-time Chat Application (Change Streams)
- ✓ Learning Management System
- ✓ Food Delivery App Database
- ✓ Hospital Management System

■ **Module 18: Assignments & Practice**

- ✓ 200+ MongoDB queries (practice sheet)
- ✓ Aggregation pipeline assignments
- ✓ Schema design tasks