THE GEEK INSTITUTE
OF CYBER SECURITY

(Building Futures Through Digital Knowledge and Innovation)

MongoDB (01 Month)

Syllabus

01: Introduction to NoSQL and MongoDB

- ✓ What is NoSQL? Types and Use Cases
- ✓ Comparison: SQL vs NoSQL
- ✓ Overview of MongoDB and its Architecture
- ✓ Documents and Collections
- ✓ BSON vs JSON
- ✓ Installing MongoDB on Windows/Linux/macOS
- ✓ Using Mongo Shell & MongoDB Compass (GUI Tool)
- ✓ Introduction to MongoDB Atlas (Cloud Version)

02: MongoDB Basics and Core Operations

- ✓ Creating Databases and Collections
- ✓ Inserting Documents
    - o insertOne(), insertMany()
- ✓ Querying Documents
    - o find(), findOne(), Projection, Filtering
    - o Using Comparison Operators ($eq, $ne, $gt, $lt)
    - o Logical Operators ($and, $or, $not)
    - o Array Queries ($in, $all, $elemMatch)
- ✓ Updating Documents
    - o updateOne(), updateMany(), $set, $unset, $inc, $push
- ✓ Deleting Documents
    - o deleteOne(), deleteMany()
- ✓ Query Optimization with Indexes

03: Advanced Querying and Aggregation

- ✓ Understanding Aggregation Framework
- ✓ Stages in Aggregation Pipeline
    - o $match, $group, $project, $sort, $limit, $unwind, $lookup
- ✓ Expressions in Aggregation
- ✓ Working with Dates, Arrays, and Conditional Operators
- ✓ Data Transformation using Aggregation
- ✓ Performance Considerations with Aggregations

04: MongoDB Data Modeling

- ✓ Schema Design Basics in MongoDB
- ✓ Embedding vs Referencing
- ✓ One-to-One, One-to-Many, and Many-to-Many Relationships
- ✓ Denormalization Best Practices
- ✓ Modeling Hierarchical Data
- ✓ Handling Large Collections

05: Indexing and Performance Optimization

- ✓ What is an Index? Why Index?
- ✓ Creating Indexes (createIndex())
- ✓ Types of Indexes:
    - o Single Field, Compound, Multikey, Text, Geospatial
- ✓ Index Strategies and Query Analysis
- ✓ Using explain() for Performance Debugging
- ✓ Covered Queries and Index Usage
- ✓ TTL (Time-To-Live) Indexes

06: MongoDB Administration

- ✓ MongoDB Configuration Files
- ✓ Database Profiling
- ✓ Working with Logs
- ✓ Authentication and Authorization
    - o Role-Based Access Control (RBAC)
- ✓ Creating Users and Assigning Roles
- ✓ Backup and Restore with mongodump, mongorestore
- ✓ Data Import and Export (mongoimport, mongoexport)

07: MongoDB Atlas (Cloud-Based MongoDB)

- ✓ Introduction to MongoDB Atlas
- ✓ Creating a Free Cluster
- ✓ Setting Up IP Whitelists and Users
- ✓ Connecting Atlas with Compass and Applications
- ✓ Cloud Backups, Monitoring & Alerts
- ✓ Atlas Performance Advisor
- ✓ Atlas Triggers and Data Federation

08: Mongoose (MongoDB with Node.js)

- ✓ Introduction to Mongoose ODM
- ✓ Setting Up Mongoose in a Node.js Project
- ✓ Connecting to MongoDB via Mongoose
- ✓ Defining Schemas and Models
- ✓ Validations in Mongoose
- ✓ CRUD Operations using Mongoose
- ✓ Mongoose Middleware (Pre/Post Hooks)
- ✓ Virtuals and Schema Methods
- ✓ Population and Relationships in Mongoose

09: MongoDB in Full Stack Applications

- ✓ Integrating MongoDB with Express.js (Node.js)
- ✓ REST API with Express and MongoDB
- ✓ MongoDB in MERN Stack (Mongo, Express, React, Node)
- ✓ Authentication with JWT and MongoDB
- ✓ Using MongoDB with GraphQL (Optional Advanced Module)
- ✓ Real-Time Applications with MongoDB and WebSockets

10: Security and Best Practices

- ✓ Secure MongoDB Deployment
- ✓ Role-Based Access Controls
- ✓ Enabling TLS/SSL for Connections
- ✓ Preventing NoSQL Injection
- ✓ Secure Password Storage with Bcrypt
- ✓ Auditing and Monitoring
- ✓ Limiting Database Exposure in Production

11: Backup, Replication, and Sharding (Advanced Concepts)

- ✓ Introduction to Replication
- ✓ Setting Up Replica Sets
- ✓ Failover and High Availability
- ✓ Sharding in MongoDB
  - o Shard Key Selection
  - o Partitioning Data Across Shards
- ✓ Backup Strategies in Production
- ✓ Using Ops Manager and Cloud Manager (Optional)

12: Real-World Projects and Capstone

- ✓ E-commerce Application Database
- ✓ Blogging System with Comments and Likes
- ✓ Inventory Management System
- ✓ Real-Time Chat Application with MongoDB
- ✓ Hosting Full Project on MongoDB Atlas