

Back-End Development

1. Introduction to Back-End Development

- A. What is Back-End Development?
- B. Client-Server Architecture & HTTP Basics
- C. Web Servers and Middleware Concepts
- D. API Basics (REST vs SOAP)
- E. Deployment & Hosting Overview

2. Server-Side Languages & Runtime Environments

- A. JavaScript & Node.js (Runtime)
- B. Python & Django
- C. Java & Spring Boot
- D. Language comparison and use-cases

3. Node.js and Express

- A. Introduction to Node.js & event-driven architecture
- B. Setting up Node projects & NPM modules
- C. Express.js Framework – Routing & Middleware
- D. REST API Development (CRUD)
- E. Handling requests, responses, errors
- F. Asynchronous programming & callbacks/promises/async-await
- G. Connecting with MongoDB (NoSQL) via Mongoose

4. Python & Django Framework

- A. Introduction to Python web back-ends
- B. Django Project setup & app structure
- C. Models, Views, Templates (MVT pattern)
- D. URL routing & middleware
- E. Form handling & validation
- F. Django ORM and database integration
- G. Authentication & authorization (sessions, tokens)

5. Java & Spring Boot

- A. Introduction to Spring ecosystem
- B. Spring Boot project setup & annotations
- C. Dependency Injection & Inversion of Control
- D. Spring MVC & REST controllers
- E. Data persistence with Spring Data JPA

- F. Unit and integration testing
- G. Security fundamentals (Spring Security, JWT/OAuth)

6. Databases & Data Management

- A. SQL Databases – MySQL/PostgreSQL
- B. NoSQL Databases – MongoDB
- C. Designing schemas for web apps
- D. ORM & query building
- E. Transactions & ACID concepts

7. Building and Testing APIs

- A. REST API design standards
- B. HTTP verbs (GET, POST, PUT, DELETE)
- C. API versioning and documentation (Swagger/OpenAPI)
- D. Using Postman for testing
- E. JSON and serialization

8. Security & Authentication

- A. Authentication strategies (sessions, JWT, OAuth2)
- B. Password hashing (bcrypt)
- C. Role-based access control
- D. Protecting APIs (CORS, rate limiting)

9. Deployment & DevOps Basics

- A. Deploying backend apps to cloud (Heroku, AWS/GCP/Azure basics)
- B. Containers & Docker overview
- C. CI/CD fundamentals (GitHub Actions/Jenkins)
- D. Monitoring & logging fundamentals

10. Advanced Topics & Best Practices

- A. Microservices intro (Spring Cloud, Docker)
- B. Caching (Redis) fundamentals
- C. WebSockets & real-time communication
- D. Performance optimization & profiling

Mini Projects:

- RESTful service for e-commerce backend
- User Management system (auth, profiles)
- Booking scheduler backend with notifications
- Integration with frontend UI using JSON APIs
- Deployment & scaling demonstration



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