

### **Phase 1: Core Java (Foundation – 2 weeks)**

**Goal:** Build strong fundamentals in Java before moving to Spring.

- Java Basics: Data types, OOP (Class, Object, Inheritance, Polymorphism, Abstraction, Encapsulation)
- Exception Handling & Logging
- Collections Framework (List, Set, Map, Generics)
- Java 8 Features: Streams, Lambda, Functional Interfaces, Optional
- Multithreading & Concurrency
- Java 17 Enhancements (switch expressions, records, sealed classes)

**Practice Project:** Employee Management CLI Application

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### **Phase 2: Databases & Persistence (1.5 weeks)**

**Goal:** Learn how to handle persistence with relational and NoSQL DB.

- SQL Basics (CRUD, Joins, Indexes)
- Database Design (ER Diagrams, Normalization)
- JDBC & Connection Pooling
- ORM Basics: Hibernate/JPA
- Relationships: One-to-One, One-to-Many, Many-to-Many
- NoSQL Introduction: MongoDB Basics

**Mini Project:** Student Database System (MySQL + JPA)

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### **Phase 3: Spring & Spring Boot (3 weeks)**

**Goal:** Master backend development with Spring Boot.

- Introduction to Spring & Spring Boot
- Dependency Injection (IoC)
- Spring Boot Annotations
- RESTful API Development
- Spring Data JPA
- Spring Boot Validation
- Spring Boot Security (Basic Auth, JWT)
- Swagger & API Documentation
- Exception Handling & Global Error Handling

- Actuator & Monitoring
- Spring Boot Testing (JUnit, Mockito)

**Project:** RESTful Employee Management System

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#### **Phase 4: Frontend Development (3 weeks)**

**Goal:** Build dynamic UIs with modern frontend stack.

##### **Frontend Essentials**

- HTML5, CSS3, Flexbox, Grid
- JavaScript (ES6+ features)
- DOM Manipulation
- AJAX & Fetch API
- Responsive Design (Bootstrap/Tailwind)

##### **Frontend Framework (React)**

- React Basics (Components, Props, State, JSX)
- Hooks (useState, useEffect, useContext)
- Routing (React Router)
- Forms & Validation
- State Management (Redux/Context API)
- API Integration with Axios/Fetch
- Authentication (JWT with React)

**Mini Project:** React-based Task Manager

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#### **Phase 5: Full-Stack Integration (2 weeks)**

**Goal:** Connect Spring Boot backend with React frontend.

- REST API consumption in React
- JWT Auth integration (Spring Boot + React)
- Handling CORS
- Error handling in frontend-backend communication
- Role-based access (Admin/User dashboards)
- File upload/download with Spring Boot & React

**Capstone Project:** Online Grocery App / Student Portal

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#### **Phase 6: Advanced Concepts (2 weeks)**

**Goal:** Professional-level skills for enterprise-grade apps.

- Microservices Architecture
- Spring Cloud (Eureka, API Gateway, Config Server)
- Inter-service communication (REST/Feign Client)
- Event-driven architecture with **Kafka**
- Docker & Containerization
- CI/CD with GitHub Actions or Jenkins
- Cloud Deployment (AWS/Render/Heroku)

### **Final Capstone Project:**

E-commerce System with:

- Product & Order Microservices
- Kafka for notifications
- React frontend with JWT Auth
- Dockerized deployment

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### **Phase 7: Soft Skills & Professional Practices (1 week)**

- Git & GitHub for version control
- Agile & Scrum basics
- Writing clean code (SOLID, Design Patterns)
- Debugging & Profiling
- Technical Interview Prep (Java, Spring, React, SQL)