

Java with AI, Microservices and DSA

Goal: To create **industry-ready full-stack Java developers** with strong DSA skills, cloud deployment knowledge, and AI integration using **Spring AI**.



Module 1 – Core Java (Foundations)

Objective: Build a strong base in Java programming language.

Topics:

- Introduction, History, Features
- Java Architecture: JVM, JRE, JDK
- Class Syntax, Naming Conventions, main () method
- Variables, Data Types, Operators, Control Flow, Wrapper Classes
- Methods, Constructors, Static vs Instance members
- Strings, Arrays, Enums
- OOPS Concepts [Encapsulation, Inheritance, Polymorphism, Abstraction]
- Packages and Access Modifiers
- Exception Handling
- Java Utility Package classes
- Collections and Generics
- Data Structures & Algorithms
 - Algorithm Analysis (Time & Space Complexity)
 - Arrays, Strings
 - Linked Lists (Singly, Doubly, Circular)
 - Stacks and Queues
 - Recursion and Backtracking
 - Trees (Binary, BST, Heap)
 - Graphs (BFS, DFS, Shortest Path)
 - Sorting & Searching Algorithms
 - Hashing & Maps
 - Dynamic Programming
 - Sliding Window and Two Pointer Techniques
- File I/O
- Multithreading
- Java 8 Features: Lambdas, Streams, Data time API
- Java 9 till 25 Features

Module 2 – Advanced Java with SQL and PL/SQL

Objective: Learn how to build dynamic web apps with database integration.

Topics:

- SQL Fundamentals: INSERT, UPDATE, DELETE, Select, Sub-Queries, Joins
- PL/SQL Basics: Procedures, Functions, Cursors, Triggers, Views
- HTML, CSS, JavaScript, Bootstrap
- Servlet Lifecycle and Architecture, Handling Request, Session handling
- JSP (Java Server Pages), JSTL & Expression language
- JDBC and Database Connectivity (MySQL / Oracle)
- Web Application Deployment (WAR packaging, Tomcat setup)

Mini Project: Learning Management System using JSP, Servlet, JDBC, and MySQL

Module 3 – Spring Framework with React JS (Full Stack Integration)

Objective: Master backend with Spring Boot and frontend with React JS.

Topics:

Spring Core & Boot:

- Learn Design Patterns like Factory, Singleton, ORM, MVC, DAO etc.
- Maven / Gradle Build Tools
- Inversion of Control (IoC) and Dependency Injection (DI)
- Spring Boot Setup and Configuration
- Spring Data JPA and Hibernate ORM
- Spring MVC
- Spring Boot REST APIs
- Validation, Exception Handling, and Logging
- JSON and XML Handling
- Unit Testing (JUnit, Mockito)
- Spring Boot Properties – profiling
- Spring Security – Authentication & Authorization using JWT, OAuth2
- OAuth2
- Consuming 3rd party Rest APIs, Working with Rest Template

- Building, Deploying and Running Spring Boot App in Tomcat

React JS (Frontend):

- React Components, Props, and State
- JSX and Virtual DOM
- React Hooks
- Event Handling and Conditional Rendering
- API Integration using Axios / Fetch
- React Router for Navigation
- Form Handling and Validation
- Integration with Spring Boot REST APIs

Project: Digital Lending System [Personal Loan App] (React + Spring Boot + MySQL)

Module 4 – Microservices with Spring Cloud & AI

Objective: Build scalable enterprise applications using a microservices architecture.

Part A - Microservices

- Monolithic vs Microservices Architecture
- Microservices Design Principles & Patterns
- Creating Sample Microservices App
- Service Registry and Discovery with Eureka Server
- API Gateway setup using Spring Cloud Gateway
- Config Server and Centralized Configuration using Spring Cloud Config
- Feign Client in the place of REST Template
- Distributed Tracing with Zipkin
- Health Monitoring using Admin Server
- Circuit Breaker with Resilience4j
- Asynchronous Communication using RabbitMQ
- Working with Streams using Kafka & Spring Cloud Streams
- Understanding CQRS and SAGA
- Best Practices of Caching Techniques
- Implementing Log aggregation

Part B – Artificial Intelligence Integration using Spring AI:

- Introduction to Artificial Intelligence and Machine Learning
- AI Libraries in Java (Deeplearning4j, Tribuo)
- Using Python-based AI Models via REST APIs
- ML Basics: Regression, Classification, Clustering
- Neural Network Fundamentals
- NLP (Text Classification, Sentiment Analysis)
- AI API Integrations (OpenAI, Hugging Face)
- **Spring AI Framework:**
 - Introduction to Spring AI
 - Prompt Engineering Basics
 - Integrating LLMs via OpenAI API
 - Building a Spring Boot Chatbot using Spring AI
 - Connecting AI to Databases and REST APIs
- **Enterprise Project:** AI-Powered Job portal with Support Chatbot to build the resume

Module 5 – Cloud, DevOps, Project Development Practices

Objective: Prepare students for real-world deployment and CI/CD pipelines.

Topics:

- Git and GitHub
- Docker Basics
- Kubernetes Basics
- Deploying to AWS
- Learning Project Development Practices
 - Understand BRD, FSD
 - Understand Work Estimations
 - Understand Sprint Planning
 - Learning Preparing Use case, Flow diagrams, DB diagrams
 - Create Epic, Story, Task & Assing using JIRA

 **Suggested Duration: 5–6 Months**