



SACHIN SIR'S
TECHNO COMP ACADEMY
AWAKENING THE STUDENT WITHIN

Spring Boot

with Microservices, Cloud and
Artificial Intelligence (AI)

- By Sachin Dhane





Course Content

MODULE 01

Foundation

What is a POJO Class?

What is a Bean Class?

POJO Class Vs Bean Class

Entity Class, Persistence Class

JAR (Java Archive)

- What is a JAR?
- Need of a JAR
- How to create our own JAR?

IS-A vs HAS-A Relationship

Optional class & its Purposes.

Functional Interface

Functional Programming with Lambda Expressions in Java

Lombok API

MODULE 02

Spring Framework

What is a Framework?

Why should we use frameworks to develop the applications?

Introduction to Spring Framework

- What is Spring Framework?
- Tight coupling Vs Loose Coupling
- Problems with traditional Java (tight coupling)
- Advantages of Spring Framework
- Spring Framework architecture overview
- Spring Framework Vs Spring Boot

Spring Architecture

Spring Modules Overview

Spring Core Module



Spring Container

- Role of Spring Container
- Types of Containers
- BeanFactory
- ApplicationContext
- Differences between BeanFactory and ApplicationContext

IOC Container

- What is IoC?
- Traditional Object Creation Vs Ioc
- How IoC Works Internally?
- Control Flow Inversion Concept
- Real-life Analogy (Driver vs Car Control)
- Role of IoC Container in Spring
- Types of IoC Container
 - BeanFactory
 - ApplicationContext

Dependency Injection in Depth

- Dependency Injection (DI) & Dependency Lookup Concept
- Auto-wiring Modes
- Handling Multiple Beans
- Circular dependency (Problem & Solution)
- Benefits of IoC & DI
- Types of Dependency Injection
 1. Setter Injection
 2. Constructor Injection
 3. Interface Injection
 4. Field Injection

SPRING BEANS

- What is a Spring Bean?
- Bean Lifecycle
 - Bean Lifecycle Phases
 - @PostConstruct and @PreDestroy



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- InitializingBean & DisposableBean
- Custom init and destroy methods

- Bean scopes
 - Singleton
 - Prototype
 - Request
 - Session
 - Application

- Lazy vs Eager initialization

Component Scanning

Auto-wiring

- Auto-wiring Strategies
 - 1.byName
 - 2.byType
 - 3.constructor

MODULE 03

Spring Core Annotations

- @Component
- @ComponentScan
- @Configuration
- @Service
- @Repository
- @Controller
- @Autowired
- @Qualifier
- @Primary
- @Value
- @Scope
- @Lazy



MODULE 04

Spring Boot

Why Spring Boot?

Spring Vs Spring boot

Spring boot Introduction

Spring boot Advantages

Spring boot Internals

How to kickstart a spring boot project?

Understanding pom.xml

What are the dependency scopes in maven?

@SpringBootApplication

- @Configuration

- @EnableConfiguration

- @ComponentScan

Understanding SpringApplication.run() method

How to execute a spring boot project from command line

Spring Boot Runner component

- 1.CommandLineRunner interface

- 2.ApplicationRunner interface

Spring Boot Banner

Command line arguments to Spring Boot Application

MODULE 05

Spring Boot JDBC

What is JDBC API

Issues with JDBC API

Spring JDBC Module

JdbcTemplate class

How to configure the Data Source Properties

SimpleJdbcCall class to invoke a procedure/function of a database



MODULE 06

Spring Boot Data JPA

What is ORM & Why ORM?

JDBC Vs ORM

What is JPA?

What is Spring DATA JPA?

Why Spring DATA JPA?

Creating a Repository interface

- Repository
- CrudRepository
- PagingAndSortingRepository
- JpaRepository

Query approaches in Data JPA

- Query Creation by Method Name
- Using @Query Annotation
- Using @NamedQuery Annotation.

JPQL Vs SQL

Identifier Generator strategies of JPA

- GenerationType.IDENTITY
- GenerationType.SEQUENCE
- GenerationType.TABLE
- GenerationType.AUTO

Custom ID Generation

JPA Relationships

- One-to-Many
- Many-to-One
- Many-to-Many
- One-to-One



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Cascade Types

- PERSIST
- MERGE
- REMOVE
- REFRESH
- DETACH
- ALL

FetchType

- EAGER Loading
- LAZY Loading

@Embeddable annotation

MODULE 07

Spring Boot Web MVC

What is Design Pattern?

MVC Design Pattern

Role of DispatcherServlet

Handler Mapper

Controller

Model and View

View Resolver

View

Model class in Spring

Spring form tags

Bean Validation API - Validating Java objects

Using Thymeleaf

Pagination

Pageable Interface



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MODULE 08

Spring REST API

How services are provided to the Java Applications?

What is mean by Webservices

SOAP Vs REST Webservices

REST Principles

HTTP Protocol

HTTP Methods

HTTP Request

HTTP Response

Status Codes

Building RESTful Webservices

Spring REST Annotations

- @RestController
- @RequestMapping
- @GetMapping
- @PostMapping
- @PutMapping
- @DeleteMapping
- @PatchMapping
- @RequestParam
- @RequestBody
- @PathVariable
- @ResponseStatus
- @ExceptionHandler
- @RestControllerAdvice

Spring MVC Flow

MVC Form Binding

Spring REST Flow

ResponseEntity class

Produces and Consumes Attributes

YAML(YAML Ain't Markup Language)

Rest-CRUD With YAML



RestTemplate class
WebClient class
Spring WebFlux
 -- Mono and Flux Core Types of Reactor Library
Swagger Tool
Springdoc Library
JSON DATA
Jackson API

MODULE 09

Spring REST Security

Authentication
Authorization
Spring Security Filters Chain
@EnableWebSecurity
UserDetailsService Interface
 -- InMemoryUserDetailsManager
 -- JdbcUserDetailsService

JWT (JSON Web Token)
JWT Token Structure
OAuth2(Open Authorization Version 2)
Understanding Googles Authorization Service

MODULE 10

Spring Caching

Spring Cache Annotations
 -- @Cacheable
 -- @CachePut
 -- @CacheEvict
 -- @EnableCaching
Installation Redis Server
Redis-Caching using Redis Server



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MODULE 11

Spring Boot Actuator

What is mean by Actuator?

What is the need of Actuator to an Application

'spring-boot-starter-actuator' Dependency

MODULE 12

Spring Profiles

What is 'Spring Profiles'?

Why we use Spring Profiles?

Manage different configurations for different environments

MODULE 13

Microservices

Monolith Architecture Vs Microservices Architecture

Monolithic Application

Microservices Benefits

Microservices Architecture

Spring Cloud

Spring Cloud Config Server

Eureka Server (Service Registry)

Config Server

Load Balancing - @LoadBalanced

Feign client

How to start multiple instances of a Service?

Resilience4J

Circuit Breaker Pattern

Spring Cloud Gateway

Distributed Tracing

Admin Server

Zipkin Server

Microservices Security



MODULE 14

Spring Boot with MongoDB

Installation of MongoDB
What is mean by NoSQL Database
CRUD Operations with MongoDB
SpringBoot Application + MongoDB

MODULE 15

Spring Boot Logging

logging framework as Logback
SLFJ API
log levels - TRACE, DEBUG, INFO, WARN, ERROR

MODULE 16

Spring AI

Artificial Intelligence (AI)
Machine Learning (ML)
Deep Learning (DL)
ML vs DL
Natural Language Processing (NLP)
GEN AI
Agentic AI?
Open AI and Its LLMs.
What is Ollama?
What is Spring AI ?
Why we should learn Spring AI?
Spring AI with OpenAI GPT Model Integration
Chat Client & Chat Memory Advisors
Spring AI with Local LLM Integration
Image Generation using Open AI
Prompt Engineering & Key Components ?
What is PromptTemplate?



Vector Store DB and RAG

VectorStore interface

Spring AI + Pinecone DB with RAG System Integration?

MODULE 16

Docker

What is Virtualization

What is Containerization

Life Without Docker

What is Docker

Docker Architecture

Dockerfile

Docker Image

Docker Registry

Docker Container

Docker Commands

Dockerfile KEYWORDS

Writing Dockerfile

Creating Docker Images

Creating Docker Containers

Pushing Images to Docker Hub

Dockerizing Spring Boot Application with MySQL

MODULE 16

Maven

Learning BuildProcess

Maven repositories

1. Central repository
2. Local repository

Maven archetypes

-- Maven commands & its purposes



MODULE 17

Dev Tools & DevOps Essentials

- Maven - Build & Dependency Management Tool
- Git - Version Control Tool
- Docker - Containerization Tool
- Postman - API Testing Tool
- Swagger - Tool used to document, visualize, and test REST APIs

MODULE 18

Servers

- TOMCAT - Web Server
- Redis - Remote DIctionary Server
- Zipkin Server - A centralized server that collects and stores trace data
- Eureka Server - Service Registry Spring Cloud Netflix
- Kayclock Server - Authorization Server

