Advanced Spring

Duration: 2 days
Prerequisite: Strong and Working Knowledge on Java Spring Framework

Day 1 – Advanced Core Spring, Data & Transactions

Module 1: Advanced Dependency Injection & Configuration

- Spring Container deep dive, bean lifecycle
- Advanced bean scopes: request, session, application, prototype
- Conditional Beans & Environment-specific settings
- Profile-based configuration
- Type-safe configuration with @ConfigurationProperties
- Externalized configuration (application.yml, profile-based configs)

Hands-on Exercise:
Implement multi-environment configuration using Spring Profiles and type-safe config.

Module 2: Spring Data JPA – Advanced Concepts

- JPQL, native queries, named queries
- Pagination & Sorting using Pageable
- Specifications & Criteria API for dynamic queries
- Entity lifecycle callbacks
- Auditing using @CreatedDate & @LastModifiedDate
- Performance tuning: N+1 problem, fetch types, caching basics

Hands-on Exercise:
Build dynamic search filters using Specifications and resolve N+1 issues.

Module 3: Advanced Transaction Management & Error Handling

- Declarative transaction management using @Transactional
- Propagation behaviors: REQUIRED, REQUIRES_NEW, NESTED
- Isolation levels overview
- Rollback rules for checked/unchecked exceptions
- Programmatic transactions
- Centralized exception handling: @ControllerAdvice, @ExceptionHandler

Hands-on Exercise:
Implement a transactional flow and test rollback behavior with custom exceptions.

Module 4: Advanced Validation & Bean Lifecycle Hooks

- Bean Validation with Jakarta/Javax validation
- Method-level validation
- Custom validation constraints

- Bean lifecycle annotations: @PostConstruct, @PreDestroy
- Integrating validation into REST APIs

Hands-on Exercise:
Add validation to DTOs and create a custom constraint annotation.

Day 2 – Advanced Spring Boot, Security, Integration & Observability

Module 5: Advanced Spring Boot Features

- Auto-configuration internal concepts
- Overriding auto-configured beans
- Introduction to Custom Spring Boot Starters (conceptual)
- Advanced Actuator capabilities: custom health checks, metrics, info endpoints
- Profile grouping & environment-specific configuration
- Config management at scale (intro to Spring Cloud Config)

Hands-on Exercise:
Create a custom Actuator health indicator and explore runtime metrics.

Module 6: Spring Security – Advanced Implementation

- Architecture of Spring Security filter chain
- Security configuration using modern Spring Security (Lambda/DSL)
- JWT-based authentication fundamentals
- Method-level security using @PreAuthorize & @PostAuthorize
- Password encoding, CSRF, CORS considerations
- Role-based vs attribute-based authorization

Hands-on Exercise:
Secure a REST API using method-level security and JWT authentication.

Module 7: Spring Integration, Eventing & Asynchronous Programming

- Asynchronous execution with @Async, thread pools, exception handling
- Application events: custom events, event publishers & listeners
- Scheduled tasks with @Scheduled
- Messaging integration overview (RabbitMQ/Kafka)

Hands-on Exercise:
Implement application events, async methods, and scheduled tasks.

Module 8: Observability, Testing & Enterprise Best Practices

- Logging best practices, correlation IDs
- Using Micrometer for metrics (conceptual)
- Distributed tracing overview (OpenTelemetry)

- Testing Spring applications:
  - @WebMvcTest, @DataJpaTest, @SpringBootTest
- Deployment & packaging guidance
- Enterprise best practices for large Spring projects
  - Layered architecture
  - DTO vs Entity separation
  - API backward compatibility

Hands-on Exercise:
Write basic integration tests and configure environment-specific logging.