**Comprehensive Spring Boot Roadmap Checklist**

**Core Java (Pre-Requisites)**

☑ Variables, Data Types, Operators, and Control Statements  
☑ Arrays and Strings  
☑ Object-Oriented Programming (OOP): Classes, Objects, Inheritance, Polymorphism, Abstraction, Encapsulation  
☑ Collections Framework: List, Set, Map, Queue  
☑ Generics and Enumerations  
☑ Exception Handling  
☑ Multithreading and Concurrency: Threads, Synchronization, Executors  
☑ Java 8+ Features: Stream API, Lambda Expressions, Optional, Date/Time API  
☑ Input/Output Streams: File Handling  
☑ Build Tools: Maven or Gradle (Dependency Management, POM/Build.gradle)

**Spring Framework Basics**

**Spring Core**

☑ Introduction to Dependency Injection (DI) and Inversion of Control (IoC)  
☑ ApplicationContext vs. BeanFactory  
☑ Configuring Beans (@Component, @Service, @Repository, @Controller)  
☑ Constructor Injection, Setter Injection  
☑ Bean Lifecycle (@PostConstruct, @PreDestroy)  
☑ Bean Scopes (Singleton, Prototype, etc.)

**Spring AOP (Aspect-Oriented Programming)**

☑ What is AOP?  
☑ Cross-cutting concerns like logging, security  
☑ Pointcuts, Advices (@Before, @After, @Around)  
☑ Defining Aspects (@Aspect Annotation)

**Spring MVC**

☑ DispatcherServlet and Request Lifecycle  
☑ @Controller vs. @RestController  
☑ Model-View-Controller Architecture  
☑ View Resolvers (JSP, Thymeleaf)

**Spring JDBC**

☑ Using JdbcTemplate for database access  
☑ NamedParameterJdbcTemplate  
☑ Exception translation with DataAccessException

**Spring Boot Fundamentals**

☑ What is Spring Boot, and how is it different from Spring Framework?  
☑ Auto-Configuration and Starter Dependencies  
☑ Creating a Spring Boot Project with Spring Initializr  
☑ Understanding @SpringBootApplication  
☑ Configuring application.properties or application.yml  
☑ Profiles (@Profile, application-{profile}.properties)  
☑ Using Externalized Configuration (Environment Variables, Property Files)  
☑ CommandLineRunner and ApplicationRunner

**RESTful API Development**

☑ REST principles: Statelessness, Resource Representations  
☑ HTTP Methods: GET, POST, PUT, DELETE, PATCH  
☑ @RequestMapping, @GetMapping, @PostMapping, etc.  
☑ Path Variables and Query Parameters  
☑ Using @RequestBody and @ResponseBody  
☑ Standardizing API Responses with ResponseEntity  
☑ Testing APIs with Postman

**Validation and Exception Handling**

☑ Validating Requests using @Valid and @Validated  
☑ Custom Validators (@Constraint)  
☑ Global Exception Handling with @ControllerAdvice  
☑ Defining Custom Exceptions  
☑ Handling Exceptions with ResponseEntityExceptionHandler  
☑ Logging and Debugging with SLF4J/Logback

**Spring Data JPA**

☑ What is JPA and ORM?  
☑ Configuring a DataSource (H2, MySQL, PostgreSQL)  
☑ Defining Entity Classes (@Entity, @Table)  
☑ Creating Repositories (JpaRepository, CrudRepository)  
☑ Writing JPQL and Native Queries  
☑ Working with Pagination and Sorting

**Advanced JPA and Hibernate**

☑ Entity Relationships:

* One-to-One
* One-to-Many
* Many-to-Many  
  ☑ Cascade Types (PERSIST, MERGE, REMOVE, ALL)  
  ☑ Fetch Types: Lazy vs. Eager Loading  
  ☑ First-Level and Second-Level Caching  
  ☑ Criteria API and Specifications

**Spring Security**

☑ Setting Up Spring Security  
☑ Authentication and Authorization Basics  
☑ Password Encoding with BCrypt  
☑ Role-Based Access Control  
☑ Custom Login Pages and Security Filters  
☑ Security for REST APIs

**JWT (JSON Web Token)**

☑ What is JWT and its Structure?  
☑ Generating and Validating JWT Tokens  
☑ Adding JWT to Secured REST APIs  
☑ Refresh Tokens

**Microservices with Spring Boot**

☑ Understanding Microservices Architecture  
☑ Service Discovery with Eureka  
☑ Load Balancing with Spring Cloud Load Balancer  
☑ API Gateway with Spring Cloud Gateway  
☑ Centralized Configuration with Spring Cloud Config Server  
☑ Circuit Breaker with Resilience4j or Hystrix  
☑ Inter-Service Communication (Feign Client, RestTemplate, WebClient)

**Caching**

☑ Basics of Caching: What is Caching?  
☑ Cache Providers: Redis, Ehcache  
☑ Using @Cacheable, @CacheEvict, and @CachePut

**Messaging**

☑ RabbitMQ:

* Setting up Queues, Exchanges, and Bindings
* Sending and Receiving Messages  
  ☑ Kafka:
* Producers, Consumers, and Topics
* Kafka Templates

**Asynchronous Processing**

☑ @Async and Configuring Executors  
☑ CompletableFuture and Async Operations

**Spring WebFlux (Reactive Programming)**

☑ What is Reactive Programming?  
☑ Mono and Flux Basics  
☑ Building Reactive APIs with Spring WebFlux

**Testing**

☑ Unit Testing with JUnit 5  
☑ Mocking with Mockito  
☑ Integration Testing with @SpringBootTest  
☑ Testing REST APIs with MockMvc  
☑ Using Test Containers for Database Integration Testing

**Docker and Deployment**

☑ Introduction to Docker and Containerization  
☑ Creating Docker Images for Spring Boot Apps  
☑ Deploying Spring Boot Applications on:

* AWS
* Azure
* Heroku  
  ☑ Running Multi-Container Applications with Docker Compose

**Monitoring and Actuator**

☑ Spring Boot Actuator Basics  
☑ Exposing Actuator Endpoints for Health and Metrics  
☑ Integrating Prometheus and Grafana for Monitoring  
☑ Distributed Tracing with Zipkin/Sleuth

**Final Enhancements**

☑ Documentation with Swagger/OpenAPI  
☑ API Versioning  
☑ Internationalization (i18n)  
☑ Building a Full-Featured Application:

* REST APIs with CRUD Operations
* Secure APIs with JWT
* Use of Database Relationships
* Implementation of Caching and Messaging
* Deployment and Monitoring