23CS404	BACKEND FRAMEWORKS	L	T	P	C
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COURSE OBJECTIVES

1. Introduce core web service concepts, including server communication and JSON/XML handling
2. Understand Spring Framework basics, IoC, DI, and REST API layers using Spring Boot
3. Explore ORM concepts with Hibernate, including Architecture, JPA, Generator class, Dialects, Mapping, and Transaction Management
4. Analyze database normalization concepts, referential integrity, and advanced JPA mapping
5. Develop expertise in HQL, HCQL, and CRUD operations using Hibernate and JPA

WEB SERVICES, TOMCAT SERVER, AND SPRING BOOT BASICS

Introduction to Web Services: Client-Server Communication, HTTP Protocol, JSON, and XML. Overview of Tomcat Server: Setup, Configuration, and Deployment of Web Applications. Introduction to Servlets: Servlet API, Lifecycle, and Handling HTTP Requests. Spring Framework Basics: Understanding IoC (Inversion of Control), Dependency Injection (DI), and Autowiring. Spring Boot Architecture: Setting up a Spring Boot Project, Layers in REST APIs, and Handling HTTP Responses. Exception Handling and Validation: Implementing Custom Exceptions, Validation Techniques, and HTTP Status Codes. Performing CRUD Operations: Working with Collections and Managing Data in Spring Boot

HIBERNATE ORM, JPA, AND DATABASE MANAGEMENT

Introduction to Hibernate ORM: Understanding Object-Relational Mapping, Hibernate Architecture, and JPA Overview. Hibernate Setup and Configuration: Generator Classes, Dialects, and Entity Relationships. Hibernate Mapping: Implementing One-to-One, One-to-Many, and Many-to-Many Relationships with Annotations. Transaction Management: Handling Database Transactions, Hibernate Query Language (HQL), and Hibernate Criteria Query Language (HCQL). Database Normalization: RDBMS Concepts, Referential Integrity Constraints, and Normalization up to 3NF. JPA Mapping in Spring Boot: Establishing Entity Relationships, Query Optimization, and Data Persistence with CRUD Operations

ADVANCED JPA MAPPING, SPRING SECURITY, AND AUTHENTICATION

Advanced JPA Mapping: Handling Complex Entity Relationships, Many-to-Many Mapping, and Debugging Spring Boot Applications. Introduction to Spring Security: Implementing Basic Authentication, Role-based Access Control, and Authorization. Securing APIs with JWT Authentication: Token Generation, User Authentication, and Protecting Endpoints. Enhancing Security in Spring Boot Applications: Managing Authentication Tokens, Enforcing Secure Data Access, and Securing REST Endpoints

LIST OF EXPERIMENTS

1. Develop and deploy a simple servlet using Tomcat Server
2. Implement CRUD operations using Spring Boot and REST APIs
3. Configure and perform Dependency Injection and IoC using Spring Framework
4. Implement Hibernate configurations, generator classes, annotations, and CRUD operations
5. Perform JPA mapping with normalization (1NF, 2NF, and 3NF)
6. Create Many-to-Many relationships and test associations in Spring Boot
7. Implement basic security controls and JWT token-based authentication in Spring Boot
8. Use HQL and HCQL to perform advanced data querying with Hibernate

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand client-server communication and deploy web services using Tomcat	[U]
CO2	Implement REST APIs with Spring Boot, handle exceptions, and validate requests	[AP]
CO3	Utilize ORM tools like Hibernate for database interaction, including JPA, Dialects, HQL, and HCQL	[AP]
CO4	Develop relational databases and implement various mappings in Spring Boot JPA	[AP]
CO5	Apply Spring Boot applications for authentication, authorization, and JWT tokens	[AP]

TEXTBOOKS

1. Herbert Schildt, “Java: The Complete Reference”, 11th Edition, McGraw-Hill Education, 2019
2. Craig Walls, “Spring in Action”, 5th Edition, Manning Publications, 2018
3. Joshua Bloch, “Effective Java”, 3rd Edition, Kindle Edition, 2018

REFERENCE BOOKS

1. Rod Johnson, *Expert One-on-One J2EE Design and Development*, Wrox Press, 2004.
2. Gavin King, *Hibernate in Action*, Manning Publications, 2005.
3. Subrahmanyam Allamaraju, *RESTful Java Web Services*, 2nd Edition, O'Reilly Media,2010.

WEB RESOURCES

1. https://fab-coep.vlabs.ac.in/List%20of%20experiments.html
2. https://www.innovationtraining.org/how-to-use-design-thinking-to-design-an-innovation-lab/
3. https://www.erdster.co.in/design-thinking-lab.html
4. https://www.coursera.org/learn/uva-darden-design-thinking-innovation