Teaching Guidelines for

Web-based Java Programming

PG-DAC March 2024

Duration: 104 hours (48 theory hours + 46 lab hours + 10 revision/practice hours)

Objective: To learn advanced concepts in java programming and perform web Programming using Java.

Prerequisites: Knowledge of core Java programming

Evaluation: 100 marks
Weightage: CCEE – 40%, Lab exam – 40%, Internals – 20%

Text Book:

- Core and Advanced Java Black Book / Dreamtech Press

References:

- Servlet and JSP: A Tutorial by Budi Kurniawan / Brainy Software
- Spring in Action by Craig Walls / Manning Publications
- Advanced Java programming by Uttam K Roy / Oxford University press
- Sun Certified Enterprise Architect for Java EE Study Guide by Mark Cade & Humphrey Sheil / Pearson Education
- Professional Java EE Design Patterns by Murat Yener, Alex Theedom & Reza Rahman / Wrox

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(Note: Each Session is of 2 hours)

Session 1:
Lecture:
J2EE Overview

- J2EE Container
- Packaging Web applications
- J2EE compliant web application
- Deployment tools.
- Web application life cycle
- Deploying web applications.
- Web Services Support

No Lab

Sessions 2, 3 & 4:
Lecture:

- Servlets: Dynamic Content Generation
- Advantages of Servlets over CGI
- Servlet Life cycle
- Servlet API & Deployment
- Servlet Annotations
- The Servlet interface

- The HttpServlet, HttpServletRequest, HttpServletResponse
- Exception Handling
- Servlet, DAO, POJO DB Layers
- Session
- Session Management
- Session Tracking with
    - Cookies
    - HttpSession
- Request Dispatcher
- Page Navigation
- Complete Case study Servlet Based

Lab:

- Installing a servlet container (Tomcat)
- Adding Server to IDE
- Develop a structured dynamic web application(e.g. Library Management System) using servlets, deploy it in Tomcat
- Use HTTP Session in the Air Ticket Reservation System

Reading: Know more about the HTTP protocol at www.w3c.org
Tutorial: Compare which way of session tracking is better Cookies or HttpSession.

Sessions 5 & 6:
Lecture

- JSP: Separating UI from Content generation code
- MVC architecture
- Design Pattern: MVC Pattern
- Life cycle of a JSP page
- Directives, Implicit and Explicit Objects, Scriptlets, Expressions, Expression Language
- Scope
- JSP Error Page handling
- JSTL

Lab:

- Separate UI code from the controller code in your Library Management System by incorporating JSP and Servlets.
- Complete the implementation of Air Ticket Reservation System.
- Implement MVC based web application using Servlet, JSP

Sessions 7 & 8:
Lecture:
JDBC & Transaction Management

- Introduction to JDBC API
- JDBC Architecture
- JDBC Drivers
- JDBC Classes& Interfaces: Driver, Connection, Statement, PreparedStatement, ResultSet and their relationship to provider implementations
- Stored procedures and functions Invocation
- SQL Injection overview and prevention

- Design Pattern: Data Access Object Pattern

Lab:

- Add Database CRUD operations to above MVC web application using JDBC Classes and interfaces. Use DAO and POJO Layers

Sessions 9, 10, 11 & 12:

Lecture:

- Hibernate Framework
  - Introduction to Hibernate Framework
  - Architecture
- Hibernate in IDE
  - Creating web application using Hibernate API
  - Lifecycle of Hibernate Entities
- HB with annotation example
- Hibernate Mappings and Relationships
- Collection and Component Mapping
- HQL, Named Queries, Criteria Queries

Lab:

- Demonstrate Hibernate as standalone library in Java application
- Develop a web application (Online Bookshop) using Hibernate Persistence

Reading: Study Hibernate architecture from**www.hibernate.org/docs**

Sessions 13, 14 & 15:

Lecture:

- What is Spring Framework
- Overview of Spring Architecture
- Spring MVC architecture
- Spring Modules Overview
- Understanding Spring 4 annotations (Basic Introduction)
- What is IoC (Inversion of Control)
- IOC container
- Dependency Injection
- Spring Beans
- Autowiring Beans
- Bean Scopes
- Spring MVC
- Model, Model & View, HandlerMapping, ViewResolver
- Design Pattern: Front Controller Pattern
- Spring MVC Web application with JSP views (without Spring Boot)
- Using Thymeleaf as alternate View Technology (only introduction)
- Spring Validations
- Spring i18n, Localization, Properties
- File Upload example

Lab:

- Design and deploy Library Management System using Spring Web

Sessions 16 & 17:
Lecture:

- Spring Boot essentials
- Why Spring boot
- Spring Boot Overview
- Basic Introduction of MAVEN
- Building Spring Web application with Boot
- Spring Boot in detail (Use Spring Boot for all demo & assignments here onwards)
- Running a web application using Spring Boot with CRUD (with Static Data not DB)

Lab:

- Create Hello World Spring Boot Web application
- Check Libraries imported by Spring Boot
- Create Spring Boot CRUD application with Thymeleaf as View technology

Sessions 18 & 19:
Lecture:
Spring Data Module

- Spring Data JPA (Repository support for JPA)
- Crud Repository & JPA Repository
- Query methods
- Using custom query (@Query)

Lab:

- Add CRUD operations with Spring JPA etc. to earlier Spring Web application.

Session 20:
Lecture:
Spring AOP

- AOP Overview
- Spring AOP
- AOP Terminology and annotations: Advice, Join Points, Pointcuts, Aspects

Lab

- Modify earlier Spring MVC application to Log all the requests using AOP

Sessions 21 & 22:
Lecture:
Building REST services with Spring

- Introduction to web services
- SOAP Vs RESTful web services
- RESTful web service introduction
- Create RESTful web service in java using Spring Boot
- RESTful web service JSON example
- RESTful web service CRUD example
- Using POSTMAN client to invoke REST API's
- REST service invocation using REST Template

Lab:

- Create REST API for Employee Management using Spring Boot
- Invoke it from POSTMAN app

- Invoke it from another Spring Boot Web application using REST Template

Session 23 & 24:
Lecture:
Testing in Spring

- Testing in Spring
- Unit Testing of Spring MVC Controllers
- Unit Testing of Spring Service Layer
- Integration Testing of Spring MVC Applications: REST API
- Unit Testing Spring MVC Controllers with REST

Securing Web Application with Spring Security

- What is Spring Security
- Spring Security with Spring Boot
- Basic Authentication
- Authentication with User credentials from Database and Authorization
- JWT Authorization

Lab:

- Design & Test Spring Application
- Secure the Spring Web application created in earlier exercise.