



Gyanmanjari
Innovative University

Syllabus
Gyanmanjari Institute of Technology
Semester-5 (B. Tech)

Subject: Deep Dive into Java: Advanced Concepts and Enterprise Development -BETICE15328

Type of course: Professional Elective Courses

Prerequisite: JAVA, Database, Basic web Development

Rationale:

This course offers a comprehensive exploration of web-based Java programming, covering essential concepts and practical techniques. Students delve into technologies like JDBC and Hibernate for seamless database integration, server-side tools for robust Java applications, and web services for cross-platform communication. The course emphasizes client-service architecture's importance in web-based applications, addressing limitations of basic Java with advanced tools. Servlets and Java Server Pages (JSPs) are introduced for creating dynamic web applications. Web socket programming facilitates real-time communication between web clients and servers, providing a scalable alternative to HTTP. In summary, this course equips students with a strong foundation in web-based Java programming, empowering them to develop sophisticated applications and enable seamless internet communication.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P	C	SEE	CCE	
2	0	4	4	100	50	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; SEE - Semester End Evaluation; CCE-Continuous and Comprehensive Evaluation.



Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	Network Programming with Java <u>Theory Topics</u> Network Programming With java.net Package- Inet Address class, URL class, URL Connection class. Establishing two-way communication between Server and Client -TCP/IP client sockets, TCP/IP server sockets. <u>Practical:</u> 1. Study and Implementation of InetAddress Class for Retrieving Host Name and IP Address. 2. Study and Implementation of URL Class to Extract Components of a Web Address. 3. Reading and Displaying Webpage Content using URL and Input Streams. 4. Establishing Connection with Web Resources using URLConnection Class. 5. Implementation of TCP/IP Client Socket for Sending Data to Server. 6. Implementation of TCP/IP Server Socket for Receiving Client Requests. 7. Establishing Two-Way Communication between Client and Server using TCP/IP Sockets. 8. Development of Multi-Client Server Application using Multithreading in Java. 9. Design and Implementation of Console-Based Chat Application using Socket Programming. 10. File Transfer between Client and Server using TCP/IP Socket Programming. 11. Implementation of UDP Client-Server Communication using DatagramSocket and DatagramPacket. 12. Development of Echo Server Application using Java Socket Programming. 13. Implementation of Remote Host Connectivity Testing using InetAddress Methods. 14. Creating a Simple Web Page Downloader using Java Networking Classes. 15. Implementation of Online Time and Date Retrieval Application using Network Programming.	18	20%



Examination Style:			
Sr. No.	Evolution Methods	SEE	CCE
1	Write and Execute Java Networking Programs: Students will write and execute Java networking programs based on the given problem statement. This task will assess program logic, syntax, execution, output, and understanding of networking concepts.	10	-
2	Demonstration of various Client-Server Communication: Students will demonstrate TCP/IP-based client-server communication using Java socket programming. They will show connection establishment, message exchange, data transfer, and correct program output.	10	-
3.	Active Learning Activity (ALA) (Active Learning Assignment): Develop a Java-based client-server application like chat, find the prime number, reverse number using the java.net package	-	10
Total		20	10
Examination Style:			
1. Write and Execute Java Networking Programs (10 Marks): - In this examination style, students are required to write Java networking programs based on the concepts studied in the syllabus and execute them successfully. The examiner give the program and evaluates the program logic, syntax, execution, output, and understanding of networking concepts. 2. Demonstration of Client-Server Communication (10 Marks): - Students must demonstrate communication between clients and server using TCP/IP socket programming. The server should accept client requests and exchange messages successfully with the client. Evaluation is based on connection establishment, data transfer, execution, and output.			



	3. ALA (Active Learning Assignment): Active Learning Assignment (ALA) (10 Marks): Develop a Java-based client-server communication application using the java.net package and TCP/IP socket programming. In this assignment, students are required to create a server program using Server Socket and a client program using Socket to establish two-way communication between the server and client systems. The client should send messages to the server, and the server should respond back to the client continuously until the user enters the "exit" command. The application should display all sent and received messages on the console and properly close all streams and socket connections after communication is completed. Through this assignment, students will understand the concepts of TCP/IP networking, socket programming, real-time communication, and client-server architecture using Java.		
2	Java DataBaseConnectivity (JDBC) <u>Theory Topics</u> Introduction to Database Management System (DBMS) and JDBC. Basics of JDBC and Database Connectivity in Java. Architecture and Working of JDBC API. JDBC Drivers: Types, Advantages, and Disadvantages. Establishing Database Connection using JDBC. JDBC Interfaces and Classes (DriverManager, Connection, Statement). The Statement Interface and SQL Query Execution. PreparedStatement Interface & Parameterized Queries. CallableStatement Interface for Stored Procedures. The ResultSet Interface and Result Processing Techniques JDBC Exception Handling and Error Management. Transaction Processing in JDBC – commit(), rollback(), and savepoint(). SQL CRUD Operations using JDBC (INSERT, SELECT, UPDATE, DELETE). Creating and Managing Database Tables using JDBC. JDBC Batch Processing and Performance Optimization. <u>Practical</u> 16. Installation and Configuration of JDBC Driver with MySQL Database. 17. Establishing Database Connection using JDBC API. 18. Program to Create Database Table using JDBC. 19. Program to Insert Records into Database Table using Statement Interface.	18	20%



	20. Program to Retrieve Records from Database using ResultSet Interface. 21. Program to Update Records in Database using JDBC. 22. Program to Delete Records from Database Table using JDBC. 23. Implementation of CRUD Operations using JDBC. 24. Program to Perform Parameterized Queries using PreparedStatement. 25. Program to Execute Batch Processing using PreparedStatement. 26. Program to Call Stored Procedure using CallableStatement. 27. Program to Demonstrate Transaction Management using commit() and rollback(). 28. Program to Demonstrate Savepoint in JDBC Transaction Processing. 29. Program to Display Metadata using DatabaseMetaData and ResultSetMetaData. 30. Mini Project: Student Management System using JDBC and MySQL.		
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Examination Style:			
Sr. No.	Evolution Methods	SEE	CCE
1	Practical Record Submission and Evaluation: Students will submit a practical record containing JDBC programs, outputs, and observations completed during laboratory sessions. Evaluation will be based on program execution, documentation quality, output correctness, and understanding of JDBC concepts.	10	-
2	CRUD Operation Implementation using SQL Queries: Students will implement INSERT, SELECT, UPDATE, and DELETE operations using JDBC and MySQL. This task will assess database connectivity, SQL query correctness, successful execution, and proper output generation.	10	-
3.	Activity Learning Activity (ALA): Simple Data Management System using JDBC and MySQL Develop a simple Data Management System implementing all CRUD operations using JDBC and MySQL.	-	10
Total		20	10
Examination Style:			
1. Practical Record Submission and Evaluation (10 marks) Students are required to maintain and submit a practical record containing all JDBC programs, outputs, and observations completed during laboratory sessions. Evaluation is based on program execution, documentation quality, correctness of output, and understanding of concepts.			



	2. CRUD Operation Implementation using SQL Queries (10 Marks) - Students must implement database operations such as INSERT, SELECT, UPDATE, and DELETE using SQL queries through JDBC programs. Evaluation is based on successful execution, database connectivity, query correctness, and output generation. 3. Active Learning Activity (ALA): Simple Data Management System using JDBC and MySQL - In this Active Learning Assignment, students will develop a simple Java-based Data Management System using JDBC and MySQL to perform all CRUD operations such as Create, Read, Update, and Delete. Students may select any suitable system such as Student Management, Employee Management, Library Management, or Product Management System. The application must include proper database connectivity, table creation, SQL query execution, record insertion, record display, record update, and record deletion using JDBC concepts such as connection, statement/prepared statement, result set, exception handling, and proper resource closing. Students must prepare a report including system objective, database design, table structure, source code, SQL queries, screenshots, output, and conclusion. The final source code, SQL file, screenshots, and PDF report shall be submitted through the GMIU Web Portal.		
3	Servlets: <u>Theory Topics:</u> Introduction to Servlets, Life Cycle of Servlet, Creating, configuring and deploying echo servlet on Tomcat, Server Parameters and Attributes in Servlet, HttpServletRequest Interface, ServletContext Interface, ServletConfig Interface, Request Delegation using RequestDispatcher Interface, Session Tracking Mechanisms in Servlet, Database Connectivity using Servlet and JDBC, Reading and Displaying Database Records using Servlet, Advantages of Servlet, and Disadvantages of Servlet. <u>Practical:</u> 31. Installation and Configuration of Apache Tomcat Server. 32. Creation and Deployment of First Simple Servlet Program. 33. Demonstration of Servlet Life Cycle Methods (init(), service(), destroy()).	18	20%



	34. Development and Deployment of Echo Servlet on Tomcat Server. 35. Program to Retrieve Client Information using HttpServletRequest Interface. 36. Program to Demonstrate Server Parameters and Attributes in Servlet. 37. Program to Use ServletConfig Interface for Initialization Parameters. 38. Program to Use ServletContext Interface for Application-Level Information. 39. Implementation of Request Forwarding using RequestDispatcher Interface. 40. Implementation of Include Action using RequestDispatcher Interface. 41. Program to Demonstrate Session Tracking using Cookies. 42. Program to Demonstrate Session Tracking using HttpSession. 43. Program to Establish Database Connectivity using Servlet and JDBC. 44. Program to Read and Display Database Table Records using Servlet. 45. Mini Project: Student Information Management System using Servlet and JDBC. 46. Program to Demonstrate URL Rewriting for Session Tracking in Servlet. 47. Program to Handle Form Data Submission using Servlet. 48. Program to Implement User Login Validation using Servlet and JDBC. 49. Program to Display Dynamic Web Content using Servlet Response Object. 50. Program to Demonstrate Exception Handling in Servlet Applications.		
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Examination Style:			
Sr. No.	Evolution Methods	SEE	CCE
1	Form Handling and Dynamic Content Generation. Students will create servlet programs to accept user input through HTML forms and generate dynamic web content based on the submitted data. This task will assess form processing, response generation, execution, and output correctness.	15	-
2	Reading and Displaying Database Records Using Servlet with Session Tracking Mechanisms Students will develop servlet applications to connect with a database using JDBC, retrieve records, display them on web pages, and maintain user sessions. This task will assess database connectivity, session management, data retrieval, and successful execution.	05	-
3	Active Learning Activity (ALA): Servlet - JDBC Student Management System Students will develop a web-based Student Management System using Servlet and JDBC. The system will include form handling, session tracking, and database record management, and the final report/source code shall be submitted through the GMIU Web Portal.	-	10
Total		20	10
Examination Style:			
1. Form Handling and Dynamic Content Generation (15 Marks): Students are required to develop servlet programs to accept user input through HTML forms and generate dynamic web content based on the submitted data.			



	Evaluation is based on form processing, response generation, program execution, and output correctness. 2. Reading and Displaying Database Records Using Servlet with Session Tracking Mechanisms (05 Marks): - Students must develop servlet applications to connect with a database using JDBC, retrieve records, display them on web pages, and maintain user sessions using session tracking techniques. Evaluation is based on database connectivity, session management, data retrieval, and successful program execution. 3. Active Learning Activity (ALA): Servlet-JDBC Student Management System (10 Marks): - In this Active Learning Activity, students will develop a web-based Student Management System using Servlet and JDBC. The system should allow basic student record operations such as adding student details, displaying student records, updating existing records, and deleting records from the database. Students must implement HTML form handling, JDBC database connectivity, dynamic content generation, and session tracking mechanisms to manage user interaction. The application should include proper servlet structure, database table design, SQL query execution, validation, output display, and error handling. Students are required to prepare a report containing the system objective, database design, source code, execution screenshots, output results, and conclusion. The final source code, screenshots, database/SQL file, and PDF report shall be submitted through the GMIU Web Portal.		
4	Java Server Pages (JSP) <u>Theory Topics:</u> JSP Scripting Elements, JSP Expressions, JSP Scriptlets, JSP Declarations, Difference between JSP Expressions and JSP Declarations, JSP Implicit Objects, JSP Directives, JSP Life Cycle, Simple JSP Programs, Database Connectivity using JSP and JDBC, Simple JSP Program to Fetch Database Records, Dynamic Web Page Development using JSP, Advantages and Disadvantages of JSP.	18	20%



Practical:

51. Installation and Configuration of JSP Environment on Tomcat Server.
52. Creation and Execution of First Simple JSP Program.
53. Program to Demonstrate JSP Scripting Elements.
54. Program to Demonstrate JSP Expressions and JSP Declarations.
55. Program to Use JSP Implicit Objects in Web Applications.
56. Program to Implement Form Handling using JSP.
57. Program to Demonstrate Session Tracking using JSP.
58. Program to Implement Cookies in JSP Application.
59. Program to Establish Database Connectivity using JSP and JDBC.
60. Program to Fetch and Display Database Records using JSP.

Examination Style:

Sr. No.	Evolution Methods	SEE	CCE
1	Database Connectivity using JSP and JDBC Students will develop JSP applications with JDBC connectivity to perform database operations such as insert, retrieve, update, and display records dynamically on web pages. This task will assess database connection, query execution, dynamic output generation, and successful program execution.	20	-
2	Dynamic Web Page Development using JSP Students will create dynamic web pages using JSP scripting elements, expressions, and implicit objects. This task will assess interactive page development, user input handling, response generation, and proper use of JSP concepts.	-	10
Total		20	10



	<i>Examination Style:</i> 1. Database Connectivity using JSP and JDBC (20 Marks): - Students are required to develop JSP applications that establish database connectivity using JDBC to perform database operations such as inserting, retrieving, updating, and displaying records dynamically on web pages. 2. Dynamic Web Page Development using JSP (10 Marks): - Students must create dynamic web pages using JSP scripting elements, expressions, and implicit objects to generate interactive and user-responsive web applications.		
5	Hibernate <u>Theory Topics</u> Overview of Hibernate, Hibernate Architecture, Hibernate Mapping Types, Hibernate O/R Mapping, Hibernate Annotation Hibernate Query Language <u>Practical:</u> 61. Installation and Configuration of Hibernate Framework. 62. Program to Demonstrate Hibernate Architecture and Configuration File. 63. Program to Implement Hibernate O/R Mapping using XML Mapping. 64. Program to Implement Hibernate Annotation-Based Mapping. 65. Program to Perform Database Operations using Hibernate Query Language (HQL).	18	20%



Examination Style:			
Sr. No.	Evolution Methods	SEE	CCE
1	Write and Execute Hibernate Programs Students will write, configure, and execute Hibernate programs to perform object-relational mapping and basic database operations. This task will assess Hibernate configuration, mapping correctness, program execution, database connectivity, and output generation.	20	-
2	Database Operations using Hibernate Query Language (HQL) Students will perform database operations such as insert, update, delete, and retrieve records using Hibernate Query Language. This task will assess HQL query execution, database interaction, result display, and understanding of Hibernate-based data handling.	-	10
Total		20	10
Examination Style:			
Write and Execute Hibernate Programs Students are required to write, configure, and execute Hibernate programs for performing object-relational mapping and database operations. Evaluation is based on program execution, configuration, mapping correctness, and output generation. Database Operations using Hibernate Query Language (HQL) Students must implement database operations such as insert, update, delete, and retrieve records using Hibernate Query Language (HQL). Evaluation is based on query execution, database interaction, and successful output display.			



Suggested Specification table with Marks (Theory):100

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	10%	15%	30%	15%	10%	20%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Apply networked applications in Java using network protocols, socket programming, and related technologies
CO2	Implement basic database operations using JDBC.
CO3	Create dynamic server-side web applications using Servlet technology.
CO4	Build interactive web applications using JavaServer Pages (JSP) and JSP tags.
CO5	Implement enterprise-level database applications using Hibernate ORM framework and Java-based web service technologies

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.



Reference Books:

- [1] Java: The Complete Reference, by Herbert Schildt, McGraw-Hill Education.
- [2] Core Java Volume I – Fundamentals, by Cay S. Horstmann, Pearson Education.
- [3] Core Java Volume II – Advanced Features, by Cay S. Horstmann, Pearson Education.
- [4] Java Network Programming, by Elliotte Rusty Harold, O'Reilly Media.
- [5] Headfirst Servlets and JSP, by Bryan Basham, O'Reilly Media.
- [6] Servlets and JSP: The J2EE Web Tier, by Jayson Falkner, Addison-Wesley.
- [7] JDBC API Tutorial and Reference, by Sharon Zakhour, Addison-Wesley.
- [8] Beginning Hibernate, by Joseph Ottinger, Apress Publication.
- [9] Java Persistence with Hibernate, by Christian Bauer, Manning Publications.
- [10] Professional Java for Web Applications, by Nicholas S. Williams, Wiley Publication.
- [11] Black Book Java Programming, by Steven Holzner, Dreamtech Press.

Suggested Assessment Guidelines:**Module 1: Network Programming with Java**

Criteria	Description	Marks
TCP/IP Socket Communication	Implementation of TCP/IP Client-Server Socket Communication for sending and receiving data.	5
UDP Socket Communication	Implementation of UDP Client-Server Communication using DatagramSocket and DatagramPacket.	5
Multi-Client Application Chat	Design and Implementation of a Console-Based Chat / Multi-Client Server Application using Socket Programming.	5
Conceptual Explanation & Viva-Voce	Ability to explain the working, code logic, and concepts (InetAddress, URL, sockets, TCP/UDP) of each practical performed.	5
Total		20

Module 2: Java Database Connectivity (JDBC)

Criteria	Description	Marks
Database Connectivity & CRUD Operations	Establishing Database Connection and Performing CRUD Operations (Insert, Retrieve, Update, Delete) using JDBC.	5
Parameterized & Batch Queries	Program to Perform Parameterized Queries and Batch Processing using PreparedStatement.	5
Stored Procedures & Transaction Management	Program to Call Stored Procedures using CallableStatement and demonstrate Transaction Management (commit/rollback).	5
Conceptual Explanation & Viva-Voce	Ability to explain JDBC architecture, driver types, and the logic/output of each practical performed.	5
Total		20



Module 3: Servlets

Criteria	Description	Marks
Servlet Life Cycle Implementation	Creation, Configuration, and Deployment of a Servlet demonstrating its Life Cycle Methods (init, service, destroy) on Tomcat.	5
Session Tracking Mechanism	Program to Demonstrate Session Tracking Mechanisms using Cookies and HttpSession.	5
Servlet-Database Connectivity	Program to Establish Database Connectivity using Servlet and JDBC to Read and Display Records.	5
Conceptual Explanation & Viva-Voce	Ability to explain the servlet life cycle, session tracking, and the logic/output of each practical performed.	5
Total		20

Module 4: JavaServer Pages (JSP)

Criteria	Description	Marks
JSP Scripting Elements	Program to Demonstrate JSP Scripting Elements: Expressions, Scriptlets, and Declarations.	5
Form Handling & Session Tracking	Program to Implement Form Handling and Session Tracking using JSP.	5
JSP-Database Connectivity	Program to Establish Database Connectivity using JSP and JDBC to Fetch and Display Records.	5
Conceptual Explanation & Viva-Voce	Ability to explain the JSP life cycle, implicit objects, and the logic/output of each practical performed.	5
Total		20

Module 5: Hibernate

Criteria	Description	Marks
Hibernate Architecture & Configuration	Program to Demonstrate Hibernate Architecture and Configuration File Setup.	5
Object/Relational Mapping	Program to Implement Hibernate O/R Mapping using XML and Annotation-Based Mapping.	5
HQL-Based Database Operations	Program to Perform Database Operations using Hibernate Query Language (HQL).	5
Conceptual Explanation & Viva-Voce	Ability to explain Hibernate architecture, mapping types, and the logic/output of each practical performed.	5
Total		20

