(Building Futures Through Digital Knowledge and Innovation)

Java Programming (03 Months)

Syllabus

01: Introduction to Java Programming

- ✓ History and evolution of Java
- ✓ Features of Java (Platform Independence, OOP, Robustness, etc.)
- ✓ Java Editions: SE, EE, ME, and JavaFX
- ✓ JDK, JRE, and JVM – Architecture and Workflow
- ✓ Setting up Java environment (IDE: IntelliJ IDEA, Eclipse, NetBeans)
- ✓ Writing your first Java program
- ✓ Java program compilation and execution process

02: Java Fundamentals

- ✓ Java Tokens: Keywords, Identifiers, Literals, Operators, and Separators
- ✓ Data types and Type casting
- ✓ Variables and Constants
- ✓ Operators and Expressions
- ✓ Input and Output using Scanner, BufferedReader
- ✓ Control flow statements:
  - o if, if-else, switch
  - o Loops: for, while, do-while
  - o break, continue, return
- ✓ Command-line arguments
- ✓ Java naming conventions and best practices

03: Object-Oriented Programming in Java

- ✓ Principles of OOP: Encapsulation, Inheritance, Polymorphism, Abstraction
- ✓ Classes and Objects
- ✓ Constructors (Default, Parameterized, Copy)
- ✓ The this and super keyword
- ✓ Method overloading and overriding
- ✓ Access specifiers: private, protected, public, default
- ✓ Static vs Non-static members
- ✓ Final keyword
- ✓ Inner Classes and Anonymous Classes

04: Arrays and Strings

- ✓ Single and Multi-dimensional Arrays
- ✓ Array manipulation techniques
- ✓ Introduction to String, StringBuilder, and StringBuffer
- ✓ Common String methods
- ✓ String immutability and memory efficiency
- ✓ Regular Expressions using Pattern and Matcher

05: Inheritance and Interfaces

- ✓ Types of Inheritance in Java
- ✓ The Object class and its methods
- ✓ Abstract Classes and Methods
- ✓ Interfaces and Multiple Inheritance
- ✓ Functional Interfaces and @FunctionalInterface
- ✓ Java 8 Default and Static methods in interfaces

06: Exception Handling

- ✓ Types of errors: Syntax vs Runtime
- ✓ Exception hierarchy: Throwable, Error, Exception
- ✓ Try-catch blocks
- ✓ Finally block and resource handling
- ✓ Multiple catch blocks
- ✓ Throw and throws keyword
- ✓ Custom exceptions

07: Java Collections Framework

- ✓ Collection hierarchy (List, Set, Queue, Map)
- ✓ List Interface: ArrayList, LinkedList, Vector
- ✓ Set Interface: HashSet, LinkedHashSet, TreeSet
- ✓ Map Interface: HashMap, LinkedHashMap, TreeMap, Hashtable
- ✓ Stack and Queue
- ✓ Generics in Java Collections
- ✓ Iterator and ListIterator
- ✓ Comparable vs Comparator

08: File I/O and Serialization

- ✓ Java I/O streams: Byte and Character Streams
- ✓ Reading/Writing from files using:
    - ○ FileReader, FileWriter
    - ○ BufferedReader, BufferedWriter
    - ○ FileInputStream, FileOutputStream
- ✓ Serialization and Deserialization
- ✓ The Serializable interface
- ✓ Transient keyword
- ✓ Java NIO (New I/O) Basics

09: Multithreading and Concurrency

- ✓ Multithreading Basics: Thread class and Runnable interface
- ✓ Thread Life Cycle
- ✓ Thread Priorities and Sleep
- ✓ Synchronization and Inter-thread Communication
- ✓ Deadlock and Thread-safe coding
- ✓ Executor Framework
- ✓ Volatile and Atomic classes
- ✓ Introduction to Concurrency Utilities (java.util.concurrent)

10: GUI Development with JavaFX and AWT/Swing

- ✓ Introduction to GUI Programming
- ✓ AWT Components: Frame, Button, Label, TextField, etc.
- ✓ Swing Components: JFrame, JPanel, JButton, JTable, etc.
- ✓ Layout Managers
- ✓ Event Handling Model (AWT/Swing)
- ✓ JavaFX: Stage, Scene, Controls, Events
- ✓ CSS styling in JavaFX

11: Java Database Connectivity (JDBC)

- ✓ Introduction to JDBC and JDBC Drivers
- ✓ Steps to connect with the database
- ✓ CRUD Operations using JDBC
- ✓ Using PreparedStatement and CallableStatement
- ✓ Batch Processing
- ✓ Transactions and Rollback
- ✓ Connection Pooling using HikariCP or Apache DBCP

12: Java 8+ Features

- ✓ Lambda Expressions
- ✓ Functional Interfaces (Predicate, Function, Consumer, etc.)
- ✓ Streams API (Filtering, Mapping, Reducing)
- ✓ Method and Constructor References
- ✓ Default and Static methods in interfaces
- ✓ Optional class
- ✓ Date and Time API (java.time)
- ✓ New enhancements in Java 9–17 (overview)

13: Networking in Java

- ✓ Networking Basics: TCP/IP and Ports
- ✓ InetAddress class
- ✓ Socket Programming (Client-Server)
- ✓ URL and HttpURLConnection
- ✓ Developing a Chat application using Sockets

14: Java Annotations and Reflection

- ✓ Built-in Annotations (@Override, @Deprecated, @SuppressWarnings)
- ✓ Custom Annotations
- ✓ Reflection API: Classes, Methods, Fields
- ✓ Accessing private members using reflection
- ✓ Annotation Processing

15: Unit Testing and Build Tools

- ✓ Introduction to JUnit 5
- ✓ Writing test cases
- ✓ Assertions and test lifecycle
- ✓ Mockito for Mocking
- ✓ Test Suites
- ✓ Maven/Gradle Introduction
- ✓ Project structure and dependency management

16: Introduction to Java Frameworks

- ✓ Spring Core:
    - ○ Dependency Injection
    - ○ Bean Lifecycle
    - ○ Annotations vs XML Configuration
- ✓ Spring Boot:
    - ○ Auto Configuration
    - ○ REST API Development
    - ○ Spring Initializr and Project Setup

- ✓ Hibernate ORM:
    - ○ Configuration
    - ○ Annotations and Mapping
    - ○ HQL and Criteria API

17: Project Development and Deployment

- ✓ Full-fledged Java Project using MVC architecture
- ✓ Project planning, UML design
- ✓ Version control using Git & GitHub
- ✓ Packaging Java apps: JAR/WAR
- ✓ Deploying to Tomcat server
- ✓ Building REST APIs with Spring Boot
- ✓ Final Project Submission and Presentation

Course Requirements

- Basic computer operation skills
- Familiarity with programming logic (optional)
- Internet-enabled system with IDE installed