

Applied Java, AI & Data Science for Future Professionals

Duration: 10 days, 70 hours

Prerequisites

- Basic understanding of computers
- Basic programming knowledge is helpful
- Familiarity with mathematics and statistics is beneficial
- No prior experience in artificial intelligence or data science is required

Technology Stack

- Java
- Object-Oriented Programming
- Collections Framework
- JDBC
- Spring Boot
- REST APIs
- SQL
- Python
- NumPy
- Pandas
- Matplotlib
- Scikit-learn
- Generative AI tools
- Git and GitHub
- Visual Studio Code or IntelliJ IDEA
- Jupyter Notebook
- Postman

Program Objectives

After completing the program, participants will be able to:

- Develop object-oriented applications using Java
 - Apply Java collections, exception handling and database connectivity
 - Build REST APIs using Java and Spring Boot
 - Work with SQL databases
 - Use Python for data analysis and machine learning
 - Clean, analyse and visualise datasets
 - Build introductory machine learning models
 - Understand artificial intelligence, generative AI and large language models
 - Use AI-assisted coding tools responsibly
 - Develop an integrated Java, AI and data science project
 - Prepare for technical interviews and entry-level employment
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Day-Wise Course Outline

Day 1: Programming Fundamentals with Java

Topics

- Introduction to software development careers
- Java ecosystem and use cases
- Java Development Kit, Java Runtime Environment and JVM
- Installing and configuring Java development tools
- Structure of a Java program
- Variables and data types
- Operators and expressions
- Type conversion
- Input and output
- Conditional statements
- Loops
- Methods
- Debugging Java programs
- Coding standards and naming conventions

Hands-on Labs

- Develop a student grade calculator
- Create a salary and tax calculation program
- Solve basic programming challenges using conditions and loops

Employment Skills

- Understanding coding-test patterns
- Writing clean and readable code
- Explaining program logic during interviews

Outcome

Participants will be able to write, compile, execute and debug basic Java programs.

Day 2: Object-Oriented Programming with Java

Topics

- Introduction to object-oriented programming
- Classes and objects
- Constructors
- Instance and static members
- Encapsulation
- Inheritance
- Method overloading
- Method overriding
- Polymorphism
- Abstraction

- Abstract classes
- Interfaces
- Packages and access modifiers
- Composition and association
- Introduction to SOLID design principles

Hands-on Labs

- Develop an employee management system
- Design a banking application using classes and inheritance
- Implement multiple user roles using interfaces

Employment Skills

- Common object-oriented programming interview questions
 - Identifying classes and relationships from business requirements
 - Explaining inheritance and polymorphism with examples

Outcome

Participants will be able to design modular Java applications using object-oriented principles.

Day 3: Advanced Java Programming and Collections

Topics

- Arrays and multidimensional arrays
- Strings and string manipulation
- Wrapper classes
- Java Collections Framework
- List, Set and Map
- ArrayList and LinkedList
- HashSet and TreeSet
- HashMap and TreeMap
- Iterators
- Comparable and Comparator
- Generics
- Exception handling
- Custom exceptions
- File input and output
- Lambda expressions
- Functional interfaces
- Stream API fundamentals
- Introduction to multithreading

Hands-on Labs

- Build a product inventory application
- Sort and filter employee records
- Read and write data using files

- Process collections using streams and lambda expressions

Employment Skills

- Solving collection-based coding problems
- Choosing suitable data structures
- Understanding time and space complexity at a basic level

Outcome

Participants will be able to process collections, handle exceptions and work with files in Java.

Day 4: SQL, Database Design and JDBC

Topics

- Introduction to databases
- Relational database concepts
- Tables, rows and columns
- Primary and foreign keys
- Database relationships
- Normalisation fundamentals
- Creating databases and tables
- SQL data types
- Insert, update and delete operations
- Select queries
- Filtering and sorting
- Aggregate functions
- Group By and Having
- Joins
- Subqueries
- Introduction to JDBC
- JDBC architecture
- Connecting Java applications to databases
- Prepared statements
- Result sets
- Transaction handling
- Preventing SQL injection

Hands-on Labs

- Design a database for a placement management system
- Write SQL queries for student and company data
- Connect a Java application to a SQL database
- Implement CRUD operations using JDBC

Employment Skills

- SQL interview questions
- Query-writing practice
- Database design discussion

Outcome

Participants will be able to design relational databases and connect Java applications using JDBC.

Day 5: Spring Boot and REST API Development

Topics

- Introduction to enterprise Java development
- Problems with traditional Java application development
- Spring Framework overview
- Spring Boot architecture
- Creating a Spring Boot project
- Dependency injection
- Inversion of control
- Controllers, services and repositories
- Building REST APIs
- HTTP methods
- Request parameters and path variables
- Request and response bodies
- Data transfer objects
- Input validation
- Exception handling
- Spring Data JPA
- Entity relationships
- Database integration
- Testing APIs using Postman
- Introduction to API documentation

Hands-on Labs

- Build a Spring Boot student management API
- Implement CRUD operations
- Add validation and exception handling
- Connect the API to a relational database
- Test endpoints using Postman

Employment Skills

- Understanding layered architecture
- Explaining REST APIs in interviews
- Reading backend developer job descriptions

Outcome

Participants will be able to build database-driven REST APIs using Spring Boot.

Day 6: Python for Data Science

Topics

- Introduction to Python
- Python applications in AI and data science
- Python development environment
- Variables and data types
- Lists, tuples, sets and dictionaries
- Conditional statements and loops
- Functions
- Modules and packages
- File handling
- Exception handling
- Object-oriented programming in Python
- Introduction to Jupyter Notebook
- NumPy arrays
- Array operations
- Mathematical and statistical operations
- Introduction to Pandas
- Series and DataFrames

Hands-on Labs

- Develop Python programs for data processing
- Perform numerical calculations using NumPy
- Create and manipulate Pandas DataFrames
- Import data from CSV and Excel files

Employment Skills

- Comparing Java and Python
- Python coding-test practice
- Explaining why Python is commonly used in data science

Outcome

Participants will be able to write Python programs and use NumPy and Pandas for data processing.

Day 7: Data Analysis and Visualisation

Topics

- Data science lifecycle
- Understanding structured and unstructured data
- Loading datasets
- Inspecting datasets
- Handling missing values
- Removing duplicates
- Correcting inconsistent data
- Data type conversion
- Detecting outliers
- Filtering and transforming data
- Grouping and aggregation

- Merging and joining datasets
- Exploratory data analysis
- Descriptive statistics
- Mean, median and mode
- Variance and standard deviation
- Correlation
- Introduction to Matplotlib
- Line, bar, scatter and histogram charts
- Communicating insights through visualisation

Hands-on Labs

- Clean a student placement dataset
- Analyse salary, skill and placement trends
- Create charts and dashboards
- Prepare a short data-insight report

Employment Skills

- Explaining data-analysis findings
- Selecting appropriate visualisations
- Presenting insights to non-technical stakeholders

Outcome

Participants will be able to clean, analyse and visualise real-world datasets.

Day 8: Machine Learning Fundamentals

Topics

- Introduction to artificial intelligence
- Artificial intelligence versus machine learning versus deep learning
- Types of machine learning
- Supervised learning
- Unsupervised learning
- Features and labels
- Training and testing datasets
- Data preprocessing
- Feature scaling
- Categorical-data encoding
- Model training workflow
- Introduction to Scikit-learn
- Linear regression
- Logistic regression
- Decision trees
- K-nearest neighbours
- Clustering using K-means
- Model evaluation
- Accuracy

- Precision
- Recall
- F1-score
- Confusion matrix
- Overfitting and underfitting
- Cross-validation overview
- Responsible AI fundamentals

Hands-on Labs

- Build a salary prediction model
- Develop a student placement prediction model
- Train a classification model
- Perform customer or student clustering
- Compare model performance

Employment Skills

- Explaining a machine learning project
- Understanding common data science interview questions
- Interpreting model evaluation metrics

Outcome

Participants will be able to prepare data, train basic machine learning models and evaluate their performance.

Day 9: Generative AI, AI-Assisted Development and Application Integration

Topics

- Introduction to generative AI
- Large language model fundamentals
- How prompts are processed
- Text-generation use cases
- Prompt engineering principles
- Writing clear and structured prompts
- Zero-shot and few-shot prompting
- Role, context, instruction and output format
- AI-assisted coding
- Code generation
- Code explanation
- Debugging with AI tools
- Unit-test generation
- Documentation generation
- Limitations of generative AI
- Hallucinations and incorrect responses
- Data privacy and security
- Bias, ethics and responsible use
- Introduction to AI APIs

- Calling an AI or machine learning service from an application
- Integrating Java applications with data science models
- Overview of model-serving approaches

Hands-on Labs

- Generate and improve Java code using an AI assistant
- Use AI to explain and debug existing code
- Create prompts for resume, interview and coding support
- Connect a Spring Boot application with a Python-based prediction service
- Build a simple AI-enabled career recommendation feature

Employment Skills

- Demonstrating effective use of AI coding assistants
- Discussing responsible AI use during interviews
- Improving productivity without depending blindly on AI

Outcome

Participants will be able to use generative AI tools responsibly and integrate AI capabilities into software applications.

Day 10: Integrated Capstone Project

Capstone Project

Participants will build an integrated employment-oriented application combining Java, artificial intelligence and data science.

Suggested Project

AI-Enabled Student Placement and Career Recommendation System

Core Features

- Student registration and login
- Student profile management
- Academic and technical-skill records
- Company and job-opening management
- Spring Boot REST API
- SQL database
- Placement prediction using machine learning
- Career or skill recommendation
- Data visualisation for placement trends
- Search and filtering
- Input validation
- Exception handling
- API testing
- Project documentation

Alternative Projects

- Employee attrition prediction system
- Loan eligibility prediction application
- Student performance prediction system
- Resume screening and job-matching application
- Customer churn prediction system
- Smart course recommendation platform

Project Activities

- Requirement analysis
- Database and application design
- Backend API development
- Dataset preparation
- Model training
- Java and Python integration
- Testing and debugging
- GitHub repository preparation
- Documentation
- Final project demonstration
- Code review
- Peer feedback

Outcome

Participants will complete and present a portfolio-ready project demonstrating Java, AI and data science skills.