

Industry-Ready Software Development, DSA, Cloud and Generative AI Bootcamp

Duration: 5 days (40 hours)

Day 1: Programming Fundamentals and Object-Oriented Programming

Module 1.1: Programming Environment and Technical Assessment Overview

- Compiler, interpreter and runtime environment
- IDE setup and debugging tools
- Comparison of C, C#, Java, Python and JavaScript
- Understanding coding assessments
- Selection of a primary programming language

Practical Activities

- Development environment configuration
- Program compilation and execution
- Breakpoints and debugging
- Basic coding exercises

Module 1.2: C Programming Fundamentals

- Variables, data types and operators
- Conditional statements
- Loops
- Functions
- Arrays and strings
- Basic pointers
- Input validation

Practical Activities

- Prime number and palindrome programs
- Factorial and Fibonacci series
- Pattern-printing exercises
- Array searching and sorting
- String manipulation
- Debugging exercises

Module 1.3: Object-Oriented Programming

- Classes and objects
- Constructors
- Encapsulation
- Inheritance
- Polymorphism
- Abstraction

- Interfaces
- Method overloading and overriding
- Exception handling

Practical Activities

- Student information management class
- Employee-management hierarchy
- Interface and abstract-class implementation
- Exception-handling exercises

Module 1.4: JavaScript Programming Fundamentals

- Variables and data types
- Functions and arrow functions
- Arrays and objects
- Array methods
- Scope and closures
- JSON processing
- Introduction to asynchronous programming

Practical Activities

- Student-record filtering and sorting
- Result-processing application
- JSON data manipulation
- JavaScript coding exercises

Day 2: Data Structures, Algorithms and SQL

Module 2.1: Data Structures Fundamentals

- Time and space complexity
- Big-O notation
- Arrays and strings
- Stack and queue
- Linked lists
- Hashing
- Searching and sorting
- Recursion

Practical Activities

- Two-sum problem
- Missing-number identification
- Duplicate detection
- Anagram validation
- Stack and queue implementation
- Linked-list operations

- Binary search
- Sorting-algorithm implementation

Module 2.2: Dynamic DSA and Problem-Solving Patterns

- Recursion versus dynamic programming
- Memoization
- Tabulation
- Sliding-window technique
- Two-pointer technique
- Prefix-sum technique

Practical Activities

- Fibonacci using dynamic programming
- Climbing-stairs problem
- Maximum sum of non-adjacent elements
- Longest substring problem
- Pair-sum problem
- Range-sum calculation

Module 2.3: SQL and Database Fundamentals

- Relational database concepts
- Tables, keys and relationships
- Primary and foreign keys
- Normalisation
- Constraints and indexes
- Joins
- Subqueries
- Aggregate functions
- Common table expressions
- Window functions
- SQL versus NoSQL

Practical Activities

- Database and table creation
- Data insertion and modification
- Filtering, grouping and sorting
- Join-based queries
- Subqueries and CTEs
- Window-function queries
- Database problem-solving exercises

Day 3: Web Development, UI/UX, ReactJS and MERN

Module 3.1: Web Development and UI/UX Fundamentals

- Client-server architecture
- HTML, CSS and JavaScript responsibilities
- Responsive web design
- UI versus UX
- Visual hierarchy
- Accessibility
- Usability
- Wireframes and prototypes

Practical Activities

- Application wireframe creation
- Responsive registration page
- Mobile-first user interface
- Form design and validation
- Usability review

Module 3.2: JavaScript and DOM Programming

- DOM selection and manipulation
- Event handling
- Form validation
- Local storage
- Fetch API
- Promises
- Async and await
- Error handling

Practical Activities

- Dynamic registration form
- Record display in tables
- Search and filtering
- Local-storage integration
- REST API consumption
- Loading and error-state handling

Module 3.3: ReactJS Fundamentals

- Component-based architecture
- Functional components
- Props and state
- Event handling
- Conditional rendering
- Lists and keys
- Forms
- React hooks
- API integration

Practical Activities

- Reusable React components
- Student and company components
- Search and filtering functionality
- Form handling
- API data integration
- Application-status updates

Module 3.4: Node.js and MERN Fundamentals

- Node.js runtime
- NPM package management
- Express framework
- Routes and middleware
- MongoDB documents and collections
- MERN application architecture

Practical Activities

- Express server creation
 - Route configuration
 - GET and POST APIs
 - MongoDB connectivity
 - Data storage and retrieval
 - API testing using Postman
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Day 4: Backend Development, REST APIs, Quality Assurance and AI-Assisted Development

Module 4.1: Backend Development Technologies

- Backend application architecture
- Node.js and Express
- ASP.NET Core Web API
- PHP application structure
- Java backend overview
- Database connectivity
- Backend technology comparison

Practical Track Options

Track A: Node.js and Express

- Routes and controllers
- Middleware
- MongoDB or SQL connectivity

Track B: ASP.NET Core

- Controllers and models
- Dependency injection

- Entity Framework Core overview

Track C: PHP

- Request processing
- Forms and sessions
- Database connectivity using PDO

Practical Activities

- Student-registration API
- Company-registration API
- Job-management API
- Application-status API
- Database integration

Module 4.2: REST API Development

- REST architecture
- HTTP methods
- HTTP status codes
- JSON request and response formats
- Input validation
- Exception handling
- Authentication overview
- API documentation

Practical Activities

- CRUD API development
- Searching and pagination
- Centralised exception handling
- Application logging
- Swagger/OpenAPI documentation
- Postman collections
- Positive and negative API testing

Module 4.3: Software Testing and Quality Assurance

- Software development life cycle
- Software testing life cycle
- Functional and non-functional testing
- Test scenarios and test cases
- Defect life cycle
- Severity and priority
- Unit testing
- Integration testing
- API testing
- UI testing

Practical Activities

- Test-scenario preparation
- Registration and login test cases
- Positive and negative testing
- Defect reporting
- API validation using Postman
- Basic automated unit tests

Module 4.4: AI-Assisted Software Development

- Introduction to Generative AI
- Large Language Model fundamentals
- AI coding assistants
- Prompt engineering for developers
- AI-generated code validation
- Responsible AI usage
- Security and privacy considerations

AI Tools Overview

- GitHub Copilot
- ChatGPT
- Claude
- Gemini
- IDE-based AI assistants

Practical Activities

- Prompt creation for code generation
- Function and class generation
- SQL query generation
- REST API generation
- React component generation
- AI-assisted debugging
- Code refactoring
- Documentation generation
- Unit-test generation
- API test-case generation

Module 4.5: Full-Stack Integration Lab

- React frontend and backend integration
 - SQL or MongoDB integration
 - Validation and error handling
 - Complete CRUD workflow
 - AI-assisted troubleshooting
 - AI-generated test-case review
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Day 5: Networking, Cloud Computing, Generative AI and Capstone Project

Module 5.1: Computer Networking Fundamentals

- LAN, WAN and internet
- OSI and TCP/IP models
- IP addressing
- DNS and DHCP
- TCP versus UDP
- HTTP and HTTPS
- Ports and protocols
- Client-server communication
- Firewall fundamentals

Practical Activities

- ipconfig
- ping
- tracert
- nslookup
- Connectivity testing
- HTTP-request inspection
- Port identification
- DNS troubleshooting

Module 5.2: Cloud Computing Fundamentals

- Cloud-computing characteristics
- IaaS, PaaS and SaaS
- Public, private and hybrid cloud
- Virtual machines
- Containers
- Cloud databases
- Cloud storage
- Cloud networking
- AWS, Azure and Google Cloud overview
- Shared-responsibility model

Practical Activities

- Cloud environment configuration
- Environment-variable setup
- Cloud-database connection
- Frontend or backend deployment
- Application-log review
- Deployment testing
- Deployment troubleshooting

Module 5.3: Generative AI and Large Language Models

- Artificial Intelligence and Machine Learning overview
- Generative AI fundamentals
- Large Language Models
- Tokens, prompts and responses
- Zero-shot prompting
- Few-shot prompting
- Structured prompting
- Hallucinations and output validation
- AI ethics and bias
- Security and data privacy
- Embeddings overview
- Vector database overview
- Retrieval-Augmented Generation introduction

Practical Activities

- Technical question prompts
- Code-generation prompts
- SQL-generation prompts
- Test-case prompts
- Document-summarisation prompts
- Structured JSON responses
- Information extraction
- Prompt-template creation

Module 5.4: AI API Integration

- AI API fundamentals
- Secure API-key management
- Prompt submission
- Response processing
- Error handling
- Input and output validation
- Structured data handling

Practical Activities

- AI API configuration
- Backend AI endpoint creation
- Prompt submission from an application
- JSON response processing
- API-failure handling
- AI-response validation

Module 5.5: AI-Enabled Application Feature

Participants will implement one AI-based feature:

Option 1: Resume Skill Extractor

- Resume-content processing

- Technical-skill extraction
- Skill categorisation
- Skill display

Option 2: Interview Question Generator

- Technology selection
- Difficulty-level selection
- Question generation
- Sample-answer generation

Option 3: Job Description Analyzer

- Required-skill extraction
- Skill comparison
- Missing-skill identification
- Structured result generation

Option 4: AI Career Assistant

- User-query handling
- Learning recommendations
- Technical-topic suggestions
- Preparation-plan generation

Option 5: Automated Test-Case Generator

- Requirement analysis
 - Test-scenario generation
 - Positive and negative test cases
 - Structured test output
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