

Full-Stack Software Development for Web, Mobile, and Desktop Applications

Duration:20 Days

Suggested Technology Stack

- HTML5, CSS3 and JavaScript
- TypeScript
- React
- Node.js and Express.js
- REST APIs
- SQL and NoSQL Databases
- React Native
- Electron.js
- Git and GitHub
- Testing and deployment tools

Prerequisites

- Basic programming knowledge
- Understanding of variables, conditions, loops and functions
- Basic knowledge of databases is helpful
- Familiarity with command-line tools is beneficial

Module 1: Software Development Foundations

Day 1: Software Development Lifecycle and Development Environment

Topics

- Introduction to software development
- Types of software applications
 - Web applications
 - Mobile applications
 - Desktop applications
- Software Development Life Cycle
- Agile and Scrum fundamentals
- Functional and non-functional requirements
- Application architecture overview
- Client-server architecture
- Monolithic and layered applications
- Introduction to development environments
- Installing and configuring:
 - Visual Studio Code
 - Node.js and npm
 - Git

- Browser developer tools
- Introduction to Git and GitHub

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- Configure the development environment
- Create a Git repository
- Perform commit, branch, merge and push operations
- Analyse the requirements of a sample business application

Outcome

Participants will understand the software development process and configure the tools required throughout the program.

Day 2: Programming with Modern JavaScript

Topics

- JavaScript syntax and execution
- Variables and data types
- Operators and expressions
- Conditional statements
- Loops and iterations
- Functions and arrow functions
- Arrays and objects
- Destructuring
- Spread and rest operators
- Modules and reusable code
- Exception handling
- Introduction to debugging

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- Build a JavaScript-based employee record manager
- Debug and correct errors using browser development tools

Outcome

Participants will be able to develop modular programs using modern JavaScript features.

Day 3: Object-Oriented Programming and TypeScript

Topics

- Object-oriented programming concepts
- Classes and objects
- Encapsulation
- Inheritance

- Polymorphism
- Abstraction
- Interfaces and reusable designs
- Introduction to TypeScript
- Type annotations
- Arrays, tuples and enums
- Interfaces and type aliases
- Classes and access modifiers
- Generics
- TypeScript configuration
- Compiling TypeScript applications

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- Convert a JavaScript application into TypeScript
- Build a class-based inventory management module

Outcome

Participants will be able to use object-oriented design and TypeScript to create maintainable applications.

Module 2: Web Application Development

Day 4: HTML5 and Accessible Web Interfaces

Topics

- Web application structure
- HTML5 document structure
- Semantic HTML
- Forms and input controls
- Form validation
- Tables and structured data
- Multimedia elements
- Accessibility fundamentals
- Web Content Accessibility Guidelines overview
- Search-engine-friendly markup

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- Create a multi-page corporate website
- Develop an accessible employee registration form

Outcome

Participants will be able to build structured, semantic and accessible web interfaces.

Day 5: CSS3 and Responsive Web Design

Topics

- CSS selectors and properties
- Box model
- Typography and visual hierarchy
- Flexbox
- CSS Grid
- Responsive web design
- Media queries
- Mobile-first design
- CSS variables
- Transitions and animations
- Introduction to component-based styling
- Overview of Bootstrap or another CSS framework

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- Convert a fixed webpage into a responsive layout
- Build a responsive administrative dashboard

Outcome

Participants will be able to create responsive interfaces for desktop, tablet and mobile browsers.

Day 6: Browser Programming and Asynchronous JavaScript

Topics

- Document Object Model
- Selecting and modifying elements
- Events and event handling
- Form handling
- Browser storage
- Local storage and session storage
- JSON data handling
- Asynchronous programming
- Promises
- Async and await
- Fetch API
- Consuming external APIs
- Error handling in asynchronous operations

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- Build a browser-based task management application
- Retrieve and display data from a REST API

Outcome

Participants will be able to build dynamic browser applications and consume asynchronous services.

Day 7: React Fundamentals

Topics

- Introduction to component-based development
- React application architecture
- Creating a React project
- Functional components
- JSX
- Properties and component communication
- State management with useState
- Event handling
- Conditional rendering
- Rendering lists
- Component composition
- React development tools

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- Build reusable user-interface components
- Develop a product catalogue application

Outcome

Participants will be able to build component-based web applications with React.

Day 8: Advanced React Application Development

Topics

- React hooks
- useEffect
- useRef
- Custom hooks
- Forms and controlled components
- Form validation
- React Router
- Nested routes
- Protected routes
- API integration
- Loading and error states
- Introduction to application state management
- Context API
- Performance considerations

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- Develop a multi-page customer management application

- Implement navigation, validation and API integration

Outcome

Participants will be able to develop structured, data-driven, multi-page React applications.

Module 3: Backend and Database Development

Day 9: Backend Development with Node.js and Express

Topics

- Backend application responsibilities
- Node.js architecture
- Node package management
- Creating a Node.js application
- Express.js fundamentals
- Routes and controllers
- Middleware
- Request and response handling
- Query, route and body parameters
- REST API design principles
- HTTP methods and status codes
- API testing using Postman
- Centralized error handling

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- Build a REST API for employee management
- Test API endpoints using Postman

Outcome

Participants will be able to design and implement REST APIs using Node.js and Express.

Day 10: Database Design and Application Integration

Topics

- Relational and non-relational databases
- Data modelling
- Tables, records and relationships
- Primary and foreign keys
- Normalization overview
- SQL CRUD operations
- Joins and aggregations
- Introduction to MongoDB
- Documents and collections
- Connecting Node.js with a database

- Repository and service patterns
- Database validation
- Transactions overview
- Database error handling

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- Design a database for an order management system
- Connect the REST API to a SQL or MongoDB database
- Implement CRUD operations

Outcome

Participants will be able to design application data models and integrate backend services with databases.

Day 11: Authentication, Authorization and API Security

Topics

- Authentication and authorization
- Password security
- Password hashing
- JSON Web Tokens
- Login and registration workflows
- Role-based access control
- Securing API routes
- Input validation and sanitization
- Cross-Origin Resource Sharing
- Secure HTTP headers
- Environment variables
- Common web application vulnerabilities
- OWASP security awareness
- Logging and audit trails

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- Implement user registration and login
- Add JWT-based authentication
- Secure routes using user roles

Outcome

Participants will be able to implement secure authentication and role-based access control.

Day 12: Full-Stack Web Application Integration

Topics

- Connecting React with REST APIs
- Organizing frontend services
- Authentication state management
- Protected routes
- CRUD user interfaces
- Search, sorting and filtering
- Pagination
- File upload overview
- Global error handling
- Loading indicators
- Application configuration
- Building production-ready applications

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- Integrate the React frontend with the Node.js backend
- Implement login, role-based navigation and CRUD functionality

Outcome

Participants will complete a secure full-stack web application connected to a database.

Module 4: Mobile Application Development

Day 13: Mobile Development Fundamentals and React Native

Topics

- Native, hybrid and cross-platform applications
- Mobile application architecture
- React Native ecosystem
- Setting up the development environment
- Expo and command-line development approaches
- React Native project structure
- Core components
- Views, text, images and buttons
- Styling mobile applications
- Flexbox for mobile layouts
- Platform-specific behaviour
- Running applications on emulators and devices

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- Configure a mobile development environment
- Build a multi-screen employee directory interface

Outcome

Participants will be able to create and run a cross-platform mobile application.

Day 14: Mobile Navigation, Forms and Device Features

Topics

- Stack and tab navigation
- Passing data between screens
- Mobile forms
- Input validation
- Touch interactions
- Lists and scrollable content
- Local storage
- Secure storage overview
- Camera and image picker
- Location services overview
- Permissions
- Handling Android and iOS differences
- Responsive mobile layouts

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- Build a mobile registration and profile workflow
- Add image selection and local data storage

Outcome

Participants will be able to create navigable mobile applications that use common device features.

Day 15: Mobile API Integration and Authentication

Topics

- Connecting mobile applications to REST APIs
- Authentication from mobile applications
- Token storage and renewal
- Displaying server data
- Creating and updating records
- Network error handling
- Offline and online state awareness
- Pull-to-refresh
- Loading and empty states
- Mobile application security
- Application configuration
- Debugging React Native applications

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- Connect the mobile application to the backend API
- Implement login and authenticated API operations
- Add offline-friendly handling for selected data

Outcome

Participants will be able to build secure mobile applications connected to backend services.

Day 16: Mobile Testing, Performance and Packaging

Topics

- Component and functional testing
- Testing mobile user interfaces
- Debugging tools
- Performance optimization
- Efficient list rendering
- Image and asset optimization
- Error boundaries
- Crash and log analysis
- Application icons and splash screens
- Environment configuration
- Android build process
- Application signing overview
- Publishing considerations for application stores

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- Test and optimize the mobile application
- Generate a testable Android application package

Outcome

Participants will be able to test, optimize and package a cross-platform mobile application.

Module 5: Desktop Application Development

Day 17: Desktop Application Development with Electron

Topics

- Desktop development approaches
- Introduction to Electron.js
- Electron architecture
- Main and renderer processes
- Creating an Electron project
- Browser windows
- Application lifecycle
- Desktop menus
- Dialog boxes
- System notifications
- Inter-process communication

- Integrating React with Electron
- Desktop application security considerations

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- Create an Electron desktop application
- Implement menus, dialogs and system notifications

Outcome

Participants will be able to create cross-platform desktop applications using Electron.

Day 18: Desktop Data, File System and API Integration

Topics

- Working with the local file system
- Reading and writing files
- Importing and exporting data
- Local database options
- SQLite overview
- Desktop configuration management
- Connecting desktop applications to REST APIs
- Authentication in desktop applications
- Offline data handling
- Synchronization strategies
- Auto-update concepts
- Error logging
- Secure storage of sensitive information

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- Build a desktop data management application
- Add file import and export functionality
- Connect the desktop application to the common backend API

Outcome

Participants will be able to develop desktop applications with local and remote data access.

Module 6: Quality, Deployment and Capstone Project

Day 19: Application Testing, DevOps and Deployment

Topics

- Software quality assurance
- Unit, integration and end-to-end testing
- Testing JavaScript and TypeScript applications
- API testing

- Frontend component testing
- Code quality and linting
- Debugging across platforms
- Git branching strategies
- Code review practices
- Introduction to continuous integration and delivery
- Environment-based configuration
- Web application deployment
- Backend API deployment
- Mobile packaging overview
- Desktop packaging and installers
- Application monitoring and logging

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- Write tests for frontend and backend components
- Configure a basic continuous integration workflow
- Build production packages for web and desktop applications
- **Outcome**

Participants will be able to test, package and prepare applications for deployment.

Day 20: Integrated Capstone Project and Presentation

Capstone Project

Participants will develop an integrated business application with three client interfaces:

- Responsive web application
- Cross-platform mobile application
- Cross-platform desktop application
- Shared Node.js REST API
- Centralized database
- Authentication and role-based access control

Suggested Project Options

- Employee leave and attendance management system
- Service request and help-desk system
- Inventory and order management system
- Learning and training management system
- Field-service management application

Project Requirements

- User registration and authentication
- Role-based access
- Dashboard
- CRUD operations
- Search and filtering

- Data validation
- API integration
- Responsive web interface
- Mobile application interface
- Desktop application interface
- Centralized error handling
- Basic testing
- Source-code management
- Deployment or packaging documentation

Activities

- Final development and integration
- Testing and issue resolution
- Code review
- Project demonstration
- Architecture presentation
- Trainer feedback
- Knowledge assessment

Outcome

Participants will demonstrate their ability to design, develop and integrate web, mobile and desktop applications using a shared backend platform.