

MERN Stack Syllabus: Beginner to Pro Level

Introduction to Programming

- **Why Learn Programming?**
 - Importance and Applications of Programming
 - Overview of Different Programming Languages

Module 1: Programming Basics with C/C++

- **Introduction to C/C++:**
 - Setting Up the Development Environment
 - Understanding Compilers and IDEs
- **Basic Syntax and Structure:**
 - Variables and Data Types
 - Operators and Expressions
 - Basic Input and Output
- **Control Structures:**
 - Conditional Statements (if, if-else, switch)
 - Loops (for, while, do-while)
- **Functions:**
 - Defining and Calling Functions
 - Function Parameters and Return Values
 - Scope and Lifetime of Variables
- **Arrays and Strings:**
 - Declaring and Using Arrays
 - String Handling in C/C++
- **Pointers and References:**
 - Understanding Pointers
 - Pointer Arithmetic
 - References in C++
- **Structures and Classes (C++):**
 - Defining and Using Structures
 - Introduction to Classes and Objects
 - Basic Object-Oriented Programming Concepts

Module 2: HTML & CSS

- **HTML Basics:**
 - Structure of an HTML Document
 - Elements, Tags, and Attributes
 - Forms, Tables, and Semantic HTML
- **CSS Basics:**
 - CSS Syntax and Selectors
 - Box Model, Flexbox, and Grid Layout
 - Responsive Design and Media Queries
 - CSS Frameworks: Bootstrap/Tailwind CSS

Module 3: JavaScript

- **JavaScript Basics:**
 - Variables, Data Types, and Operators
 - Control Structures: Loops and Conditionals
 - Functions and Scope
 - Arrays and Objects
- **Advanced JavaScript:**
 - Asynchronous JavaScript: Callbacks, Promises, and Async/Await
 - DOM Manipulation and Events
 - ES6+ Features: Arrow Functions, Spread Operator, Destructuring

Module 4: React.js

- **Introduction to React:**
 - Understanding Components and JSX
 - Props and State
 - Event Handling
- **Advanced React:**
 - React Hooks: useState, useEffect, and Custom Hooks

- Context API for State Management
- React Router for Navigation
- Form Handling and Validation
- Redux for State Management (Optional)

Module 5: Node.js & Express.js

- **Introduction to Node.js:**
 - Understanding the Event Loop
 - Modules and NPM
 - Creating a Basic Server with HTTP Module
- **Express.js Basics:**
 - Setting Up an Express Server
 - Routing and Middleware
 - Handling Requests and Responses
 - Building a RESTful API
- **Advanced Express.js:**
 - Authentication and Authorization (JWT)
 - Error Handling and Logging
 - Working with Middleware
 - File Uploads and Static Files

Module 6: MongoDB

- **Introduction to MongoDB:**
 - Understanding NoSQL Databases
 - Installing and Setting Up MongoDB
 - CRUD Operations
- **Advanced MongoDB:**
 - Indexes and Aggregation
 - Relationships and Embedded Documents
 - Using Mongoose for Data Modeling
 - Database Security and Backup

Module 7: Full-Stack Development with MERN

- **Connecting Frontend and Backend:**
 - Integrating React with Express and Node.js
 - Fetching Data with Axios/Fetch
 - State Management with Redux (Optional)
- **User Authentication:**
 - Implementing JWT-Based Authentication
 - Role-Based Access Control
- **Deployment:**
 - Preparing Apps for Production
 - Deploying MERN Apps to Heroku/Vercel/Netlify
 - Setting Up Continuous Integration/Continuous Deployment (CI/CD)

Module 8: Advanced Topics

- **Testing:**
 - Unit Testing with Jest
 - Integration Testing with Supertest
 - End-to-End Testing with Cypress
- **Performance Optimization:**
 - Analyzing and Improving Frontend Performance
 - Caching Strategies
 - Optimizing Database Queries
- **GraphQL:**
 - Introduction to GraphQL
 - Setting Up a GraphQL Server with Node.js
 - Fetching Data with Apollo Client

Module 9: Capstone Project

- **Building a Real-World Application:**
 - Planning and Designing the Project
 - Implementing Features Using the MERN Stack
 - Testing and Debugging

- Deployment and Maintenance