

MEAN Stack Course Syllabus**★ MEAN Stack****Module 1: Introduction to the MEAN Stack**

- What is MEAN Stack?
- Evolution of MEAN
- Difference between MEAN & MERN (React vs Angular)
- Angular's Component-Based Architecture
- Modular Architecture vs React's Functional Model
- Real-world use cases of MEAN
- Understanding SPAs (Single Page Applications) with Angular
- Installing Node.js, Angular CLI, MongoDB, Git
- Using package managers: npm, yarn, pnpm

Module 2: Modern JavaScript (ES6+) & TypeScript for Angular
JavaScript Essentials

- let, const, arrow functions
- Promises & async/await
- Classes & modules
- Spread & rest operators

TypeScript

- Types, interfaces, enums
- Generics
- Decorators
- TypeScript with Angular CLI
- TypeScript with Node.js/Express
- Strict mode for enterprise Angular apps

Module 3: Angular – Modern Frontend Development**Angular Fundamentals**

- Angular project setup
- Components, templates & metadata
- Interpolation & Property binding
- Event binding
- Two-way binding with ngModel

Angular Latest Features

- **Standalone Components (no NgModule)**
- **Angular Signals (reactive state management)**
- Reactive event handling
- SSR-ready components

Directives & Pipes

- Structural directives (*ngIf, *ngFor, *ngSwitch)

- Attribute directives ([ngClass], [ngStyle])
- Custom directives & pipes

Angular Services & Dependency Injection

- Injectable services
- Singleton & hierarchical DI
- API calls with HttpClient

Routing

- Route configuration
- Lazy loading modules
- Preloading strategies
- Guards (CanActivate, CanDeactivate, Resolve)

Forms

- Template-driven forms
- Reactive forms
- FormBuilder & custom validation

State Management

- RxJS Observables & Operators
- BehaviorSubject, ReplaySubject
- NgRx Store
- Actions, Reducers, Effects
- NgRx Entity for complex state

UI & Styling

- Angular Material
- Tailwind CSS
- Custom component libraries

Module 4: Node.js – Backend Development

- Understanding Node.js architecture
- Event Loop
- Working with modules (ESM)
- File system module
- Streams & buffers
- Background workers & Job queues
- Async programming: Callbacks → Promises → Async/Await

Module 5: Express.js – Building Scalable REST APIs

- Express project structure
- Router-level middleware
- Custom middleware
- Error-handling middleware
- API versioning
- File uploads with Multer
- Validation with Zod / Joi
- Logging with Morgan / Winston

■ **Module 6: MongoDB – Database Modeling & Optimization**

MongoDB Essentials

- CRUD operations
- Indexing strategies
- Aggregation pipeline
- Joins (lookup)
- Schema design (1–1, 1–many, many–many)

Mongoose (with TypeScript)

- Schema validation
- Pre/Post hooks
- Virtuals
- Transactions
- Populate & references

MongoDB Atlas

- Cloud hosting
- Performance insights
- Backup & scaling

■ **Module 7: Integrating Angular, Express, Node & MongoDB**

- Angular → Node API communication
- Using HttpClient & interceptors
- CORS & security headers
- Handling API errors globally
- Real-time UI updates with RxJS
- Folder structure for MEAN monorepo

■ **Module 8: Authentication & Authorization (Enterprise Level)**

- JWT authentication (login, signup, refresh tokens)
- HttpOnly cookies vs localStorage
- bcrypt hashing
- OAuth 2.0 (Google, Facebook login)
- Angular Guards for route protection
- Role-based access control (RBAC)
- Token rotation & session management
- Preventing attacks:
 - CSRF
 - XSS
 - SQL/NoSQL Injection
 - Rate limiting (express-rate-limit)
 - Helmet security

■ **Module 9: Real-Time Applications**

- What are WebSockets?

- Using Socket.io with Express & Node
- Real-time chat app
- Live notifications
- Real-time dashboard with MongoDB Change Streams

■ **Module 10: Server-Side Rendering (SSR) with Angular Universal**

- Why SSR matters for SEO
- Setting up Angular Universal
- Pre-rendering pages
- SEO strategies
- Meta tags, Open Graph tags
- Faster load times with preloading & lazy loading
- SSR caching strategies

■ **Module 11: Deployment & DevOps in MEAN Applications (Optional)**

Frontend Deployment

- Angular → Firebase Hosting
- Angular → Vercel

Backend Deployment

- Express.js → AWS EC2
- Express.js → Render / DigitalOcean
- PM2 process manager

Database

- MongoDB Atlas (Global Clusters, Backup)

Containerization

- Dockerizing Angular + Node + MongoDB
- Docker Compose
- Nginx reverse proxy

CI/CD Pipelines

- GitHub Actions
- Jenkins
- Auto deploy pipelines

■ **Module 12: Advanced MEAN Topics (Optional)**

- GraphQL with MEAN (Apollo Server)
- Microservices architecture
- Event-driven communication
- Message Queues:
 - RabbitMQ
 - Kafka
- Redis caching & session stores
- Background jobs (Bull / BullMQ)
- Performance optimization:
 - Angular Signals optimization

- Node.js clustering
 - Query optimization
 - Load balancing with Nginx
 - Edge Functions (Cloudflare Workers, Vercel Edge)
 - Integrating AI in MEAN apps (OpenAI, HuggingFace APIs)
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■ Module 13: Capstone Project – Production-Ready MEAN Application

Students will build a complete industry-level application with:

Key Features:

- Angular as frontend
- Node + Express backend
- MongoDB (Atlas)
- JWT authentication
- Admin & User dashboards
- NgRx store
- Real-time notifications with Socket.io
- File uploads (Cloudinary)
- Payment Integration (Stripe/Razorpay)
- Dockerized deployment
- Full CI/CD pipeline

Project Examples:

- Ecommerce Web App
 - LMS (Learning Management System)
 - Social Media App
 - Travel Booking System
 - Real-time Chat Platform
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