

Full Stack Web Development with MERN

Duration: 100 hours

Objective: To acquire the knowledge of Full Stack Web Development using NodeJs, ReactJS and MySQL.

Prerequisites: Students are expected to know any OOP's Based Language. They should have undergone the Web Programming basics which includes HTML, CSS, JavaScript, Knowledge of any database is required.

Module 1: Introduction to Web

- Brief history of the Internet, How does the Internet work?
- Internet Protocol
- Domain Name Service servers
- HTTP Protocol
- Web Server vs Application Server
- Architecture of the Web

Module 2: HTML & HTML5

- Introduction to HTML
- Basic HTML Tags
- HTML Form & Controls
- HTML5: New features in HTML5

Module 3: Cascading Style Sheets (CSS)

- Introduction to CSS, Styling HTML with CSS, Structuring pages with CSS,
- Inline CSS, Internal CSS, External CSS
- CSS Selectors
 - Linking a style to an HTML document
- Responsive Web Design with Bootstrap

Module 4: JavaScript

- Introduction to JavaScript
- Variables in JavaScript
- Statements, Operators, Comments, Expressions, and Control Structures
- JavaScript Scopes
- Strings, Numbers, Date
- Arrays, Array Methods

Module 5: JavaScript

- Objects, Object Definitions, Object Properties, Object Methods, Object Prototypes
- Functions, Function Definitions, Function Parameters, Function Invocation, Function Closures

Module 6: JavaScript

- Document Object Model (DOM)
 - o Object hierarchy in JavaScript
 - o HTML DOM, DOM Elements, DOM Events
 - o DOM Methods, DOM Manipulation, Forms & Forms Validation

Module 7: JSON & Ajax

- JSON: JavaScript Object Notation (JSON)
 - o Introduction and need of JSON
 - o JSON Syntax Rules
 - o JSON Data - a Name and a Value,
 - o JSON Objects, JSON Arrays, JSON Files, JSON parsing

- Ajax
 - o Introduction to Ajax, Ajax Framework, Ajax Architecture
 - o Web services and Ajax, Ajax using JSON and jQuery

Module 8: Introduction to Node.js

- Introduction to Node.js, Browser JS vs. Node.js
- ECMAScript 2015 (ES6), Node.js REPL

Module 9: Node.js Asynchronous Programming

- Introduction to Asynchronous programming and callbacks
- Promises and async & await
- The Event Loop and Timers

Module 10: Node.js Modules

- Understanding Node modules, exports, and require
- Introduction to npm
 - o package.json and package-lock.json files
 - o Install, update, and manage package dependencies
 - o Local and global packages

Module 11: Node.js Modules – *fs* and *http*

- File I/O – Sync & Async Methods
- HTTP Module – Building an HTTP server
- Developing a Node web application

Module 12: Introduction to Express

- Introduction to Express, Getting started with Express
- Application, Request and Response Objects
- Routes and Middlewares

Module 13: CURD using Express & MYSQL:

- Working with MYSQL
- Performing CURD operations with Express

Module 14: Introduction to React JS:

- Introduction to React, Getting started with React
- React Elements and React Components
- Function and Class Components
- Working with React Components and Props
 - o Compose components
 - o Render components
 - o Declutter components

Module 15: React JS:

- Introduction to State and Lifecycle
- Stateful components and lifecycle methods
- Props vs. State vs. Context
- Handling events
- Conditional rendering

Module 16: React JS

- Lists and Keys
 - o Rendering Multiple Components

- o Basic List Component
- Working with forms and inputs
- Composition vs. Inheritance
 - o Containment
 - o Specialization

Module 17: Express & React JS

- Build React App
- Merging React with Express

Module 18: Capstone Project

CDAC Patna

Artificial Intelligence and Data Science using Python

Duration: 100 hours

Objective: This course is designed to provide a broad overview of AI and its various applications, including machine learning, deep learning, and computer vision & python. Students will learn about AI, and explore the different types of AI systems.

Prerequisites: Familiarity with the basics of Mathematics and Statistics would be helpful for this course.

Module 1: Introduction of AI

- What is AI?, Terminologies of Artificial Intelligence
- Components of Artificial Intelligence – ML & DL
- Difference between AI, ML, Deep Learning
- History and Evolution of AI, Introduction to Machine Learning
- Find out where AI is applied in Technology and Science.
- Difference between Traditional Programming and ML Programming

Module 2: Basics of Python

- Introduction of python
- Control flow statements (Loops)
- Python Data Structures & Data Types
- Functions , Modules & OOP's Concepts

Module 3: Mathematical Computing using NumPy

- Introduction to NumPy
- Create and Print Numpy Arrays
- Numpy Operations

Module 4: Data Manipulation with Pandas

- Introduction to Pandas
- Pandas Series & DataFrames
- Missing Values, Handling Missing Values
- Various Data Operations

Module 5: Data visualization with Python

- Data Visualization, Considerations of Data Visualization
- Factors of Data Visualization
- Python Libraries
- Create Your First Plot Using Matplotlib
- Line Properties
- Multiple Plots and Subplots, Create a Plot with Annotation
- Create Multiple Subplots Using plt.subplots
- Creating different types of graphs

Module 6: AI/ML Implementations

- Types of Machine Learning, Labelled Data and Unlabelled Data
- Concept of Supervised & Unsupervised
- Steps of Machine Learning
- Concept of Collecting the historic training Data for ML
- Concept of Pre-process data for Machine Learning
- Need for Data Pre-processing
- Data Transforms Steps
- Types of Data Transformation Methods

- Rescale, Standardize & Normalize Data
- Concept of Train the ML model
- Concept of Test the ML Algorithm
- Algos of Regression, Classification & K-Means Clustering
- Concept of Sigmoid Function
- Validation and Evaluations (k-fold, AUC, ROC, Confusion matrix)

Module 7: Introduction to Deep Learning

- A revolution in Artificial Intelligence
- Limitations of Machine Learning
- What is Deep Learning?
- Advantage of Deep Learning over Machine learning

Module 8: Introduction to Neural Networks, Computer Vision & RNN

- Introduction to Neural Networks, Neural Network Architecture, The Neuron
- Introduction to image processing and computer vision,
- Convolutional features for visual recognition
- Object detection, Image classification
- Introduction to RNN & LLM

Module 9: Capstone Project

Cyber Security and Ethical Hacking

Duration: 100 hours

Objective: This course equips participants with hands-on skills to identify, analyze, and mitigate cyber threats. It covers digital security, penetration testing, and emerging attack vectors, preparing learners to safeguard systems effectively.

Prerequisites: Basic knowledge of IT, networking, and operating systems is required. Familiarity with programming (Python/Bash) is a plus, but not mandatory.

Module 1:

- Introduction to Cyber Security
- Linux Fundamentals

Module 2:

- Understanding Linux Shell
- Working with the Commands

Module 3:

- Navigating through Linux, Exploring the Linux Environment
- Manipulating Files & Directories

Module 4:

- Understanding Permissions
- Processes
- Package Management

Module 5:

- Storage Media
- Basic Networking Commands
- Searching for Files
- Network Security: Defense & Countermeasures

Module 6:

- Understanding Shell Script
- Flow Control
- Basic functions and file manipulations

Module 7:

- Managing User & Groups
- Switching Users
- Configuring User policies

Module 8:

- System Monitoring & Performance Tuning
- Backup & Recovery

Module 9:

- Advanced Networking
- DNS Working & Configurations
- DHCP Working & Configurations

Module 10:

- Network Security: Defense & Countermeasures
- IP Address Configuration

Module 11:

- Firewalls, Network Traffic Monitoring & Analysis – Using Wireshark
- DoS Mitigation Techniques
- Zero Trust Architecture

Module 12:

- Ethical Hacking Fundamentals, Phases of Ethical Hacking
- OWASP Top 10

Module 13:

- Web Application Pen Testing: Burp Suite, Nessus

Module 14:

- Web Application Pen Testing, Exploitation of Vulnerable Machines

Module 15: Capstone Project

Mastering Programming using Core Java

Duration: 100 hours

Objective: To reinforce knowledge of Object Oriented Programming concepts using Core Java.

Prerequisites: Basic knowledge of computer programming.

Module 1:

- Introduction of Java programming language.
- History of Java language, Types of languages.
- Features of Java language.
- Different Editions of Java Language.
- Java Development Tool Kit.
- Java Development Environment Setup.
- Compilation & Execution of a Java Program.
- First Java Program.

Module 2:

- Java Programming Fundamentals.
- Keyword & Identifiers.
- Java Data Types and Literals.
- Variable and Constants.
- Java Comments.
- Java Programming Naming Conventions.
- Programming Indentation Techniques
- Operators
- Java Flow Controls (conditional, looping)

Module 3:

- OOP's Concept
- Class and Object.
- Concept of Encapsulation, Abstraction, Inheritance & Polymorphism
- Class Deceleration.
- Object Construction.
- Data Fields & Methods

Module 4:

- Constructors, initializing reference variables using constructors
- Pass by value v/s pass by reference
- Re-assigning a reference variable
- Passing reference variable to method
- Initializing reference variable of different class
- Heap memory and stack memory

Module 5:

- Inheritance and Its types
- Association, Aggregation and Composition
- Polymorphism: Compile time and runtime polymorphism
- Rules of overriding and overloading of methods
- super and this keywords
- Reference Assignment compatibilities.
- Class Casting Rules

Module 6:

- Abstract class and abstract methods
- Interface (implementing multiple interfaces)
- Final variables, final methods and final class
- Functional interface
- New interface features (Java 8 & above)

Module 7:

- Access modifiers (public, private, protected and default)
- Packages and import statements
- Static imports
- Constructor chaining (with and without packages)
- Accessing protected variables and methods outside the package

Module 8:

- Introduction to Arrays in JAVA
- Declaring Array Variables & Construction of Array
- Array's Memory Representation
- Initializing an Array – static and dynamic
- Single & Multi-dimensional Arrays
- Anonymous Arrays
- Using methods from java.util.Arrays class
- Method Overloading Issues : using var-args methods

Module 9:

- Garbage collection in java, Requesting JVM to run garbage collection
- Different ways to make object eligible for garbage collection: (Nulling a reference variable, Re-assigning a reference variable & island of isolation)
- Finalize method

Module 10:

- Wrapper classes and constant pools
- String class, StringBuffer & StringBuilder class, String constant pool

Module 11:

- Exception hierarchy, Errors, Checked and un-checked exceptions
- Exception propagation try-catch-finally block, throws clause and throw keyword
- Multi catch block
- Creating user defined checked and unchecked exceptions

Module 12:

- Understanding Streams and stream operation
- Types of Stream – character and Binary streams
- Input and Output Streams, Reader and Writer interfaces
- File Reading writing operations
- Serialization and de-serialization
- Shallow copy and deep copy

Module 13:

- Object Class & java.util Package
- Date, DateTime, Calendar class
- Converting Date to String and String to Date using SimpleDateFormat class
- Object Class: Overriding to String, equals & hashCode method

Module 14:

- Introduction to collections: Collection hierarchy
- List, Queue, Set and Map Collections
- List Collection: ArrayList, LinkedList
- Collections class, Comparable and Comparator interfaces
- Queue collection

Module 15:

- Set Collection: HashSet, LinkedHashSet & TreeSet collection, Backed set collections
- Map Collection: HashTable, HashMap, LinkedHashMap & TreeMap classes, Backed Map collections
- Generics

Module 16:

- MultiThreading : Thread class and Runnable Interface
- sleep, join, yield, setPriority, getPriority methods
- Thread Synchronization, deadlock, Wait, notify and notifyAll methods

Module 17:

- Inner Class (Regular, Method local, Anonymous & static inner class)
- Lambada Expression

Module 18: Capstone Project

Mastering Programming using Python

Duration: 100 hours

Objective: To reinforce knowledge of Object Oriented Programming concepts using Python. Build the basic foundation for AI & Data Science using Python.

Prerequisites: Basic knowledge of computer programming

Module 01 – Introduction to PYTHON

- A Brief History of Python, How Python is differing from other languages
- Python Version, Installing Python
- IDLE, Getting Help
- How to execute Python program? Writing your first program

Module 02 – Python Basics

- Python Keywords and Identifiers
- Variables and Constants
- Python statements, Comments in python
- Basic Syntax, Printing on screen
- Getting user input -Reading data from keyboard

Module 03 –Data Types & Operators

- Data types: Numbers & Strings
- Operators in Python

Module 04 – Decision Making & Loops

- Control flow and syntax
- The if statement
- The while Loop
- Break and continue
- The for Loop
- Pass statement

Module 05 – Built-in Data Structure in Python

- Lists, Tuples, Sets, Dictionary

Module 06 – Function

- Introduction to Function, Calling a function, Function arguments
- Built in function vs User Defined Functions
- Scope of variables, Decorators
- Passing function to a function

Module 07 – Modules and Packages

- Introduction to Modules and Packages
- Importing Modules
- Standard Modules- sys
- Standard Modules- OS
- Useful built-in functions
- Packages

Module 08 – Exception Handling

- Introduction to Exception Handling
- Errors, Run Time Errors
- Handling IO Exception
- Try....except statement
- Raise & Assert

Module 09 – File Handling in Python

- Introduction to File Handling in Python
- Files and Directories
- Writing Data to a file, Reading data from a file
- Additional file methods, Working with files
- Working with Directories, The pickle Module

Module 10 – Object Oriented Programming in Python

- Introduction to OOP's
- Classes & Objects
- Creating classes, Instance methods
- Special class method
- Inheritance, Method overriding
- Data hiding

Module 11 – Mathematical Computing using NumPy

- Introduction to NumPy in Python
- Installing NumPy, Creating Arrays using NumPy
- Operations Using NumPy
- NumPy Data Types, Indexing & Slicing, Advanced Indexing
- NumPy – Iterating Over Array
- NumPy – Array Manipulation
- NumPy – Mathematical Functions

Module 12 – Data visualization using Matplotlib

- Data Visualization
- Considerations of Data Visualization
- Factors of Data Visualization
- Python Libraries
- Create Your First Plot Using Matplotlib
- Line Properties
- Create a Line Plot for Football Analytics
- Multiple Plots and Subplots
- Create a Plot with Annotation
- Create Multiple Plots to Analyze the Skills of the Players
- Create Multiple Subplots Using plt.subplots
- Creating different types of graphs for visualization

Module 13 – Data Manipulation with Pandas

- Introduction to Pandas
- Data structures of Pandas
- Pandas Series & Dataframes
- Pandas Object creation
- Viewing Pandas data, Selection on Pandas Data
- Operations on Pandas Data
- Head and tail on Pandas DataFrame
- Grouping, Sorting
- Importing and exporting data
- Indexing and selecting data
- Different choices for indexing, Attribute access, Slicing ranges
- Selecting random samples

Module 14- Capstone Project

Embedded Systems & Robotics

Duration: 100 hours

Prerequisites: Basic knowledge of computer programming and electronics.

Module 1: Basic Programming Concepts with Arduino

Arduino Programming, Variables and Data Types, Variable Scope and Qualifiers, Operators - Comparison and Logical, Control Structures, Arrays, Strings, Functions, Arduino's Built-In functions, associated concepts, libraries

Module 2: Introduction to Embedded Systems

What is an Embedded System?, Trends in embedded systems, Challenges and Design Issues in Embedded Systems, Assemblers, Compilers, Linkers, Loaders, Debuggers, Integrated Development Environment (IDE), Embedded In-Circuit Emulators (ICE), Build Tools for Embedded Systems, Embedded Systems Architectures.

Module 3: Microcontroller Programming and Interfacing

Introduction to Microcontrollers, Microprocessors and SoC, RISC / CISC and Harvard / Princeton, Architectures, Embedded Memory, Timers / Counters, UART, SPI, PWM, Input Capture, Output Compare Modes, LED, Switches, LCD. Introduction to 8 bit Processors, AVR series Architecture model and Registers Set. Programming with Arduino Board

Module 4: Introduction to Robotics

Basics of Robotics, Components of a Robot: Sensors, Actuators, Controllers, Types of Robots (Industrial, Service, Humanoid, etc.), Degrees of Freedom (DoF) in Robotics, Isaac Asimov's Laws of Robotics, Ethical and Social Implications of Robotics, Introduction to DC, Stepper and Servo Motors, Driving DC Motor using Relay, Speed control of DC Motor using PWM (Pulse Width Modulation)

Module 5: Capstone Project with Robotics Project Ideation and Planning, Hardware Development and Circuit Design, Programming and Integration, Documentation and Presentation such as Line Following Robot, Obstacle Avoidance Robot, Smartphone Controlled Wireless Robot