

Teaching Guidelines for Web Programming Technologies PG-DAC September 2021

Duration: 52 classroom hours + 52 lab hours (104 hours)

Objective: To introduce the students to HTML, CSS, JavaScript, XML, JSON, Ajax, Node.js, Express.js, React, React-Redux, and practical relevance of all these technologies.

Text Books:

- Fundamentals of Web Development, 1e, by Randy Connolly, Ricardo Hoar / Pearson
- MERN Quick Start Guide – Build web applications with MongoDB, Express.js, React, and Node by Eddy Wilson Iriarte Koroliova / Packt

References:

- Internet & World Wide Web : How to Program by Paul Deitel, Henry Deitel & Abbey Deitel / Pearson Education
 - XML - How to Program by Deitel et al / Pearson Education
 - Ajax in Action by Dave Crane, Eric Pascarello / Dreamtech Press
 - JavaScript: The Good Parts by Douglas Crockford / O'Reilly
 - Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node by Vasanth Subramanian / Apress
 - Web Application Security: A Beginner's Guide by Bryan Sullivan & Vincent Liu / Tata McGraw Hill
 - W3Schools Tutorials [<https://www.w3schools.com/>]
 - Mozilla Developer Network Web Development Tutorials [https://developer.mozilla.org/en-US/docs/Learn/Getting_started_with_the_web]
 - Curated Tutorial Links on ES6, React, etc. [<https://github.com/markarikson/react-redux-links>]
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(Note: Each Session is of 2 hours)

Session 1: Architecture of Web

Lecture:

- Brief history of the Internet
- How does the Internet work?
- Internet Protocol; HTTP
- Domain Names; Domain Name Service servers
- HTTP Protocols
 - Difference between HTTP 1.0, HTTP 1.1, and HTTP 2.0
 - Methods – GET, POST, HEAD, PUT, DELETE, etc.
 - Status codes
 - Stateless nature of the protocol and HTTP Session
 - HTTPS
- Architecture of the Web
- Web servers – IIS, Apache server

Lab:

- Exploring different browsers
 - Mozilla Firefox, Google Chrome, Safari
- Exploring different text editors
 - Windows: Notepad++, Linux: Gedit or Vim or Emacs

Session 2: HTML**Lecture:**

- Introduction to HTML5
- Introduction to basic HTML Tags
 - Alignment, Headings, Anchor, Paragraph, Image, Lists, Tables, and iFrames
- HTML5
 - New features in HTML5
 - New elements, new attributes, link relations, microdata, ARIA accessibility, objects, events, and Canvas tags
 - HTML5 Validation
 - Audio & Video Support
 - Geo-location Support
- HTML Forms & Controls
 - Input, Text Area, Radio Button, Checkbox, Dropdown, Submit, Reset, Button, etc.
- Introduction to Document Object Model (DOM)

Lab:

- Create a HTML form for building your resume.

Session 3: Cascading Style Sheets (CSS)**Lecture:**

- Introduction to CSS, Styling HTML with CSS, Structuring pages with CSS,
- Inline CSS, Internal CSS, External CSS, Multiple styles, CSS Fonts
- CSS Box Model
- id Attribute, class Attribute
- HTML Style Tags
- Linking a style to an HTML document

Lab:

- Apply inline, internal, and external CSS to change colors of certain text portions, bold, underline, and italics certain words in the previously created HTML resume form.

Session 4: XML**Lecture:**

- Introduction to XML & Reason for XML
- XML and the browser
- A basic XML Document
- Namespaces
- Root Element
- Tags and Elements
- Attributes and Values
- CDATA and PCDATA
- XML Tree Structure
- XML Schema and Validation
- XML Parsers, XML SAX Parser
- Introduction to XML style language

Lab:

- Create some basic XML documents and check them out in the different browsers for validity.

Session 5: JavaScript**Lecture:**

- Introduction to JavaScript
- Variables in JavaScript
- Statements, Operators, Comments, Expressions, and Control Structures
- JavaScript Scopes
- Strings, String Methods
- Numbers, Number Methods
- Boolean Values
- Dates, Date Formats, Date Methods
- Arrays, Array Methods

Lab:

- Practice writing basic JavaScript programs for better understanding of the language constructs

Sessions 6 & 7: JavaScript**Lecture:**

- Objects, Object Definitions, Object Properties, Object Methods, Object Prototypes
- Functions, Function Definitions, Function Parameters, Function Invocation, Function Closures
- Introduction to Object Oriented Programming in JS
 - Method, Constructor, Inheritance, Encapsulation, Abstraction, Polymorphism

Lab:

- Write a JavaScript program to sort a list of elements by implementing a sorting algorithm.
- Write a JavaScript program to list the properties of a JavaScript object.

Sessions 8 & 9: JavaScript**Lecture:**

- Document Object Model (DOM)
 - Object hierarchy in JavaScript
 - HTML DOM, DOM Elements, DOM Events
 - DOM Methods, DOM Manipulation
- Forms, Forms API, Forms Validation
- Regular Expressions
- Errors, Debugging
- Introduction to Browser Dev Tool
- Pushing code quality via JSLint tool

Lab:

- Write a JavaScript function to get First and Last name from the previously created Resume form
- Validate the entire Resume form using client-side JavaScript
- Write a JavaScript function to validate whether a given value is RegEx or not.

Session 10: jQuery**Lecture:**

- Introducing to jQuery
- jQuery selectors
- jQuery events
- jQuery animation effects

- jQuery DOM traversal and manipulation
- Data attributes and templates
- jQuery DOM utility functions
- jQuery plugins

Lab:

- Write a jQuery program to get a single element from a selection of elements of a HTML page.
- You are having sample data for the link. Write jQuery code to change the hyperlink and the text of an existing link.
- Write a jQuery program to attach a click and double-click events to all <p> elements.
- Write a jQuery program to hide all headings on a page when they are clicked.
 - Also find the position of the mouse pointer relative to the left and top edges of the document.

Sessions 11 & 12: JSON & Ajax

Lecture:

- JSON: JavaScript Object Notation (JSON)
 - Introduction and need of JSON
 - JSON Syntax Rules
 - JSON Data - a Name and a Value,
 - JSON Objects, JSON Arrays, JSON Files
 - JSON parsing
- Ajax
 - Introduction to Ajax
 - Ajax Framework
 - Ajax Architecture
 - Web services and Ajax
 - Ajax using JSON and jQuery

Lab:

- Create a page showing live score/feed using Ajax and JSON from a live sport/news service end-point given by the faculty

Session 13: Introduction to Node.js

Lecture:

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

Lab:

- Install Node.js 12.x.x LTS version on your machine
- Write a recursive function in Node.js
- Write a Node program that prints all the numbers between 1 and 100, each on a separate line.

A few caveats:

 - if the number is divisible by 3, print "foo"
 - if the number is divisible by 5, print "bar"
 - if the number is divisible by both 3 and 5, print "foobar"

Sessions 14 & 15: Node.js Asynchronous Programming

Lecture:

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

Lab:

- Assignment on JavaScript callback functions
- Assignment on Timers, Promises, and Async & Await

Session 16: Node.js Modules**Lecture:**

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

Lab:

- Create a module and import it in other programs
- Install a module/package using npm

Session 17: Node.js Modules – *fs* and *http***Lecture:**

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

Lab:

- Write a program to create a new file and write some content to it in synchronous mode and read and display file contents on standard output in async mode
- Build a simple Node.js web application serving both HTTP GET and POST methods

Sessions 18 & 19: Introduction to Express**Lecture:**

- Introduction to Express
- Getting started with Express
- Application, Request and Response Objects
- Routes and Middlewares
- Templates, Template Engines, and Rendering Views

Lab:

- Use Node and Express to write a simple web application that consists of at least 5 route implementations
- Rebuild any previous Node assignment using Express and a template engine

Session 20: Introduction to React**Lecture:**

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

Lab:

- Rebuild any previous plain HTML lab assignment using React
- Build a React Clock app showing time (hh:mm:ss) of any three countries

Sessions 21 & 22: React

Lecture:

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

Lab:

- Implement the following items in the React Clock app
 - Update the time (hh:mm:ss) using State and Lifecycle methods
 - Add a close function on each rendered clock component
 - Assign background color of rendered clock components based on AM, PM

Session 23: React

Lecture:

- Lists and Keys
 - Rendering Multiple Components
 - Basic List Component
- Working with forms and inputs
- Refs and the DOM
- Lifting state up

Lab:

- Implement and integrate a new feature in the React Clock app where one can select a country time zone from dropdown list and click on “Add” button to render it.

Session 24: React

Lecture:

- Error Boundaries
- Composition vs. Inheritance
 - Containment
 - Specialization
- Thinking in React

Lab:

- Implement error boundaries at appropriate places in the React Clock app

Session 25: Introduction to React-Redux

Lecture:

- Introduction to Redux
- Actions, Reducers, and Stores
- Usage with React

Lab:

- Make necessary changes in the design and implementation of React Clock app using React-Redux to maintain the application state.

Session 26: Responsive Web Design & Web Security

Lecture:

- Introduction of UI Scripting
- The Best Experience for All Users
 - Desktop, Tablet, Mobile
- Bootstrap

- Overview of Bootstrap, Need to use Bootstrap
- Bootstrap Grid System, Grid Classes, Basic Structure of a Bootstrap Grid
- Typography
- Components – Tables, Images, Jumbotron, Wells, Alerts, Buttons, Button Groups, Badges/Labels, Progress Bars, Pagination, List Groups, Panels, Dropdowns, Collapse, Tabs/Pills, Navbar
- Forms, Inputs
- Bootstrap Themes, Templates
- Web Security
 - Introduction to Web security
 - SQL Injection, Cross-Site Scripting (XSS)
 - JSON and Security Concerns, Cross Site Request Forgery (CSRF), Injection Attacks
 - Security Standards (OWASP)

Lab:

- Update the design of the Resume form using Bootstrap