

**Faculty of Engineering
Bachelor of Technology**

**Integrated Course with Specialization in Full Stack Web Design &
Development**

Semester	Subjects	Lecture(L) Credits	Practical(P) Credits
1	Digital Transformation and Agile Development	3	
2	Software Craftsmanship	3	1
	DevOps Engineering	2	
3	Think Python	3	1
	UI Specialist	3	1
4	UX Expert with React Redux	2	1
	Backend Development with NodeJS	3	1
5	Database Engineer- MongoDB	3	1
	Test Automation with Selenium	3	1
6	Microservices & Design Patterns	3	1
	Monitoring	2	

Total Credits: 38

Total Course Duration: 552 Hours

Lab 1 Credit = 2 hrs per week / 24 hrs delivery

**Credits can be altered.*

Semester 1	Lecture: 3 Credits
Total Credits: 3	Lab:

Digital Transformation and Agile Development

Unit 1: Introduction to Digital Transformation

Introduction, Challenges of Traditional Business Model, Why Digital Transformation, Design Thinking, Different Phases of Design Thinking, Divergence, Emergence and Convergence of Design Thinking, Design Thinking vs. Agile vs. Lean, Agile Practices, Design Sprint and its Phases, Design Thinking Vs Design Spirit

UNIT 2 Product Management

Introduction to Product Management & Service Mindset, Product Manager, Building Products and services, Product lifecycle and phases, product development & Methodology; systems thinking, value chain, Introduction of Capability Optimization and Capability Maturity Model, Business Integration methods, Agile methodology, Product Marketing; User Experience Design

Unit 3: Agile Practices

Agile Methodology, Software, History of Software Engineering and Software, Development Methodologies, Traditional Software Development Models, Waterfall Model, Classical Waterfall Model, Traditional IT Organizations, Developers vs IT Operations Conflict, Birth of Agile, Four Values of the Agile Manifesto, Agile and Lean

Unit 4: Agile & Scrum Methodology

Scrum, Scrum Theory, Scrum Values, Scrum Roles, Scrum Master Scrum Sprints, Benefits of Scrum, Planning and Estimation, Agile Planning, Levels of Agile Planning, Conditions of Satisfaction, Velocity, Estimating Techniques, Soft Skills in Agile, Kanban Model.

Unit 5: Kanban Principles

Kanban Principle, Kanban Board, Kanban Core Practices, Make work visible, Limit work in progress (WiP), Manage flow, Make progress policies explicit, Implement feedback mechanisms, Improve collaboratively (using methods and models).

Semester 2	Lecture: 3 Credits
Total Credits: 4	Lab: 1 Credits

Software Craftsmanship

Unit 1: Introduction to Software Craftsmanship

Definition, History of the emergence of software craftsmanship, Software craftsmanship, Process versus paradigm, Software development processes, Software development models, Software design paradigms, Software development paradigms, Major programming paradigms Procedural programming paradigm, Object-oriented programming paradigm, Functional programming paradigm, Dimensions of craftsmanship, Craftsmanship - Mastery of the paradigm Describing and defining well-crafted code, Becoming a craftsman, The programming process

Unit 2: Code Design

Clean code and its fundamental concepts, Code Design, Software design considerations, Kent Beck's principle of simple design, Fundamental characteristics of good design, Design Patterns: Reusing best practices, SOLID design principles, Programming Principles

Unit 3: Code Structure

Classes, packages and methods: building blocks of code, organizing code: the size of methods and classes, What makes methods and classes "good", Software metaphors, Objects and data structures, data transfer objects, Using libraries, Overview of the best practices in structure: Law of demeter and open close principle,

Unit 4 Code Formatting & Documentation

Introduction, Variants, Vertical Openness, Vertical Density, Distance and Ordering, Naming Best Practices, Intention-Revealing Names, Avoid Mental Mappings, Naming Classes, Methods and Functions, Comments, Writing Code Documentation

Unit 5: Testing Debugging & Refactoring

Testing and Debugging, Basic Test-driven Development (TDD), Categories of TDD and Unit tests, Unit Testing Techniques, Automating Testing Using Junit, Refactoring: Improving Structure, Refactoring: Changing Code Structure without Changing Functionality, The need for Refactoring, The Refactoring Process and the Different Levels of Refactoring, Refactoring Strategies, Code Smells: Symptoms of Poorly Designed Code, Categories of Code Smells, Code Base, Using Frameworks & Tools

Semester 2	Lecture: 2 Credits
Total Credits: 2	Lab

DevOps Engineering

UNIT 1: Introduction to DevOps

Definition of DevOps: Challenges of traditional IT systems & processes, History and emergence of DevOps, DevOps definition and principles governing DevOps, DevOps and Agile, The need for building a business use case for DevOps, Purpose of DevOps, Application Deployment, Automated Application Deployment, Application Release Automation (ARA), Components of Application Release Automation (ARA), Continuous Integration, Best Practices of CI, Benefits of CI, Continuous Delivery, Process

Unit 2: Typical Toolkit for DevOps

DevOps: An Overview, Achieving DevOps, Continuous Practices, Continuous Integration (CI), How does CI Work?, Continuous Integration Practices, Benefits of Continuous Integration A Quick Recap of Continuous Delivery, Continuous Delivery Process, Benefits of Continuous Delivery, Continuous Deployment, Continuous

UNIT 3: Source Code Management

History of Version Control Systems (VCS), Basic operations in a VCS, Examples of version control systems, Subversion (SVN), Features and Limitations, Mercurial, Git, Overview, History - Linux and Git by Linus Torvalds, Advantages of Git, Explain how local version control works, Centralized Version Control Systems (CVCS), Distributed Version Control Systems (DVCS), advantages of DVCS, Private Workspace

Unit 4: Application Containerization

Understanding Containers: Transporting Goods Analogy, Problems in Shipping Industry before Containers, Shipping Industry Challenges, Container: Virtualization Introduction, Hypervisor, Scope of Virtualisation, Containers vs Virtual Machines, Understanding Containers, Containerisation Platform, Runtime and Images, Container Platform, Container Runtime, The Chroot System, FreeBSD Jails, Linux Containers (LXC), Docker

UNIT 5: Introduction to Containerization

Docker architecture, Docker Daemon (Container Platform), Docker Rest API, CLIDifferent environments: (Dev, QA and Prod), Overcoming issues with different environments, Development Environment Docker Swarm and Kubernetes, Architecture, AWS (ECS,EKS), AWS Elastic Container Services Architecture, Azure Kubernetes Services, Openshift, KUBERNETES ON CLOUD, Monitoring of container

Semester 3	Lecture: 3 Credits
Total Credits: 4	Lab:1 Credits

Think Python

Setting Up The Python Environment

Installing Python, Anaconda, Jupyter Notebook, Spyder, Introduction to Python, Components, Versions and Distributions, Difference between Python 2 and Python3, Compiler vs Interpreter, Statically vs Dynamically typed languages.

Programming With Python

Python REPL, variables, control structures, functions, objects, First-class functions, Immutable data, Strict and non-strict evaluation, Recursion instead of an explicit loop state, Functions, Iterators, and Generators, Writing pure functions, Functions as first-class objects, Using strings, tuples and named tuples, Using lists, dicts, and sets, The Itertools Module, Best Practices, Clean coding, Reading data files into Python, manipulating rows and columns in files, writing files, Introduction to python libraries

Data Pre-Processing

Introduction, Introduction to Pandas and Basic Concepts of Pandas, Data Cleaning and Preparation, Handling Missing Data, Filtering out Missing Data, Filling in Missing Data, Data Transformation, Removing Duplicates

Data Pre-Processing Extended

Transforming Data Using a Function or Mapping, Replacing Values, Renaming Axis Indexes, Discretization and Binning, Detecting and Filtering Outliers, Permutation and Random Sampling, String Manipulation, Feature Engineering

Statistical Modeling

Derived Variables, Basic Exploratory Data Analysis, Methods for EDA and Examples, Statistical Modeling, Curve Fitting: Linear Regression, Nonlinear Regression

Semester 3	Lecture: 3Credits
Total Credits: 4	Lab:1 Credits

UI Specialist

Unit 1: Introduction to HTML

Introduction, Need of HTML, HTML Tags, HTML Elements, Formatting Text in HTML, Headings, HTML Paragraphs, Identifying HTML Elements, HTML Basics & Attributes, HTML Links, Lists, Colors, Tables, Symbols, Attributes, Overview of Attributes, Core Attributes, Styles, Class Attribute, Generic Attributes

Unit 2: Creating web pages with HTML5 & CSS

HTML5 introduced features, HTML5 form validate/no validate, HTML5 canvas, embedding audio, and video in a webpage, drag and drop, HTML5 Local Storage, HTML5 web workers and server sent events, HTML Attributes, Forms, Form Validation, Validation to HTML Page, CSS Semantics, CSS Selectors CSS Styling, CSS Color, CSS Backgrounds, Borders, Margins, Padding, Box Model, Heightwidth, Tables, Selectors, Display, CSS Buttons, CSS Animation, CSS Display, CSS Float & Clear, CSS Overflow, CSS Align- Horizontal & Center Responsive Web Design, View Port, Grid View, Media Queries, Flex Box

Unit 3: Javascript

Javascript, importance, What can JavaScript Do, Need of Javascript, Javascript with HTML Content, HTML Attributes, HTML DOM Elements Java script with CSS, HTML Nodes, Syntax, Rules, Writing Javascript, Tags, Programming Errors, Syntax Error, Runtime Error, Logical Errors, Data Types, Non-primitive, Javascript Data Types, Objects in Javascript, Events in Javascript Objects, Changing HTML Styles, Events, Event Handler Attributes, Adding Event Handlers, Using Element Attribute directly, Using Event Attribute, Using HTML DOM, Reacting to Events

Unit 4: JavaScript Functions, Objects & Events

Introduction, Execution of Functions, Invoking Functions, As methods, As constructor, call(), arguments, apply(), bind(), Nesting Functions & Closure, Objects, Primitive Values, Strings & Objects, Creating JS Object, Literal Syntax, New Keyword, Adding Methods to Objects

Unit 5 JavaScript Arrays

Creating arrays, elements in array access, changing array elements, objectsVs Arrays, recognizing Arrays, Looping Array, Array Methods, Adding Array Elements using Array Methods, Removing Last Array Elements, Converting Array into Strings, Converting and Joining Array into Strings with special separator, Array Methods & Manipulations, Sorting Array Methods, Iteration Methods, The Map()

Semester 4	Lecture: 2Credits
Total Credits: 3	Lab:1 Credits

UX Expert with React Redux

Unit 1: Refreshing ES6

Specifications and Features, Introduction, The let and const, The arrow functions, New Literal Syntax, Classes, Inheritance using extends, Default Parameter Values, Spread Operator (...), Iterators and Generators, Introduction to React, Features of React, Why we Need React,

Unit 2: ECMA , E6

ECMA Script, ES6 let and const, the arrow functions, New Literal Syntax, Classes, Inheritance using extends, Default Parameter Values, Spread Operator (...), Iterators and Generators, Features of React, Practical Application, Why need React, How React Works, Leveraging Virtual DOM, Setting up React

Unit 3: JSX

Why JSX, Embedding JavaScript, Expression in JSX, JSX as an Expression, Nested elements in JSX, JSX Attributes, JSX Comments, JSX Styling and representation as object, The State of the Component, Defining State, Changing the State, Props, Validation, Validators

Unit 4: Elements

Rendering Element, About render (), Creating React Element, Updating Element, components, Introducing Components, Types of Components, Functional Component, Functional Components as Stateless, Using Functional Component

Unit 5: Redux

Redux Concepts, Redux Principles, Data Flow, Actions, Functions, Reduces, Testing , DevTools, React & Redux Integrate

Semester 4	Lecture: 3Credits
Total Credits:4	Lab:1 Credits

Backend Development

Unit 1: Introduction to Node.js

What is Node.js, History of Node.js, Why Node.js, Node.js Architecture, Working and Features, Installation and Setup, Installing Node.js, Launching REPL, Environment, Installing Visual Studio, Code Editor, Components of Node.js

Unit 2: Modules

Module Exports, Export Object, Export Functions, Export Functions as Class, Loading module from, Separate Folder, Modules, File System Module, Reading and Writing into, Files, Appending and Opening Files, Events and Event Emitters, Handling Events, Customized Class for Handling Events, In-built Modules File Systems, Operating System

Unit 3: Buffers

Writing to Buffers, Reading from Buffers, Concatenating Buffers, Copying Buffers, Slicing Buffers, The Stream Module, Reading From Stream, Writing to Stream, Pipes, Pipe Chaining

Unit 4: REST API

Explain REST API, Describe Node.js express, Discuss the importance of express, Explain the installing process of express, Learn express request and response, Describe routing, REST API : Intro to API, History of API Development, Development of AJAX, CRUD

Semester 5	Lecture: 3Credits
Total Credits:4	Lab:1 Credits

Database Engineer Mongo DB

Unit 1: Getting started with MongoDB

NoSQL Databases, Features of MongoDB, Installation overview, Documents, Collections, Databases, What is the NoSQL approach?, Why Use the NoSQL Approach?, Benefits of NoSQL, Types of Databases, Key-Value Stores, Wide-column Stores/ Columnar Databases, Document/Document-store/Document-oriented Databases, Graph-based Databases, Starting and stopping MongoDB

Unit 2: Javascript in MongoDB

Javascript in MongoDB, Execution of a JavaScript file in MongoDB, Making the output of find readable in shell, Complementary Terms, Installation, Basic commands on mongo shell, Hello World, Create, Update Delete, Read, Update of embedded documents, More update operators, Updating multiple documents

Unit 3: Collections

List all collections in the database, List all databases, Find(), findOne(), limit, skip, sort and count the results of the find() method, Query Document – Using AND, OR and IN Conditions, find() method with Projection, Find() method with Projection, \$set operator to update specified field(s) in document(s), Insert a document, Create a Collection, Drop Collection, Aggregation

Unit 4 Indexes

Indexes, Index Creation Basics, Dropping/Deleting an Index, Sparse indexes and Partial indexes, Get Indices of a Collection, Compound, Unique Index, Single field, Delete, List, Mongo as Shards

Unit 5: Sharding Environment Setup

Managing Database for Availability and Performance, Database Scaling, Database Distribution Models, Database Replication, Types of Database Replication, Master-Slave Replication, Peer-to-Peer Replication, Advantages and Disadvantages of Peer-to-Peer Replication, Introduction to Sharding, Why Sharding, The Lookup Strategy, Basic configuration with three nodes, Mongo as a Replica Set, Mongoose

Semester 5	Lecture: 3Credits
Total Credits:4	Lab1 Credits

Test Automation with Selenium

Unit 1: Introduction to Software Testing

Seven principles of Software Testing, SDLC vs STLC, Testing Life Cycle, Usability Testing, Why do we need Usability Testing, How to do Usability testing, Advantages & Disadvantages, Functional Testing, End to End Testing, Methods, Advantages & Disadvantages, Compatibility Testing, Types GUI testing, Techniques API testing, Advantages

Unit 2: Test Automation: Selenium

Selenium components, Selenium Architecture, TestNG Installing TestNg in Eclipse, TestNG annotations – Understanding usage, Setting priority of execution for test cases, Hard Assertion, Soft Assertion, TestNG Reports, ANT- Downloading & Configuring, XSLT report generation generation using TestNg and Ant

Unit 3: Introduction to Selenium 3.x

Describe Selenium 3.x advantages and implementation, Define drivers for Firefox, IE, chrome, Iphone, Android etc, Analyse first Selenium Code, Differentiate between Close and Quit, Describe Firepath and firebug Add-ons installation in Mozilla, Inspect elements in Mozilla, Chrome and IE, Identifying WebElements using id, name, class, Generate own CssSelectors. Differentiate between performance of CssSelectors as compared to Xpaths, Define class attribute, Handle Dynamic objects/ids on the page, Analyse whether object is present on page or not

Unit 4: Manual Testing

Manual Testing, Manual Testing – How to Approach?, Manual Testing – Myth and fallacy, Defect Life Cycle, Qualities of a good Manual Tester, Manual Testing vs Automation Testing, Types, System Testing, Acceptance Testing, Unit Testing, Techniques, Integration Testing, Smoke- Sanity Testing

Unit 5: Introduction to Test Design

Test Scenario, Test Case Design, Test Basis Traceability Matrix

Semester 6	Lecture: 3Credits
Total Credits: 4	Lab:1 Credits

Microservices& Design Patterns

Unit 1: SOA Vs Microservices

Software Architecture and its Stakeholders, Architectural Patterns and Styles, Monolithic Architecture, Strengths and Limitations, SOA Architecture, Domain-Driven Approach to Design and Implement Microservices, Strategic and Tactical Design, Domain, Bounded Context, Ubiquitous Language and Context Mapping, The Building Blocks of DDD, Strengths and Limitations of DDD, How Domain Driven Design Applies to Microservices, Designing Services Applying DDD Concepts, Service Communication, The API Gateway, Case Studies One Detail Case Study , RainyDay Grocer, UBER, Multiple Case Studies

Unit 2: Introduction to Software Architecture:

Software architecture: Overview, Stakeholders, Stakeholders' Areas of Concern, Software Architecture: Definition, Architecture Description, ISO/IEC/IEEE 42010, Architecture Structural Description, Architecture Behavioral Description, Benefits, Architectural Patterns, Architectural Style Vs. Architectural Pattern,

Unit 3: Introduction to Design Patterns

Design Pattern: Overview, Design Pattern Discovery, Elements, Documenting Design Pattern, Design Pattern: Benefits, Criticisms, Design Pattern Classifications, Creational Patterns, Structural Pattern, Behavioral Patterns, Architectural Patterns Vs. Design Pattern, Anti Patterns, Anti Pattern Vs. Bad Habit, God Object, Anti Patterns in Object Oriented Programming (OOP), Architectural Patterns, Layered Pattern, Layers, Use Cases, Layered Pattern: Advantages, Layered Pattern: Disadvantages, Event-driven Pattern: Definition, Components, Use Cases, Advantages & Disadvantages

Unit 4: Microkernel & Microservices

Microkernel Pattern: Definition, Components, Use Cases, Advantages & Disadvantages , Microservices (MS): Definition, MS: Architecture, MS Principles: Single Responsibility, MS Principles: Loose Coupling, Domain Driven Design, Principles: Service Discovery, Fault Tolerance/Circuit Breaker, Automation, Use Cases, Advantages & Disadvantages, Space-Based Architecture, Use Cases, Advantages & Disadvantages

UNIT 5 Design Patterns:

Creational Design Patterns, Factory pattern, Builder Pattern, Prototype Pattern, Singleton Pattern, Structural Design Patterns, Adapter Pattern, Bridge Pattern, Composite Pattern, Decorator Pattern, Facade Pattern, Flyweight Pattern, Proxy Pattern, Behavioural Design Patterns, Command Pattern, Iterator Pattern, Mediator Pattern, Memento Pattern, Observer Pattern, Observer Pattern, template pattern, Visitor Pattern

Semester 6	Lecture: 3Credits
Total Credits:3	Lab:

Monitoring

Unit 1: DevOps and Monitoring

Introduction to monitoring, Goals of monitoring, DevOps approach to monitoring, Network operations center, Role of NOC in DevOps world, Telemetry and metrics, Types of monitoring: end user, infrastructure, application, log monitoring and analysis

Unit 2: End User Monitoring

Overview, Objectives of end user monitoring, Types of end user monitoring, Real user monitoring, Synthetic transaction monitoring, Server side monitoring, Benefits of end user monitoring, Tools overview

Unit 3: Infrastructure Monitoring

Overview of infrastructure monitoring, Monitoring components and metrics, Agent vs agentless monitoring, Reactive monitoring vs proactive monitoring, Cloud vs on premise, Network and security monitoring, Infrastructure monitoring challenges, Tools overview

Unit 4: Application Monitoring

Overview, How to Measure Application Performance, Key Functionalities, Application vs infrastructure monitoring, Monitoring components and metrics, Dependency monitoring, Tools overview

Unit 5: Log Monitoring and Analysis

Overview, Objectives of log monitoring, Metrics, Log monitoring vs analysis, Log analysis techniques, Purpose and benefits of log analysis, Log analysis best practices, Purpose and Benefits of Log Analysis, Best Practices, Tools overview; Monitoring Techniques: Visualization – Dashboards, Alerts, Alert triage process, DevOps dashboard with Hygieia, AI in monitoring – AIOps, Tools overview

