



Maharashtra Education Society's
Abasaheb Garware College, Pune.
(Autonomous)
(Affiliated to Savitribai Phule Pune University)

Two Years M.Sc. Degree Program in Computer Science
(Faculty of Science and Technology)

Syllabi under NEP
M.Sc. (Computer Science) II

Choice Based Credit System Syllabus
To be implemented from Academic Year 2024-2025

Structure of the Course: M. Sc. (Computer Science)

Year	Semester	Course Type	Course Code	Course Title	Remark	Credit	No. of Lectures /Practical to be conducted		
2	III	Core	CS-601-MJ	Software Architecture and Design Patterns		4	48		
			CS-602-MJ	Machine Learning		4	48		
			CS-603-MJ	Full Stack Development - II		4	48		
			CS-604-MJP	Lab course based on CS-602 and CS-603		2	4 per batch per week		
		Elective	CS-610-MJ	Big Data		2	30		
			CS-611-MJP	Lab Course Based on Big Data		2	4 per batch per week		
			OR						
			CS-612-MJ	Web Analytics		2	30		
			CS-613-MJP	Lab Course Based on Web Analytics		2	4 per batch per week		
		Project	CS-631-RP	Research Project		4	-		
	IV	Core	CS-651-MJP	Industrial Project Design		4			
		Elective	CS-660-MJ	MOOC		2	-		
			CS-661-MJ	MOOC		2	-		
		OJT	CS-681-OJT	Industrial Training / Industrial Project		14	-		

SECOND YEAR: Semester I
CS-601-MJ Software Architecture and Design Patterns
No. of Lectures 48 (Credits 4)

Pre-requisites:

- Familiarity with UML and OOPs Concepts
- Programming in Java

Course Objectives:

1. To introduce students to the basic concepts and techniques of SADP.
2. To write java programs using Design Pattern.
3. Use of patterns and architectures for solving practical problems.
4. To understand about design pattern.
5. To understand about the process of deploying web apps using specific Frameworks.

Learning Outcomes: On completion of this course, students will be able to:

1. Recognize the characteristics of patterns that make it useful to solve real-world problems.
2. Able to use specific frameworks as per applications need.
3. Design java application using design pattern techniques.

Unit 1: Introduction

02

- 1.1 UML The Notation
- 1.2 Process Unified Process / Rational Unified Process inception, elaboration, construction, transition
- 1.3 How various components fit in the life cycle, the artifacts at end of each process / discipline

Unit 2: Software Architecture

03

- 2.1 Introduction to Software Architecture
- 2.2 Importance of architecture
- 2.3 Architectural structures and views

Unit 3: Architectural Styles

05

- 3.1 Architectural Styles
- 3.2 Pipes and Filters
- 3.3 Data Abstraction and Object – Oriented Organization
- 3.4 Event-Based, Implicit Invocation
- 3.5 Layered Systems
- 3.6 Repositories
- 3.7 Interpreters

- 3.8 Other familiar Architectures
- 3.9 Heterogeneous Architectures

Unit 4: Introduction to Patterns **04**

- 4.1 Pattern & Design Pattern
- 4.2 What makes a Pattern (GOF)
- 4.3 Describing Design Patterns
- 4.4 Pattern Categories & Relationships between Patterns
- 4.5 Organizing the Catalogue
- 4.6 Patterns and Software Architecture

Unit 5: Study of Design Patterns **12**

- 5.1 Creational Patterns-singleton, factory method, abstract factory
- 5.2 Structural Patterns-adapter, decorator, facade
- 5.3 Behavioral Patterns - iterator, observer, strategy, command and state (study of intent, applicability, participants, structure, collaboration , Java Example code , Implementation and consequences)

Unit 6: GRASP (General Responsibility Assignment Software Patterns) **06**

- 6.1 Expert, Creator, High Cohesion, Low Coupling
- 6.2 Controller, Polymorphism, Pure Fabrication, Indirection
- 6.3 Don't Talk to Strangers

Unit 7: Study of Frameworks **12**

- 7.1 Frameworks as reusable chunks of architecture
- 7.2 The framework lifecycle, development using frameworks
- 7.3 Spring Core Framework
- 7.4 Spring Boot Framework
- 7.5 Microservices with Spring
- 7.6 Web Architectures: Google Web Tool Kit, Spring, Hibernate etc.
- 7.7 Selection of proper framework
- 7.8 Comparing Frameworks
- 7.9 Advantages of Spring
- 7.10 Web based Case Study

Unit 8: Case Study (any one of the web Architecture) **04**

- 8.1 Take a Framework and find Patterns in the Frame work
- 8.2 Benefits of Patterns in the chosen Framework
- 8.3 How Pattern interact in the selected Framework

References:

1. Design Patterns – Elements of Reusable Object-oriented Software By E. Gamma, RichardHelm, Ralph Johnson , John Vlissides (GoF)

2. Pattern – Oriented Software Architecture (POSA) Volume 1. By : Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal.
3. Software Architecture in Practice. By Len Bass, Paul Clements, Rick Kazman
4. Applying UML and Patterns By Craig Larman.
5. Head First Design Pattern by Kathy Sierra, Bert Bates, Elisabeth Robson, Eric Freeman
Publisher: O'Reilly Media, Inc.
6. Building Microservices-Designing Fine-Grained Systems By Sam Newman Publisher O'Reilly Media
7. Design patterns in Java by Douglas Schmidt Publisher O'Reilly
8. Professional Java Development with the Spring Framework 1st Edition by Rod Johnson, Alef Arendsen, Thomas Risberg, Colin Sampaleanu ; WROX publication

CS-602-MJ - Machine Learning

No of Lectures: 48 (Credits-4)

Prerequisites:

- Familiarity with Probability Theory, Multivariable Calculus, Linear Algebra
- Programming in Python (NumPy, SciPy, Pandas, Matplotlib, Seaborn, SciKit-Learn, StatsModel)

Course Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To write python programs using machine learning algorithms for solving practical problems.
3. To understand about Machine Learning Library and use cases.
4. To understand about the process of deploying ML model.

Learning Outcomes: On completion of this course, students will be able to:

1. Recognize the characteristics of machine learning that make it useful to real-world problems.
2. Process available data using python libraries and predict outcomes using Machine Learning algorithms to solve given problem.
3. Able to estimate Machine Learning models efficiency using suitable metrics.
4. Design application using machine learning techniques.

Unit 1: Introduction to Machine Learning

08

- 1.1 Introduction: Machine Learning, Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross-validation.
- 1.2 Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning.
- 1.3 Components of Generalization Error (Bias, Variance, underfitting, overfitting)
- 1.4 Metrics for evaluation viz. accuracy, scalability, squared error, precision and recall, likelihood, posterior probability
- 1.5 Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis

Unit 2: Supervised Machine Learning

14

- 2.1 Regression - Linear Regression, Univariate Regression, Multivariate Linear Regression, Polynomial Regression, Logistic Regression
- 2.2 Classification - K - Nearest Neighbours (KNN), Naive Bayes Theorem, Support Vector Machine, Decision Tree, Random Tree
- 2.3 Model Accuracy, Confusion Matrix

Unit 3: Un-Supervised Machine Learning

12

- 3.1 Clustering Fundamentals
- 3.2 K-means
- 3.3 Hierarchical Clustering (Agglomerative, Divisive),
- 3.4 Dendrogram
- 3.5 Selecting optimal number of clusters: Within Clusters Sum of Squares (WCSS) by Elbow Method

3.6 Association Rules - Support, Confidence and Lift

3.7 Apriori Algorithm

Unit 4. Reinforcement Learning

06

4.1 Introduction- Environment, State, Reward, Policy, Value

4.2 Upper Confidence Bound

4.3 Thompson Sampling

4.4 Q-Learning

Unit 5. Deep Learning

08

5.1 Introduction to Deep Learning

5.2 Artificial Neural Network

5.3 Convolution Neural Network

5.4 Recurring Neural Network

5.5 Generative Adversarial Networks

Reference Books:

1. Mitchell, Tom M. "Machine learning. WCB." (1997).
2. Rogers, Simon, and Mark Girolami. A first course in machine learning. CRC Press, 2015.
3. Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. The elements of statistical learning. Vol.1. Springer, Berlin: Springer series in statistics, 2001.
4. Witten, Ian H., and Eibe Frank. Data Mining: Practical machine learning tools and techniques. Morgan Kaufmann, 2005.
5. Machine learning course material by Andrew Ng, Stanford university
6. Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. Vol. No. 1. Cambridge: MIT press, 1998.
7. Iba, Takashi, et al. "Learning patterns: A pattern language for active learners." Conference on Pattern Languages of Programs (PLoP). 2009.

CS-603-MJ Full Stack Development - II

No of Lectures: 48 (Credits-4)

Prerequisites:

- Basics of Java Scripts
- Fundamentals of Full Stack Development
- Concepts of REST and REST APIs
- Fundamentals of databases

Course Objectives

1. To introduce React.js
2. To explain component life-cycle and implements hook
3. To understand event handling
4. To introduce routing using React Routers
5. To explain global state management library using Redux
6. To understand Authorization and Authentication
7. To introduce socket programming
8. To explain how to build and deploy React applications

Learning Outcomes: On completion of this course, students will be able to:

1. Understand virtual DOM, state, props, functional components and JSX
2. Create custom hook and use hooks as per functionality
3. Apply event handling
4. Create basic routes and dynamic routes
5. Create and use global store along with multiple reducer
6. Apply Authorization and Authentication using JWT token
7. Understand two-way communication between client and server through a web socket
8. Able to deploy React.js applications on server

Unit 1: Introduction to React.JS

08

- 1.1 React Overview
 - 1.1.1 Basic Structure
 - 1.1.2 Functional Components
 - 1.1.3 Features
 - 1.1.4 Introduction to virtual DOM
 - 1.1.5 Advantages and Limitations
- 1.2 Rendering UI with React
 - 1.2.1 Anatomy of react project
 - 1.2.2 Create a new react application
 - 1.2.3 Templating using JSX
 - 1.2.4 Use of JSX for UI elements
 - 1.2.5 Create react reusable components

Unit 2: Hooks Overview

05

2.1	Concept of Hooks	
2.2	Different types of hooks (useState, useEffect, useReducer, useCallback, useMemo, useRef)	
2.3	Using state and effect hooks	
2.4	Use of React's useState hook to manage state	
2.5	Rules of hooks	
Unit 3:	Event Handling in React	02
3.1	Understanding React event system	
3.2	Understanding Synthetic event	
3.3	Working with event handlers	
3.4	Form events	
Unit 4:	React Router	05
4.1	Introduction to React Router	
4.2	Understanding Exact Match	
4.3	Route Links	
4.4	useEffect cleanup - handling cancelled request on unmount	
4.5	Dynamic routing - router parameters	
4.6	Fetching data based on router parameters	
Unit 5:	State Management Using Redux	10
5.1	Concept of managing the state in applications	
5.2	Concept of middleware and redux cycle	
5.3	Redux principles	
5.4	Create actions, reducer and store it	
5.5	Working on Redux with React Library	
5.6	API store: getState(), dispatch(), and subscribe()	
5.7	Use cases in Redux	
Unit 6:	Session Management and JWT	08
6.1	Concept of Authorization and Authentication	
6.2	Types of Authentications and Techniques	
6.3	Concept of JWT	
6.4	JWT Authentication	

7.1 Redux Toolkit

7.1.1 Migration to modern Redux

7.1.2 Installation

7.1.3 Why Redux toolkit over Redux ?

7.1.4 What is slice?

7.1.5 What is configureStore(), createReducer(), create action (), createSlice(), combine slices ()

7.1.6 Advantage of Redux toolkit over Redux

7.2 RTK Query

7.2.1 What is RTK query?

7.2.2 Why to use RTK query?

7.2.3 How to use RTK query?

1. CreateApi()

2. FetchBaseQuery()

3. Setup listener()

4. Provider()

5. Use of hooks in component

7.2.4 Advantage and Disadvantage of RTQ query?

Unit 8: Deployment and Hosting React Application on Cloud**References:**

1. Learning React: Functional Web Development with React and Redux, O'REILLY publications
2. Full-Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js, 2nd Edition
3. Learning React: A Hands-On Guide to Building Web Applications Using React and Redux, Kirupa Chinnathambi

CS-604-MJ - Lab course based on CS-602 and CS-603

No. of Sessions 15: (Credits-2)

Assignments of Machine Learning:

1. Write a python program to Prepare Scatter Plot (Use Forge Dataset / Iris Dataset)
2. Write a python program to find all null values in a given data set and remove them.
3. Write a python program the Categorical values in numeric format for a given dataset.
4. Write a python program to transform data with Principal Component Analysis (PCA)
5. Write a python program to implement simple Linear Regression for predicting house price.
6. Write a python program to implement multiple Linear Regression for a given dataset.
7. Write a python program to implement Polynomial Regression for given dataset.
8. Write a python program to Implement Naïve Bayes.
9. Write a python program to Implement Decision Tree whether or not to play tennis.
10. Write a python program to implement linear SVM.
11. Write a python program to find Decision boundary by using a neural network with 10 hidden units on two moons dataset
12. Write a python program to implement k-nearest Neighbors ML algorithm to build prediction model.
13. Write a python program to implement k-means algorithm on a synthetic dataset.
14. Write a python program to implement Agglomerative clustering on a synthetic dataset.

Assignments of Full Stack Development - II:

1. Installation and configuration of React and necessary tools.
2. Design and handle forms in React.
3. Creating a simple counter using React which increments or decrements count dynamically on-screen as the user clicks on the button.
4. Implement checklist in React. Page should display list of options, and selected choices on the web page dynamically.
5. Implement Search Filter in React.
6. Implement authentication process using JWT concepts.
7. Create a route for adding a todo item and adding dynamic routes for each todo item
8. Implement Socket programming
9. Deploying and hosting React.js Applications

CS-610-MJ Big Data

Lectures: 30 (Credits-2)

Prerequisites:

- Basic knowledge of Programming Language (preferably Java),
- Basic knowledge of SQL,
- Exposure to Linux Environment

Course Objectives:

1. To understand Big Data platform and its Use cases
2. To provide overview of Apache Hadoop
3. To provide understanding of HDFS concepts
4. To Understand concepts of Map Reduce
5. To provide hands on Hadoop Eco System

Learning Outcomes: On completion of this course, students will be able to:

1. Identify Big Data
2. List components of Hadoop and Hadoop Eco system
3. Get knowledge of Map Reduce framework
4. To use framework like Pig and Hive to process Big Data

Unit 1: Introduction to Big Data

06

- 1.1 What is Big Data?
- 1.2 History of Data Management – Evolution of Big Data
- 1.3 Characteristics of Big Data (3V's of Big Data)
- 1.4 Challenges of Big Data
- 1.5 Approaches used traditionally to solve data volume related challenges
- 1.6 NoSQL
 - 1.6.1 Sharding, Replication, Combination of Sharding and Replication
- 1.7 Big Data Analytics
 - 1.7.1 Need for Big Data Analytics
 - 1.7.2 Stages in Big Data Analytics
 - 1.7.3 Types of Big Data Analytics
 - 1.7.4 Domains for Big Data Analytics: Healthcare, Telecom, Finance, Logistics, Retail, Governmentetc.

Unit 2: Introduction to Hadoop

04

- 2.1 Introducing Hadoop, RDBMS versus Hadoop
- 2.2 Distributed Computing Challenges, History and overview of Hadoop,
- 2.3 Processing Data with Hadoop
- 2.4 Interacting with Hadoop Ecosystem
- 2.5 HDFS (Hadoop Distributed File System)

Unit 3: Hadoop Distributed File System (HDFS)	04
3.1 The Design of HDFS,	
3.2 HDFS Concepts, Basic Filesystem Operations,	
3.3 Hadoop Filesystems.	
3.4 The Java Interface- Reading Data from a Hadoop URL	
3.5 Reading Data Using the Filesystem API, Writing Data.	
3.6 Data Flow- Anatomy of a File Read, Anatomy of a File Write	
3.7 Managing Resources and Applications with Hadoop YARN (Yet Another Resource Negotiator)	

Unit 4: Understanding Map Reduce Fundamentals	08
4.1 The MapReduce Framework	
4.2 Mapper, Reducer, Combiner, Partitioner	
4.3 Searching, Sorting, Compression	
4.4 Techniques to Optimize MapReduce Jobs	
4.5 Uses of MapReduce	
4.6 Developing Simple MapReduce Application	

Unit 5: Hive and Pig	08
5.1 Introducing Hive	
5.2 Getting Started with Hive	
5.3 Hive Services	
5.4 Data Types in Hive	
5.5 Built-In Functions in Hive	
5.6 Hive DDL - Data Manipulation in Hive	
5.7 Data Retrieval Queries	
5.8 Using JOINS in Hive	
5.9 Introducing Pig	
5.10 Getting Started with Pig Latin	
5.11 Working with Operators in Pig	
5.12 Debugging Pig	

Reference Books:

1. Seema Acharya, Subhashini Chellappan, —"Big Data and Analytics", Wiley Publications, 2nd Edition, 2014
2. Tom White, —"Hadoop: The Definitive Guide", O'Reilly, 3rd Edition, 2012.
3. DT Editorial Services - "Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization"

CS-611-MJP - Lab Course Based on Big Data

No. of Sessions - 15 (Credits - 2)

Assignments:

1. Assignments Based on simple Hadoop commands
2. Assignments based on Map Reduce
3. Assignments using Apache HIVE
4. Assignments Using Apache PIG

CS-612-MJ - Web Analytics

Lectures: 30 (Credits-2)

Prerequisites: None

Course Objectives:

1. To understand social media, web and social media analytics, and their potential impact.
2. To determine how to leverage social media for better services and understand usability metrics, web and social media metrics.
3. To understand how to make use of various data sources and collect data relating to the metrics and key performance indicators.
4. To identify key performance indicators for a given goal, identify data relating to the metrics and key performance indicators.

Learning Outcomes: On completion of this course, students will be able to:

1. understand how to perform web and social media analytics and its impact.
2. understand how to avail better services from social media web and social media metrics.
3. understand various sources of data and how to collect data required for measuring the performance of web site or social media.

Unit 1: Introduction

02

- 1.1 What is web Analytics
- 1.2 Importance of web Analytics
- 1.3 Web Analytics process
- 1.4 Types of web analytics
- 1.5 Web analytics technical requirements
- 1.6 Web analytics 2.0 framework

Unit 2: Qualitative Analysis

04

- 2.1 Heuristic evaluations:
 - 2.1.1 Conducting a heuristic evaluation
 - 2.1.2 Benefits of heuristic evaluations
- 2.2 Site Visits:
 - 2.2.1 Conducting a site visit,
 - 2.2.2 Benefits of site visits
- 2.3 Surveys:
 - 2.3.1 Website surveys
 - 2.3.2 Post-visit surveys
 - 2.3.3 Creating and running a survey
 - 2.3.4 Benefits of surveys

Unit 3: Web Metrics

10

- 3.1 Key metrics
- 3.2 Dashboard
 - 3.1.1 Implementation
 - 3.1.2 Metrics

- 3.1.3 Types of metrics
- 3.2 Conversion
 - 3.2.1 Goals
 - 3.2.2 Funnels
- 3.3 Data sources
 - 3.3.1 server log
 - 3.3.2 visitors data
 - 3.3.3 search engine statistics and conversion funnels
 - 3.3.4 Data segmentation
- 3.4 Analysis
- 3.5 Emerging analytics
 - 3.5.1 e commerce
 - 3.5.2 mobile analytics
 - 3.5.3 A/B testing
- 3.6 Social Media Analytics
 - 3.6.1 Sentimental Analysis
 - 3.6.2 Text Analysis
- 3.7 Annotation and Reporting
 - 3.7.1 Automated
 - 3.7.2 Actionable

Unit 4: Web Analytics 2.0

07

- 4.1 Introduction to analytic 2.0
- 4.2 Competitive intelligence analysis
- 4.3 CI data sources:
 - 4.3.1 Toolbar data
 - 4.3.2 Panel data
 - 4.3.3 ISP data
 - 4.3.4 Search engine data
 - 4.3.5 Hybrid data
- 4.4 Website traffic analysis:
 - 4.4.1 Comparing long term traffic trends
 - 4.4.2 Analyzing competitive site overlap and opportunities

Unit 5: Google Analytics:

07

- 5.1 Audience analysis
- 5.2 Acquisition analysis
- 5.3 Behaviour analysis
- 5.4 Conversion analysis
- 5.5 Google website optimizer
- 5.6 Implementation technology
- 5.7 Privacy issues

Reference Books:

1. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd ed.
2. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of Customer

Centricity, Wiley Publishing, Inc. 1st ed.

3. Kaushik A., *Web Analytics: An Hour a Day*, 1st ed.
4. Sterne J., *Web Metrics: Proven methods for measuring web site success*, John Wiley and Sons

CS-613-MJ - Lab Course Based on Web Analytics

No. of Sessions 15 (Credits-2)

Assignments:

1. Mining Twitter: Exploring Trending Topics, Discovering What People Are Talking About, and More
Why Is Twitter All the Rage? Exploring Twitter's API, Fundamental Twitter, Terminology, Creating a Twitter API Connection, Exploring Trending Topics, Searching for Tweets, Analysing the 140 Character, Extracting Tweet Entities, Analysing Tweets and Tweet Entities with Frequency Analysis, Computing the Lexical Diversity of Tweets, Examining Patterns in Retweets, Visualizing Frequency Data with Histograms
2. Mining Facebook: Analysing Fan Pages, Examining Friendships, and More Overview, Exploring Facebook's Social Graph API, Understanding the Social Graph API, Understanding the Open Graph Protocol, Analysing Social Graph Connections, Analysing Facebook Pages, Examining Friendships
3. Mobile Analytic: Analyse the your site on mobile device
In last 30 days, how many new users come from mobile, What was the bounce rate of visitors on mobile device, What was the average session duration?
4. Segment traffic:
Which social channel is sending the most engaged new users, Which page of your Website have been shared most, Which URL has the best engagement matrix.
5. Use Google Analytics to measure the various metrics for E-commerce site amazon.
On-site – It measures the users' behaviour once it is on the website. For example, measurement of your website performance.
Off-site – It is the measurement and analysis irrespective of whether you own or maintain a website. For example, measurement of visibility, comments, potential audience, etc.
6. Use Google Analytics to measure the various metrics for E-commerce site flipkart
Count
It is most basic metric of measurement. It is represented as a whole number or a fraction. For example,
Number of visitors = 12999, Number of likes = 3060, etc.
Total sales of merchandise = \$54,396.18.
Ratio
It is typically a count divided by some other count. For example, Page views per visit.
Key Performance Indicator (KPI)
It depends upon the business type and strategy. KPI varies from one business to another.
7. Visitors loyalty:
Analyse the person who visit site again and again is loyal to company because they can become customer
8. Consider the any E-Commerce site and to measure the web analytics.
Content
It gives you insight about website's content section. You can see how each page is doing, website loading speed, etc.
Page Load Time
More is the load time, the more is bounce rate. Tracking page load time is equally

important.

Engagement Rate

It shows how long a person stays on your web page. What all pages he surf. To make your web pages more engaging, include informative content, visuals, fonts and bullets.

9. Text Analytics: Interpreting Twitter Data From college students Tweets. Extracting Tweet Entities, Analysing Tweets and Tweet Entities with Frequency Analysis, Computing the Lexical Diversity of Tweets, Examining Patterns in Retweets, Visualizing Frequency Data with Histograms

10. Consider the any E-Commerce site and to measure the web analytics.

Bounce Rate

If a person leaves your website within a span of 30 sec, it is considered as a bounce.

The rate at which users spin back is called the bounce rate.

To minimize bounce rate include related posts, clear call-to-action and backlinks in your webpages.

Behavior

Behavior lets you know page views and time spent on website. You can find out how customer behaves once he is on your website.

CS-631-RP : Research Project

(Credits-4)

Guidelines:

1. Students should work in a team of minimum 2 and maximum 3 students.
2. Students can choose a project topic without any restriction on technology or domain.
3. Students are expected to carry out the following tasks during project work –
 - a. Problem Identification
 - b. Literature Review/ Study
 - c. Feasibility Study
 - d. Design (includes DB design, system flow or design diagrams)
 - e. Modelling (if applicable)
4. Track sheet will be maintained by project guide for each group separately.
5. Project guide will conduct presentation for the work done (mentioned in point no. 3)
6. Project groups will work on actual development and/or implementation of proposed idea/topic.
7. Record of progress will also be maintained by keeping track sheet.
8. At the end of the project, the group should prepare a report which should conform to international academic standards. The report should follow the style in academic journals and books, with clear elements such as: abstract, background, aim, design and implementation, testing, conclusion and full references, Tables and figures should be numbered and referenced to in the report.
9. Minimum 2 demos will be conducted for the project work.
10. The final project presentation with demonstration (EE) will be evaluated.

SECOND YEAR: SEMESTER II

CS-651-MJP: Industrial Project Design

(Credits- 04)

Course Objectives:

1. To develop skills in the application of theory to practical work situations
2. To apply the design techniques studied in theory to a real life project.
3. To expose students to real work environment.

Learning Outcomes: After completion of the course, students will be able to:

1. Apply fundamental principles of software design to real world problems.

Guidelines:

1. Each student will take up either training at an industry/research institute or will work on campus on a project idea. This will be a full time activity for the period of minimum four months.
2. The institute will appoint faculty members to work as coordinators/mentors to supervise this activity.
3. Student has to follow the software development life cycle for the software project, which they are doing in industry / research institute and design the software system using UML techniques.
4. Continuous assessment will be carried out by the faculty mentor for 50% marks on the basis of weekly attendance and the correctness of the design.
5. A student will produce a hard copy of the project report at the time of final exam, which will include all the UML diagrams and student will have to explain his/her project with the help of diagrams.

CS-660-MJ and CA-661-MJ: MOOC courses

(2 courses of 2 credits each)

Guidelines:

1. Students are supposed to complete 2 online MOOC courses during their second semester of second year.
2. Students can opt for Swayam, NPTEL, Spoken tutorial courses.
3. Students should register for these courses in parallel to their Industrial Training.
4. Each course should be of minimum 30 hours (2 credits)
5. Students will have to appear for online exams of the courses and should obtain the passing certificate to earn the credits.
6. The number of hours of the course must be mentioned on the certificate and it should be minimum 30 for gaining 2 credits.
7. The courses should be relevant to Computer Science

CS-681-OJT: Industrial Training / Industrial Project

(Credits- 14)

Course Objectives:

1. To develop skills in the application of theory to practical work situations
2. To provide students the opportunity to test their interest in a particular career
3. To expose students to real work environment experience, gain knowledge in writing report in technical works/projects.
4. To build strength, teamwork spirits and self-confidence in student.

Learning Outcomes: After completion of the course, students will be able to:

1. Apply fundamental principles of the subjects to solve real world problems.
2. Become master in at least one specialized area
3. Able to communicate efficiently
4. Ability to identify, formulate and model problems and find solutions.

Guidelines:

1. Each student will take up either training at an industry/research institute or will work on campus on a project idea. This will be a full time activity for the period of minimum four months.
2. The institute will appoint faculty members to work as coordinators/mentors to supervise this activity.
3. Students will meet the coordinator/mentor at least once in a week and will submit synopsis and weekly report of the work done during the period of Industrial training (ITP).
4. Continuous assessment will be carried out by the faculty mentor for 50% marks based on weekly attendance, performance, progress report, presentations given by the student.
5. After Completion of the ITP, a student will have to submit the project completion certificate from the respective industry/research institute.
6. A student will produce a hard copy (Hard Bound with black colour cover and Golden Embossing on it) and a soft copy of the report in the specified format.
7. End semester examination will be conducted by two examiners: faculty mentor, expert from industry (appointed by the college).
8. Student will have to present the work done by him/her in the period of Industrial Training with the help of PowerPoint presentation.

Evaluation Pattern

The internal and external evaluation will be 50-50%

For all the courses, which are of four credits, total marks will be 100. Out of 50 marks will be allotted for internal evaluation and 50 marks for external evaluation.

For all the courses, which are of two credits, total marks will be 50. Out of 25 marks will be allotted for internal evaluation and 25 marks for external evaluation.

Theory Courses of four credits:

- Internal evaluation will be of 50 marks for which 4 continuous evaluation exams of 10, 10, 10 and 20 marks will be conducted
- External evaluation will be of 50 marks

Theory Courses of two credits:

- Internal evaluation will be of 25 marks for which 3 continuous evaluation exams of 10, 5 and 10 marks will be conducted
- External evaluation will be of 25 marks

Practical Courses of four credits:

- Internal evaluation will be of 50 marks out of which 30 marks will be for assignments/submissions done throughout the semester and a test/viva will be conducted for 20 marks
- External evaluation will be of 50 marks

Practical Courses of two credits:

- Internal evaluation will be of 25 marks out of which 15 marks will be for assignments/submissions done throughout the semester and a test/viva will be conducted for 10 marks
- External evaluation will be of 25 marks

Methods of assessment for internal evaluation:

Seminar, objective test, open book test, Quiz, viva, projects, assignments, group discussion, research paper review, case study, industrial visit

Passing percentage

The student must secure at least 40% marks of that course to earn the full credit.

Examination	Credits	Marks Out of	Passing marks (40%)
Internal	4	50	20
External	4	50	20
Internal	2	25	10
External	2	25	10

Note: There is separate passing for internal and external examinations.