SOFTWARE ENGINEERING & AGILE METHODOLOGIES

(CORE COURSE - 11)

Credits : 4 **Semester: IV**

Subject Code: CSML24401 **No. of Lecture hours: 60**

Objectives:

- To enable students to learn software engineering principles
- To learn the theoretical foundation from the view of Object-Oriented Concepts.

Course Outcome:

CO1: Design software through various process models.

CO2: Analyze Object-Oriented concepts and various models.

CO3: Choose different designs and architectures.

CO4: Explain components, golden rules, and design evaluation.

CO5: Select testing techniques and about DevOps.

UNIT - I	**12 Hrs**
1. The evolving role of software, software, changing nature of software	2
2. Legacy Software, Software Myths	2
3. Software engineering-layered technology, Process Framework	2
4. CMMI, Process patterns, Personal and Team Process	2
5. Process Models: waterfall, incremental, evolutionary process models	2
6. Agile Process Models	2

UNIT- II		**12 Hrs**
1.	Requirements Engineering tasks, initiating requirements engineering process	2
2.	Eliciting requirements	1
3.	Developing Use Cases, Building analysis Model	2
4.	Negotiating and validating requirements	2
5.	Requirements analysis, analysis modeling approaches, Data modeling Concepts	2
6.	Object-oriented analysis, Scenario-based modeling, Flow oriented modeling	2
7.	Class-based modeling, creating behavioral model	1

UNIT - III		**12 Hrs**
1.	Design Process and Quality	2
2.	Design concepts and Design model	2

3.	Pattern Based software design	2
4.	Software architecture, Data design, Architectural styles and Patterns	2
5.	Architectural design, Assessing alternative architectural design	2
6.	Managing Data flow into Software architecture	2

UNIT - IV **12 Hrs**

1.	Introduction to Components, designing class-based components	2
2.	Conducting component level design, Object constraint language	2
3.	Design conventional components	2
4.	Golden Rules, User Interface Analysis and Design	2
5.	Design Evaluation	2
6.	Software Metrics and its types	2

UNIT - V **12 Hrs**

1.	A Single approach to Software Testing, Software Quality	1
2.	Strategic issues, Test strategies for Conventional Software	2
3.	Validation testing, System Testing	1
4.	Testing fundamentals, Black box and White Box Testing	2
5.	Devops: Introduction, cloud as a Platform-Operations.	2
6.	Deployment Pipeline: Architecture-Building and testing.	2
7.	Case Study: Migrating to Microservices	2

ESSENTIAL READING

1. Pressman, Rogers S. 2015. Software Engineering, A Practitioner's Approach. 8th Edition. McGraw Hill Education.

2. Jennifer Davis and Ryn Daniels 2016. Effective Devops, 1st edition O'Reilly publication.

SUGGESTED READING

1. Deepak Jain. 2009. Software Engineering. New Delhi: Oxford University Press.

2. Rajib Mall. 2018. Fundamentals of Software Engineering. 5th Edition. New Delhi: PHI.

3. Sommerville. 2007. Software Engineering. 9th Edition. New Delhi: Pearson Education.

WEB TECHONOLOGIES

(CORE COURSE – 12)

Credits : 4 **Semester: IV**

Subject Code : CSML24402 **No. of Lecture hours: 60**

Objectives:

To design and develop web pages using HTML and CSS.

Course Outcome:

CO1: Illustrate basic HTML scripts to design web pages.

CO2: Explain about cascading style sheets.

CO3: Analyze java script programming using operators, expressions, functions.

CO4: Classify event handling in java script and introduction to XML.

CO5: Develop PHP programs and database connectivity through MySQL.

UNIT – I	**12 Hrs**
Origin and evolution of HMTL and XHTML, basic syntax	3
Document structure	3
Basic text markup, images	2
Hypertext links, lists	2
Tables, forms	2
Frames	2

UNIT – II	**12 Hrs**
CASCADING STYLE SHEETS	
Introduction, level of style sheets, style specification format	3
Selector forms, property value forms	3
Font properties, List properties	2
Color, alignment of text, the box model	2
Background images, the and tags	2

UNIT – III	**12 Hrs**
JAVASCRIPT	
Overview, object orientation and JavaScript	2
General synthetic characteristics	2

Primitives, operations, expressions	2
Control statement, screen output and keyboard input	2
Object creation and modifications, arrays, functions	2
Pattern matching using regular expressions	2

UNIT – IV **12 Hrs**

EVENT HANDLING JAVA SCRIPT

Document object model, element access in JavaScript	2
Events and event handling	2
Human events from body, button, text box and password elements	2
Moving elements, element visibility, changing color and fonts	2

XML

Introduction, syntax, document structure, DTD	2
Displaying XML documents with CSS, XSLT style sheets	2

UNIT – V **12 Hrs**

Overview of PHP, General synthetic characteristics	2
Primitives, Operations and Expressions	2
Output, control statements, arrays, functions	2
Pattern matching, Form handling, Files, Cookies, and session tracking	2
Database access through web: Architectures for database access	2
MySQL Database System, Database access with PHP and MySQL	2

ESSENTIAL READING:

1. Sebesta, Robert W. 2008. **Programming the World Wide Web.** 4th Edition. New Delhi: Pearson Education.

DATA MINING

(SEC - 3)

Credits : 4 **Semester: IV**

Subject Code: CSML24403 **No. of Lecture hours: 75**

Objective: To get familiar with mathematical foundations of data mining tools and master the techniques in various applications.

Course Outcomes:

CO1: Understand the functionality of various data mining and data warehousing components.

CO2: Appreciate the strengths and limitations of various data mining and data warehousing models.

CO3: Characterize the kinds of patterns that can be discovered by association rule mining.

CO4: Discover interesting patterns from large amounts of data to analyze for predictions and classifications.

CO5: To **organize** unlabeled data into groups based on their similarities.

UNIT – I	**15 Hrs**
Moving toward the Information Age	1
Data Mining as the Evolution of Information Technology	1
Database Data, Data Warehouses, Transactional Data, Other Kinds of Data	2
Class/Concept Description: Characterization and Discrimination	1
Mining Frequent Patterns, Associations, and Correlations	1
Classification and Regression for Predictive Analysis	1
Cluster Analysis	1
Outlier Analysis	1
Statistics, Machine Learning	2
Database Systems and Data Warehouses	1
Information Retrieval	1
Business Intelligence, Web Search Engines	2

UNIT – II	**15 Hrs**
Data Mining overview, Data Warehouse and OLAP Technology	1
Data Warehouse Architecture	1
Steps for the Design and Construction of Data Warehouses	2
A Three-Tier Data Warehouse Architecture	1

OLAP, OLAP queries, metadata repository	2
Data Preprocessing – Data Integration and Transformation	2
Data Reduction	2
Data Mining Primitives: What Defines a Data Mining Task?	1
Task-Relevant Data, The Kind of Knowledge to be Mined.	1
KDD	2

UNIT – III **15 Hrs**

Mining Association Rules in Large Databases.	1
Association Rule Mining, Market Basket Analysis: Mining A Road Map.	1
The Apriori Algorithm: Finding Frequent Item Sets Using Candidate Generation	2
Generating Association Rules from Frequent Item Sets	2
Improving the Efficiently of Apriori, Mining Frequent Item sets without Candidate Generation	
Multilevel Association Rules.	2
Approaches to Mining Multilevel Association Rules.	2
Mining Multidimensional Association Rules for Relational Database and Data Warehouses	
Multidimensional Association Rules	2
Mining Quantitative Association Rules	1
Mining Distance-Based Association Rules	1
From Association Mining to Correlation Analysis	1

UNIT – IV **15 Hrs**

Introduction to classification and prediction	1
Issues Regarding Classification and Prediction.	1
Classification by Decision Tree Induction.	2
Bayesian Classification, Bayes Theorem, Naïve Bayesian Classification	2
Classification by Backpropagation	1
A Multilayer Feed-Forward Neural Network	1
Define Network Topology	1
Classification Based on Concepts from Association Rule Mining	1
Other Classification Methods, k-Nearest Neighbor Classifiers	2
Genetic Algorithms, Rough Set Approach, Fuzzy Set Approaches	1
Prediction, Linear and Multiple Regression, Nonlinear Regression	1
Other Regression Models, Classifier Accuracy	1

UNIT – V	15 Hrs
Introduction to clustering, Types of Data in Cluster Analysis	1
A Categorization of Major Clustering Methods	1
Classical Partitioning Methods: k-Means and k-Medoids	2
Partitioning Methods in Large Databases: From k-Medoids to CLARANS	2
Hierarchical Methods, Agglomerative and Divisive Hierarchical Clustering	2
Density-Based Methods	2
Wave Cluster: Clustering Using Wavelet Transformation	2
CLIQUE: Clustering High-Dimensional Space, Model-Based Clustering Methods	2
Statistical Approach, Neural Network Approach.	1

ESSENTIAL READING:

1. Jiawei Han, Jian Pei, HangHang Tong, "Data Mining Concepts and Techniques", fourth Edition, 2022, Morgan Kaufmann Publishers, Elsevier.

2. Charu C. Aggarwal, "Data Mining - The Textbook", 2015, Springer Nature Publisher.

DESIGN AND ANALYSIS ALGORITHMS

(GE - 2)

Credits : 4 **Semester: IV**

Subject Code: CSML24404 **No. of Lecture hours: 75**

Objective: To understand data structures and emphasizes design and analysis of algorithms.

Course Outcomes:

CO1: Define elementary data structures.

CO2: Explain divide and conquer, greedy methods with examples.

CO3: Explain divide and conquer, greedy methods with examples.

CO4: Explain back tracking and branch and bound.

CO5: Analysis of NP – Hard and NP – complete problems.

UNIT – I	**15 Hrs**
Definition of an algorithm	
Algorithm specifications, Performance analysis	3
Randomized algorithms	4
Elementary Data Structures	
Stacked and queues, trees, Dictionaries	4
Sets and disjoint set union, Graphs	4

UNIT – II	**15 Hrs**
Divide and Conquer	
Binary search, finding maximum and minimum	3
Merge sort, quick sort	4
The Greedy Method	
Knapsack problem, tree vertex splitting	4
Minimum cost spanning trees, Single source shortest paths.	4

UNIT – III	**15 Hrs**
Dynamic Programming	
General Method, multistage graphs	3
All – pairs shortest path, single source shortest path	3
The travelling salesperson problem.	3

Basic traversal and search techniques

Techniques for binary trees 3

Techniques for graphs 3

UNIT – IV **15 Hrs**

Back Tracking

General method, 8 – Queens problem, Knapsack Problem. 7

Branch – Bound

The method, 0/1 knapsack Problem, Travelling salesperson 8

UNIT – V **15 Hrs**

NP – Hard and NP – complete problems

Basic concepts, Cook's Theorem 7

NP – Hard graph problems, Some simplified NP – Hard Problems 8

ESSENTIAL READING:

1.E. Horowitz, S. Sahni, S. Rajasekaran, 2007, "Fundamentals of Computer Algorithms", 2nd edition, Hyderabad University Press.

SUGGESTED READING:

1. Pannerselvam. R, 2007, "Design Analysis of Algorithms", PHI, New Delhi.
2. Hari, Mohan Pandey, 2009, "Design analysis and Algorithms", University Science Press, India.
3. TH Cormen, CE Leiserson, RL Rlvert, C. Stein, 2010, "Introduction to Algorithms", 3rd Edition, PHI, New Delhi.
4. PH Dave, HB Dave, 2008, "Design and Analysis of Algorithms", Pearson Education, New Delhi.

INTRODUCTION TO MACHINE LEARNING

(CORE - 13)

Credits : 4 **Semester: IV**

Subject Code: CSML24405 **No. of Lecture hours: 60**

Objectives:

- To understand the concepts of machine learning
- To understand supervised and unsupervised learning and their applications
- To learn aspects of computational learning theory.

Course Outcomes:

CO1: Understand the fundamental issues and challenges of machine learning and basics of Python for machine learning

CO2: Classify the supervised learning algorithms and apply to the given data set.

CO3: **Identify** the underlying relationships within and across unsupervised Machine Learning algorithms

CO4: Evaluate and interpret the results of Neural Networks

CO5: Design and **implement** advanced machine learning algorithms

UNIT – I: Introduction to Machine Learning	**12 Hrs**
Overview of Machine Learning: Definition, scope and applications	2
Types of learning: Supervised, unsupervised and reinforcement	2
Basic concepts and Python basics for ML	
Understanding datasets, features and labels	2
Exploratory data analysis, data visualization	3
Libraries: NumPy, Pandas, Matplotlib	3

UNIT – II: Supervised Learning	**12 Hrs**
Linear regression: Basic and mathematical representation	3
Introduction to regression: linear and multiple regression	3
Classification algorithms: logistic regression, KNN, decision trees, SVM	3
Evaluation metrics: accuracy, precision, recall	3

UNIT – III: Unsupervised Learning	**12 Hrs**
Clustering: K – Means, Hierarchical clustering	4
Dimensionality reduction: PCA	4

Association rule learning: Apriori algorithm	4

UNIT – IV: Introduction to Neural Networks	**12 Hrs**
Basics of Neural Networks: Neurons, layers, activation functions	4
Feedforward and backpropagation	4
Types of neural networks: MLPs, CNNs, RNNs	4

UNIT – IV: Advanced Topics in Machine Learning	**12 Hrs**
Natural Language Processing (NLP): Basics and applications in text processing	3
Transfer learning: Understanding transfer learning	2
Applications of pre – trained models	2
Artificial Intelligence Integration: Exploring intersections between AI and ML	1
Applications and synergies	1
Reinforcement learning fundamentals: Basics, algorithms, and key concepts	3

ESSENTIAL READING:

1. Ethem Alpaydin , 2020, "An Introduction to Machine Learning" 4th Edition, MIT Press.

2. Sebastian Raschka, Vahid Mirjalili, 2019, "Python Machine Learning", 3rd Edition, Packt Publishing Ltd.

3. Aurelien, 2022, “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools and techniques to build Intelligent Systems" 3rd Edition, Shroff/O’Reilly.

SUGGESTED READING:

1. Andrew NG, 2018, “Machine Learning Yearning – Technical Strategy for AI Engineers, in the Era of Deep Learning”, 1st Edition.(Web link)

2. Christopher M. Bishop, 2016, “Pattern Recognition and Machine Learning" Softcover reprint of the original 1st ed. 2006, Springer Publication.

OPERATING SYSTEMS

(CORE COURSE - 14)

Credits : 4 **Semester: IV**

Subject Code: CSML24406 **No. of Lecture hours: 60**

Objective: To learn the core ideas in operating systems, process management, memory processing, CPU Scheduling, concurrent programming, dead locks and file systems.

Course Outcome:

CO1: Describe and compare different structures for operating systems.

CO2: Understand and analyze theory and implementation of process.

CO3: Understand what is deadlock and how it occurs when giving mutually exclusive access to multiple resources.

CO4: Understand the concepts of file system interface.

CO5: Define segmentation of memory management in operating systems.

UNIT – I	**12 Hrs**
Introduction to operating systems, mainframe systems, desktop systems	2
Multiprocessor systems, distributed systems, clustered systems	2
Real time systems, handheld systems	2
Operating system structures – system components	2
Operating systems services, system calls	2
System programs, system structures, virtual machine	2

UNIT – II	**12 Hrs**
Process concept, process scheduling	3
Operation on processes, cooperating processes	3
Inter process communication	3
Process Scheduling – basic concepts, scheduling criteria, scheduling algorithms	3

UNIT – III	**12 Hrs**
Process synchronization – critical selection problem	3
Semaphores, monitors	3
Deadlocks: deadlock characterization, methods for handling deadlocks	3
Deadlock prevention, deadlock avoidance, deadlock detection	3

UNIT – IV	**12 Hrs**
File system: file concept, access methods	3
Directory structure, file system mounting, file system sharing	3
File system implementation – file system structures, file system implementation	3
Directory implementation, allocation methods, free space management	3

UNIT – V	**12 Hrs**
Memory management – swapping, contiguous memory allocation	2
Fragmentation – internal and external fragmentation	2
Paging, segmentation, segmentation with paging	2
Virtual memory management – demand paging	2
Page replacement algorithms, thrashing and working set model	2
workstations: Introductions, types – single CPU, multi – GPU	
and optimized modeling with NVIDIA GPU acceleration, Edge XT workstation.	1
features, performance, technologies, configurations of the above-mentioned workstations.	1

ESSENTIAL READING:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, 2017, "Operating System Concepts", 8th Edition, Wiley India.

SUGGESTED READING:

1. Andrew S, Tanenbaum, 2009, "Modern Operating Systems", 3nd Edition, Prentice Hall India Learning Private Limited.

WEB TECHNOLOGIES PRACTICAL

(CORE COURSE – 12)

Credits : 1 **Semester: IV**

Subject Code: CSML24407 **No. of Practical Hours: 30**

Objective:

To develop web applications using HTML, JavaScript, XML.

Outcome:

Students will be able to develop dynamic web pages using Java Script, gain knowledge in server-side scripting with PHP language, and parsing XML.

1-2. Programs to demonstrate basic HTML tags.

3-4. Programs to demonstrate on different types of lists.

5-6. Programs to demonstrate frames, forms, tables creation.

7. Programs to demonstrate on inline, external, embedded style sheets.

8-9. Programs to demonstrate control structures.

10. Programs to demonstrate functions, arrays.

11. Programs to demonstrate XML document.

12. Programs to demonstrate on DTD and its XML document.

13. Programs to demonstrate control structures in PHP.

14-15. Programs to demonstrate arrays and functions in PHP.

INTRODUCTION TO MACHINE LEARNING PRACTICAL

(CORE - 13)

Credits : 1 **Semester: IV**

Subject Code: CSML24408 **No. of Practical Hours: 30**

Objective: To develop a general-purpose algorithm that solves a practical and focused problem.

Outcome: To provide basic grounding in concepts such as training and testing sets, overfitting, and error rates.

List of Practical Programs:

1. Linear Regression
2. Logistic Regression
3. K Nearest Neighbour (KNN)
4. Decision Tree algorithm
5. Support Vector Machine (SVM)
6. K Means algorithm
7. Apriori algorithm
8. Artificial Neural Networks (ANN)

CASE STUDIES:

Case Study 1: Movie Recommendation System

Scenario: An online streaming platform wants to enhance user experience by recommending movies based on user preferences.

Objective: Develop a basic recommendation system using user ratings and movie metadata.

Tasks:

- Explore and preprocess movie ratings data.
- Implement a simple collaborative filtering algorithm.
- Evaluate the recommendation system's effectiveness.

Supervised Learning

Case Study 2: Predicting Housing Prices

Scenario: A real estate agency wants to predict housing prices based on various features like square footage, number of bedrooms, and location.

Objective: Build a regression model to predict house prices.

Tasks:

- Collect and preprocess housing data.
- Train a linear regression model using scikit-learn.
- Evaluate the model's performance and interpret coefficients.

Unsupervised Learning

Case Study 3: Customer Segmentation for an E-commerce Platform

Scenario: An online retailer wants to understand its customer base and tailor marketing strategies.

Objective: Apply clustering algorithms to segment customers based on their purchasing behavior.

Tasks:

- Analyze and preprocess customer transaction data.
- Apply K-Means clustering to identify customer segments.
- Visualize and interpret the customer segments.

Neural Networks

Case Study 4: Image Classification of Animals

Scenario: A zoo wants to automate the classification of animals in images captured by security cameras.

Objective: Build a neural network model to classify images into different animal categories.

Tasks:

- Collect and preprocess a dataset of animal images.
- Implement a simple neural network using a deep learning framework.
- Train the model and assess its accuracy.

BRIDGE COURSE

Title: Basics of Mathematics, Electronics & Computer Science

Semester: I **Number of Lecture Hours: 15 Hours**

Objective: To assist the students in transitioning smoothly from their previous educational level to the current one.

Outcome: The course enables the students to improve their skill sets and makes them ready with confidence to pursue their current education.

MATHEMATICS **5 Hrs**

1. Differential Equations- Order and Degree of the Differential Equations
2. Differential equations of first order and First Degree
3. Methods of solving Differential Equations- Variables separable- Homogeneous Equations
4. Non- Homogeneous Equations

ELECTRONICS **5 Hrs**

Resisters and color-coding

Units and measurements

Measuring instruments – CRO, multi-meter, etc.

Capacitors

Boolean Algebra

COMPUTER SCIENCE **5 Hrs**

1. Introduction: What is a computer, characteristics of a computer
2. Generations of computers.
3. Classifications of computers.
4. Applications of computers.
5. Input and output devices.

SELF STUDY COURSE

Title: IT ACT

Semester: IV **No. of Lecture Hours: 30**

Objectives: IT ACT explains the cyber laws that are in place to keep cybercrimes in check. In addition to cyber laws, it elaborates various IT Security measures that can be used to protect sensitive data against potential cyber threats.

Outcome: Students will be able to gain knowledge on cyber laws and IT security.

UNIT – I **6 Hrs**

1. Introduction to Cyber Law & IT Act Overview
2. Cyberspace, Cyber security, Cyber security Policy and Cyber Crime
3. Information Technology Act, Mission and Vision Cyber security Program
4. Cyber Law – Objectives, Emerging Trends of Cyber Law
5. Create Awareness, Areas of Development

UNIT – II **6 Hrs**

1. Cyber Law - Intellectual Property Right
2. Types of Intellectual Property Rights
3. Advantages of Intellectual Property Rights
4. Intellectual Property Rights in India
5. Intellectual Property in Cyber Space

UNIT – III **6 Hrs**

1. Cyber Law - Strategies for Cyber Security
2. Strategy 1 − Creating a Secure Cyber Ecosystem
3. Strategy 2 − Creating an Assurance Framework
4. Strategy 3 − Encouraging Open Standards
5. Strategy 4 − Strengthening the Regulatory Framework
6. Strategy 5 − Creating Mechanisms for IT Security
7. Strategy 6 − Securing E-Governance Services
8. Strategy 7 − Protecting Critical Information Infrastructure

UNIT – IV **6 Hrs**

1. Cyber Law - Policies to Mitigate Cyber Risk
2. Mitigate Risks through Human Resource Development
3. Cyber Law - Network Security, Types of Network Security Devices and Firewalls
4. Antivirus, Content Filtering, Intrusion Detection Systems
5. Cyber Law - I.T ACT, Features of I.T Act

UNIT – V **6 Hrs**

1. Scheme of I.T Act, Application of the I.T Act and Amendments Brought in the I.T Act
2. Intermediary Liability, Highlights of the Amended Act
3. Cyber Law – Signatures: Digital Signature

4. Electronic Signature and Digital Signature to Electronic Signature
5. Cyber Law - Offence & Penalties, Offences and Compounding of Offences

ESSENTIAL READING:

1. Brian Craig, **Cyber law: The Law of the Internet and Information Technology** 1st Edition
2. Heather Harrison Denniss**, Cyber Warfare and the Laws of War (Cambridge Studies in International and Comparative Law)** Reprint Edition

SUGGESTED READING:

1. Saurabh Sharma, **Information Security and Cyber Laws Paperback** November 1, 2010.