SOFTWARE ENGINEERING AND PROJECT MANAGEMENT

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21CS61**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamentals of software Development activities, Management functions.

COURSE OBJECTIVES:

- Outline software engineering principles and activities involved in building large software programs.
- Identify ethical and professional issues and explain why they are of concern to Software Engineers.
- Describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.
- Infer the fundamentals of object-oriented concepts, differentiate system models, use UML diagrams and apply design patterns.
- Explain the role of DevOps in Agile Implementation.
- Discuss various types of software testing practices and software evolution processes.
- Recognize the importance Project Management with its methods and methodologies.
- Identify software quality parameters and quantify software using measurements and
- metrics. List software quality standards and outline the practices involved

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS	
MODULE - I	
Introduction: The evolving role of software, The changing nature of software, Software engineering, A Process Framework, Process Patterns, Process Assessment, Personal and Team Process Models, Process Technology, Product and Process. **Process Models**: Prescriptive models, Waterfall model, Incremental process models, Evolutionary process models, Specialized process models. **Requirements Engineering**: Requirements Engineering Task, Initiating the Requirement Engineering process, Eliciting Requirements, developing use cases, Building the analysis model, Negotiating Requirements, Validating Requirements, Software Requirement Document (Sec 4.2). Case Tools(Text book 5).	**8 Hours**
MODULE - II	
Introduction, Modeling Concepts and Class Modeling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modeling history. Modeling as Design technique: Modeling, abstraction, The Three models. Class Modeling: Object and Class Concept, Link and associations concepts, Generalization and Inheritance, A sample class model, Navigation of class models, and UML diagrams **Building the Analysis Models:** Requirement Analysis, Analysis Model Approaches, Data modeling Concepts, Object Oriented Analysis, Scenario-Based Modeling, Flow-Oriented Modeling, class Based Modeling, Creating a Behavioral Model.	**8 Hours**
MODULE - III	
Software Testing: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging. Agile Methodology: Before Agile – Waterfall, Agile Development.	**8 Hours**
MODULE - IV	
Introduction to Project Management: Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.	**8 Hours**
MODULE - V	
Activity Planning: Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass– Backward Pass, identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks. **Software Quality:** Introduction, the place of software quality in project planning, Importance of software quality, software quality models, ISO 9126, quality management systems, process capability models, techniques to enhance software quality, quality plans.	8 Hours

COURSE OUTCOMES		
Upon Completion of this course, the students will be able to:		
CO No.	**Course Outcome Description**	**Bloom's Taxonomy Level**

CO1	Understand the activities involved in software engineering and analyze the role of various process models	CL2
CO2	Explain the basics of object-oriented concepts and build a suitable class model using modeling techniques	CL2
CO3	Interpret various software testing methods and to understand the importance of agile methodology.	CL2
CO4	Apply the Concepts of project planning and quality management in software development	CL2
CO5	Illustrate the importance of activity planning and its models	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1				1		2	1	1		2	1	1
CO2	2	2	2		2	1		2	2	2	2	2	2	1
CO3	2	2	2		2			2	2	3	1	2	3	1
CO4	2	2	2		2			2	3	3	2	2	3	1
CO5	2	2	2		2	2	2	2	3	3	2	2	3	1
3: Substantial (High)					22: Moderate (Medium)					1: Poor (Low)				

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note:

For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05

4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005.
3. Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.
4. Deepak Gaikwad, Viral Thakkar, DevOps Tools from Practitioner's Viewpoint, Wiley.
5. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. https://www.youtube.com/watch?v=WxkP5KR_Emk&list=PLrjkTql3jnm9b5nrggx7Pt1G4UAHeFlJ
3. http://elearning.vtu.ac.in/econtent/CSE.php
4. http://elearning.vtu.ac.in/econtent/courses/video/CSE/15CS42.html
5. https://nptel.ac.in/courses/128/106/128106012/ (DevOps)

DATA SCIENCE AND APPLICATIONS

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21DS62**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Fundamental knowledge of mathematical concepts, analytical skills and programming.

COURSE OBJECTIVES:

- Develop relevant programming abilities.
- Demonstrate proficiency with statistical analysis of data.
- Develop the ability to build and assess data-based models.
- Learn to execute statistical analyses.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction: The Ascendance of Data, What Is Data Science? , Visualizing Data, matplotlib, Bar Charts, Line Charts, Scatterplots, Statistics, Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation, Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem. ***Text book 1: Chapter 1, Chapter 3, Chapter 5 and Chapter 6***	**8 Hours**

MODULE - II

Working with data: Getting Data, stdin and stdout, Reading Files, Scraping the Web, Using APIs, Example: Using the Twitter APIs, Exploring the Data, Using NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, An Aside: tqdm, Dimensionality Reduction. The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, Projection, Manifold Learning, PCA, Preserving the Variance, Principal Components, Projecting Down to d Dimensions.	**8 Hours**

Text book 1: Chapter 9 and Chapter 10 ***Text book 2: Chapter 8***	
MODULE - III	
Training: Models, Linear Regression, The Normal Equation, Computational Complexity, Gradient Descent, Batch Gradient Descent, Stochastic Gradient Descent, Mini-batch Gradient Descent, Polynomial Regression, Learning Curves, Regularized Linear Models , Ridge Regression, Lasso Regression, ElasticNet Early Stopping, Logistic Regression, Estimating Probabilities, Training and Cost Function Decision Boundaries, Softmax Regression ***Text book 2: Chapter 4***	**8 Hours**
MODULE - IV	
Machine Learning and Deep Learning: Machine Learning, Modeling, What Is Machine Learning, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, Neural Networks, Perceptrons, Feed-Forward Neural Networks, Backpropagation, Example: Fizz Buzz, Deep Learning, The Tensor, The Layer Abstraction, The Linear Layer, Neural Networks as a Sequence of Layers, Loss and Optimization, Other Activation Functions, Softmaxes and Cross-Entropy, Dropout, Saving and Loading Models, Clustering, The Idea, The Model, Choosing k, Bottom-Up Hierarchical Clustering. ***Text book 1: Chapter 11, Chapter 18, and Chapter 19***	**8 Hours**
MODULE – V	
Network Analysis, Recommender System and MapReduce: Betweenness Centrality, Eigenvector Centrality, Directed Graphs and PageRank, Recommender Systems, Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization, Create Table and Insert, Update, Delete, Select, Group By, Order By, Join, Subqueries, Indexes, Query Optimization, N0Sql, MapReduce, Example: Word count, Why MapReduce, MapReduce more generally, Example: Analyzing status updates, Example: Matrix multiplication, An Aside: Combiners. ***Text book 1: Chapter 22, Chapter 23, Chapter 24 and Chapter 25***	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Identify and demonstrate data using visualization tools and apply statistical analysis methods, to analyze and interpret data effectively in various real-world contexts.	CL3
CO2	Apply techniques for data acquisition, exploring and preparing data, dimensionality reduction , to reduce dataset complexity while preserving key information.	CL3
CO3	Apply gradient descent optimization techniques, to train linear regression models	CL3

	effectively.	
CO4	Demonstrate the use of machine learning and deep learning models to implement efficient data-driven solutions for real-world problems.	CL3
CO5	Demonstrate knowledge about the recommender system, MapReduce and understand the importance of data ethics.	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1	Demonstrate all the basic plots using Matplotlib package and python programming.	CO1	CL3
2	Implement a python program to perform File Operations on Excel Dataset.	CO2	CL3
3	Write a python program to perform Array operations using the Numpy package.	CO2	CL3
4	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	CO3	CL3
5	Demonstrate Linear Regression operation using python programming.	CO4	CL3
6	Train a regularized logistic regression classifier on the in-build iris dataset using scikit-learn. Train the model and report the best classification accuracy.	CO4	CL3
7	Write a python program to perform Data Manipulation operations using Pandas package.	CO4	CL3
8	Develop a MapReduce program to find the grades of students in python.	CO5	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	2	3						2	2	3	2
CO2	3	3	3	2	3						2	2	3	2
CO3	3	3	3	2	3						2	2	3	2
CO4	3	3	3	2	3						2	2	3	2
CO5	3	3	3	2	3						2	2	3	2

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS				
Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE:

- Assessment will be both CIA and SEE.
- The practical sessions of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.
- The questions from the practical sessions shall be included in Theory SEE.

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

SEE QUESTION PAPER PATTERN:

1. The question paper will have **TEN** full questions from **FIVE** Modules
2. There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
3. Each full question may have a maximum of four sub-questions covering all the topics under a module.
4. The students will have to answer FIVE full questions, selecting one full question from each module.

TEXT BOOKS:

1. Joel Grus, Data Science from Scratch-First Principles with Python, O' Reilly Publications, 2nd Edition, 2019, ISBN: 978-9352138326.
2. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn & TensorFlow, O'Reilly Media Publications, 3rd Edition, 2022, ISBN: 978-93-5542-198-2.

REFERENCE BOOKS:

1. Emily Robinson, Jacqueline Nolis, Build a Career in Data Science, Manning Publications, 1st Edition, 2020, ISBN: 9781638350156.
2. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn & TensorFlow, O'Reilly Media Publications, 3rd Edition, 2022, ISBN: 978-93-5542-198-2.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc21_cs69
2. https://onlinecourses.nptel.ac.in/noc22_cs32

MACHINE LEARNING

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21AI63**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of statistics, probability, artificial intelligence and programming.

COURSE OBJECTIVES:

- Understand a wide variety of learning algorithms.
- Understand how to evaluate models generated from data.
- Understand the mathematical and statistical perspectives of machine learning algorithms.
- Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction: Machine Learning, Types of Machine Learning, Main challenges of Machine Learning, Testing and Validating, Concept Learning tasks, Concept Learning as search, Find S algorithm, Version Spaces and Candidate Elimination algorithm.	**8 Hours**

MODULE - II

Machine Learning Project: Working with real data, Explore and visualize the data, Prepare the data for Machine Learning, Select and train the model, Fine tune the model, Launch and maintain the system, MNIST, Training a binary classifier, Performance measures, Multiclass Classification, Error Analysis, Multilabel classification, Multioutput classification.	**8 Hours**

MODULE - III	
Support Vector Machine, Decision Tree and Random Forest: Linear SVM classification, Nonlinear SVM classification, SVM Regression, Decision Tree representation, Appropriate problems for Decision Tree learning, Basic Decision Tree learning algorithm, Voting classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking.	**8 Hours**
MODULE - IV	
Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and Concept learning, Maximum likelihood and least squared error hypothesis, Minimum description length principle, Bayes Optimal Classifier, Gibbs algorithm, Naive Bayes classifier, Text classification, Bayesian Belief Networks.	**8 Hours**

MODULE - V	
Instance-Based and Reinforcement Learning: Introduction, k-Nearest Neighbor learning, Locally Weighted Regression, Radial Basis Function, Case-Based Reasoning, Reinforcement Learning, Learning task, Q-Learning.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate the concepts of Machine Learning and Concept Learning.	CL3
CO2	Examine the usage of machine learning algorithms with real-world datasets.	CL3
CO3	Apply various machine learning algorithms for classification problems.	CL3
CO4	Illustrate the Bayes theorem and the Bayesian belief network for building models from data.	CL3
CO5	Demonstrate the concepts of Instant based and Reinforcement-based learning.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	1	1					1		1		
CO2	3	3	2	1	2					1		1		
CO3	3	3	2	2	2	1			1					
CO4	3	3	2	2	2	1			1					
CO5	3	3	2	1	2	1								

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks

1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	**Assignment Description**	**Max. Weightage (%)**	**Max. Marks**
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn &TensorFlow, O'Reilly Media Publications, 3rd Edition, 2022, ISBN: 978-93-5542-198-2.
2. Tom M Mitchell, Machine Learning, McGraw Hill Education Pvt. Ltd, 1st Edition, 2017, ISBN: 978-1-25-909695-2.
3. Ethem Alpaydin, Introduction to Machine Learning, PHI Learning Pvt. Ltd., 3rd Edition, 2014, ISBN: 978- 8120350786.
4. Manaranjan Pradhan and U Dinesh Kumarg, Machine Learning with Python, Wiley Publications, 2019, ISBN: 9788126579907.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://onlinecourses.nptel.ac.in/noc23_cs18
2. https://onlinecourses.nptel.ac.in/noc23_cs87

INFORMATION STORAGE MANAGEMENT

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21IS641**	CIA Marks	50
Number of Contact Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Contact Hours	40	Exam Hours	03

CREDITS - 3

Prerequisites:

- Knowledge of Data Communication, Database Management System and Data Warehousing

Course Objectives:

This course will enable students to:

- Describe the importance of data, information, and storage infrastructure.
- Review the evolution of storage technology.
- Understand the key management requirements of a storage system.
- Introduce RAID and intelligent storage systems.
- Explain the storage networking technologies and virtualization.
- Discuss CAS, business continuity, backup and recovery.

Teaching-Learning Strategy:

Following are some sample strategies that can be incorporated for the Course Delivery:

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem-Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. **Data Center Environment:** Application, Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-	**8 Hours**

Attached Storage, Storage Design Based on Application Requirements and Disk Performance.	
MODULE - II	
Data Protection: RAID - RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares. **Intelligent Storage Systems:** Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems.	**8 Hours**
MODULE - III	
Fibre Channel Storage Area Networks - Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies. **IP SAN**: iSCSI, FCIP. **Network-Attached Storage (NAS)**: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance, File Level Virtualization.	**8 Hours**
MODULE - IV	
Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. **Backup and Archive:** Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Targets, Data Archive, Archiving Solution Architecture.	**8 Hours**
MODULE - V	
Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas. **Remote Replication:** Modes of Remote Replication, Remote Replication Technologies, Three Site Replication, Data Migration Solutions.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Describe the evolution of information storage architecture and data center environment. Also identify the storage requirements for the applications.	CL3
CO2	Explain the importance of RAID and an intelligent storage system for the effective maintenance and protection of data. Also, identify the disk load in different types of RAID.	CL3

CO3	Discuss the different storage networking technologies including FC SAN, IP SAN and NAS.	CL2
CO4	Explain the process of business continuity, backup, and recovery to ensure information availability for vital business operations.	CL2
CO5	Explain the process of replication to minimize the risk of business disruption and ensure business continuity.	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2									2	1	2
CO2	3	3	2		2							2	1	2
CO3	3	3	3		2							2	1	2
CO4	3	3	3		2							2	1	2
CO5	3	3	3									2	1	2

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Student's learning will be assessed using Direct and Indirect methods.

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
M I			M I	M I
M II			M II	M II
	M III		M III	M III
	M IV	M IV	M IV	M IV
		M V	M V	M V

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks

1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer-to-Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands.

SEE Question Paper Pattern:

- The question paper will have **TEN** full questions from **FIVE** Modules.
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Reference Books:

1. Somasundaram Gnanasundaram, Alok Shrivastava: "Information Storage and Management", 2nd Edition, EMC Education Services, Wiley India Publications. ISBN: 978-81-265-3750-1
2. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2003.
3. Rebert Spalding: Storage Networks, The Complete Reference, Tata McGraw Hill, 2003.
4. Richard Barker and Paul Massiglia: Storage Area Networks Essentials A Complete Guide to Understanding and Implementing SANs, Wiley India, 2002.

Reference Web Links And Video Lectures (E-Resources):

1. https://nptel.ac.in/courses/106108058

INDUSTRIAL IOT AND ANALYTICS

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21IS642**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Industrial IOT Systems.

COURSE OBJECTIVES:

- To provide students with good depth of knowledge of Designing Industrial IOT Systems for various application.
- Knowledge for the design and analysis of Industry 4.0 Systems.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Basics of Internet of Things: Introduction to IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Deployment Templates	**8 Hours**

MODULE - II

Industrial IoT (IIoT) Systems: The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.	**8 Hours**

MODULE - III

Implementation systems for IIoT: Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.	**8 Hours**

MODULE - IV

IIoT Data Analytics: IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.	**8 Hours**

MODULE - V

Industrial IoT- Applications: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Discuss the fundamentals of IoT systems	CL2
CO2	Knowledge of theory and practice related to Industrial IoT Systems.	CL3
CO3	Ability to identify, formulate and solve engineering problems by using Industrial IoT.	CL3
CO4	Analyze data Analytics for Industrial Internet of Things	CL3
CO5	Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability.	CL4

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1											1	1
CO2	2	1	3										1	1
CO3	2	1	3				2						1	1
CO4	2	1					2						1	1
CO5	2	1											1	1

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	Semester End Exam (SEE) (50%)
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Dimitrios Serpanos & Marilyn Wolf, "Internet of Things (IOT) System Architectures, Algorithms, Methodologies" Springer International publishing, AG 2018
2. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist Publications.
3. Dr. OvidiuVermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers.
4. Embedded System: Architecture, Programming and Design by Rajkamal, TMH3.
5. The Concept Industry 4.0 "An Empirical Analysis of Technologies and Applications in Production Logistics" Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.
6. The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications.
7. Internet of Things- From Research and Innovation to Market Deployment; By Ovidiu & Peter; River Publishers Series.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.cisco.com/c/en/us/solutions/internet-of-things
2. https://www.tibco.com/reference-center/what-is-iiot

SOCIAL NETWORK ANALYSIS

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21CS643**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematics, Data Structures and algorithms.

COURSE OBJECTIVES:

- To understand the science of networks, including the principles of graph theory and key statistical properties of network.
- To acquire a working knowledge of descriptive network analysis techniques.
- Gain proficiency in evaluating network structure through the analysis of nodes and edges, calculating network diameter, and determining average path length To visualize social networks.
- Study the dynamics of information and influence propagation on networks, including the basic cascade model and strategies for influence maximization.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores.	**8 Hours**

MODULE - II

Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector	**8 Hours**

centrality and PageRank. Algorithm HITS.	
MODULE - III	
Network communities and Affiliation networks: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems.	**8 Hours**
MODULE - IV	
Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low -dimensional projections.	**8 Hours**
MODULE - V	
Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate proficiency in applying the principles of the new science of networks, exemplifying their understanding through the identification and analysis of network structures.	CL2
CO2	Evaluate and apply advanced concepts in social network analysis, for comprehensive understanding of network structures and node centrality metrics.	CL3
CO3	Analyze and differentiate various network community detection techniques.	CL3
CO4	Analyze network structures by identifying and justifying the significance of the most influential nodes and show proficiency in using network visualization tools.	CL3
CO5	Evaluate and apply advanced techniques, including natural language processing and sentiment mining, to analyze Facebook, VK, and Twitter data.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	1				2				2	2	2
CO2	3	3	2					2				2	2	2
CO3	3	3	3					2				2	2	2
CO4	3	3	3					2				2	2	2
CO5	3	3	3					2				2	2	2

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS				
Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010.
2. Eric Kolaczyk, Gabor Csardi. Statistical Analysis of Network Data with R (Use R!). Springer, 2014
3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994.
4. Guandong Xu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and

applications‖, First Edition, Springer, 2011.

5. Dion Goh and Schubert Foo, ―Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
6. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, ―Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling‖, IGI Global Snippet, 2009.
7. John G. Breslin, Alexander Passant and Stefan Decker, ―The Social Semantic Web‖, Springer, 2009.

DRONE TECHNOLOGY AND APPLICATIONS

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21IS644**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Drone technology.

COURSE OBJECTIVES:

- To understand the basics of drone technology.
- To learn and understand the fundamental methods of Surveying with Drone.
- To understand the concepts of Image processing and Photogrammetry of drone.
- To understand the Mapping and data modeling in drones.
- To know about the various applications of drone.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to Drones: Introduction to Drones, History of Drone/UAS/UAVs, payload, battery life, Specs for good results, Regulations of DGCA and Drone license, Pre and Post Flight planning- Flight execution and photography, data collection- Image Format, GSD, Scale and Resolution.	**8 Hours**

MODULE - II

Surveying with Drones: Consideration for hardware selections, comparison on surveying drone and its accuracy, Techniques of controlling errors, Consideration of GCP in vertical and horizontal accuracies, Planning and estimation of drone surveying jobs, Autonomous flight vs. manual and hybrid flight profiles.	**8 Hours**

MODULE - III

Image Processing and Photogrammetry: Aerial Triangulation, post processing softwares, Analyzing Data, Contouring, DEM, DSM, Cut, Fill, and Volumetric Measurement Calculation and orthophoto generation.	**8 Hours**

MODULE - IV

Mapping and Modeling: Introduction to mapping and modeling concepts, Understanding RTK, PPK and GCP's, Overview of popular data processing software platforms and functions	**8 Hours**

MODULE - V

Applications of Drone Technology: Application of drone for Surveying & Mapping-Construction, Irrigation and Agricultural, Engineering Land Survey and Transportation.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Know about a various type of drone technology and its fundamentals.	CL2
CO2	Execute the suitable operating procedures for surveying a drone.	CL3
CO3	Select appropriate Image Processing and Photogrammetry for Drones.	CL3
CO4	Develop a mapping and modeling for data processing in drones.	CL3
CO5	Discuss the applications of drones in construction, irrigation, agriculture, and in land survey.	CL4

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1											1	1
CO2	2	1				2							1	1
CO3	2	1				2							1	1
CO4	2	1				1							1	1
CO5	2	1											1	1

3: Substantial (High) | **2: Moderate (Medium)** | **1: Poor (Low)**

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII

		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. "One Nation Under Drones: Legality, Morality, and Utility of Unmanned Combat Systems" by John E. Jackson.
2. Lillesand and Kiefer, "Remote Sensing and Image Interpretation", 5th Edition, published by John Wiley and Sons, 2008.
3. A.M. Chandra, S.K. Ghosh, "Remote Sensing and Geographical Information System", Narosa Publishing house, 1st Edition, 2007.
4. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", 2021 John Wiley & Sons, Inc.
5. Terry Kilby and Belinda Kilby, "Make:Getting Started with Drones ",Maker Media, Inc, 2016
6. John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016
7. Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://www.dronedeploy.com/resources
2. https://www.techtarget.com/iotagenda/definition/drone

BLOCK CHAIN AND APPLICATIONS

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code:	**21CS651**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematics, Data Structures, Networking

COURSE OBJECTIVES:

- Explore the concepts of Blockchain, cryptography behind the blockchain
- Understanding the technology behind bitcoin, Ethereum, smart contract and Hyper ledger

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to Blockchain Technology: Distributed systems , The history of blockchain , CAP theorem and blockchain, Benefits and limitations of blockchain, Decentralization using blockchain , Methods of decentralization, Routes to decentralization.	**8 Hours**

MODULE - II

Cryptography in Blockchain: Introduction, cryptographic primitives, Asymmetric cryptography, public and private keys ,RSA, ECC , Hash functions, financial markets and trading.	**8 Hours**

MODULE - III

Bit Coin Introduction, Transactions: Structure ,Transactions types , The structure of a block, The genesis block , The bitcoin network, Wallets and its types, Bitcoin payments, Bitcoin investment and buying and selling bitcoins, Bitcoin installation , Bitcoin programming and the command-line interface	**8 Hours**

, Bitcoin improvement proposals (BIPs).	

MODULE - IV

Ethereum : Ethereum block chain, Ethereum network, Components of the Ethereum ecosystem, Keys and Addresses, Accounts and its types , Transactions and Messages, Contract Creation transaction, Message call transaction, messages ,Calls, Transaction Validation and execution, Transaction substrate, State storage in the Ethereum blockchain, Ether cryptocurrency / tokens (ETC and ETH), The Ethereum Virtual Machine (EVM), Execution environment, Native contracts	**8 Hours**

MODULE - V

Smart Contract and Hyper ledger: Ricardian contracts, Application developed on Ethereum. The DAO **Hyper ledger:** Hyper ledger projects, Hyperledger as a protocol, The reference architecture, Requirements and design goals of Hyperledger Fabric, Applications on blockchain on fabric, Consensus in Hyperledger Fabric, The transaction life cycle in Hyperledger Fabric, Sawtooth lake , Corda Architecture.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply basic concepts of Blockchain and evaluate the benefits and limitation of Blockchain.	CL3
CO2	Examine the decentralization concepts and apply thee cryptography techniques in Blockchain.	CL3
CO3	Demonstrate the structure, usage, wallet transaction and installation of Bitcoin.	CL3
CO4	Demonstrate Application development using Ethereum.	CL3
CO5	Illustrate the usage of Smart contract and architecture of Hyperledger.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2						1		2	2	2	2
CO2	3	3	2						1		2	2	2	2
CO3	3	3	2		2				1		2	2	2	2
CO4	3	3	2		2				1		2	2	2	2
CO5	3	3	2		2				1		2	2	2	2

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				**Semester End Exam (SEE) (50%)**
Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
I	**II**	**III**		
Syllabus Coverage			**Syllabus Coverage**	**Syllabus Coverage**
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained,

2nd Edition, 2nd Revised edition. Birmingham: Packet Publishing, 2018.

2. A. M. Antonopoulos, Mastering bitcoin, First edition. Sebastopol CA: O 'Reilly,2015.

3. Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, ―An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends in 2017 IEEE International Congress on Big Data (Bigdata Congress), 2017, pp.557–564

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://ethereum.org/en/
2. https://www.blockchain.com/explorer

COMPUTER VISION

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21IS652**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40L	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Image Processing.

COURSE OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature-based alignment and motion estimation.
- To develop skills on 3D reconstruction.
- To understand image-based rendering and recognition

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to Image Formation and Processing: Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.	**8 Hours**

MODULE - II

Feature Detection, Matching and Segmentation: Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and	**8 Hours**

energy-based methods.	

MODULE - III

Feature Based Alignment and Motion Estimation: 2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.	**8 Hours**

MODULE - IV

3D Reconstruction: Shape from X - Active range finding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps.	**8 Hours**

MODULE - V

Image- Based Rendering and Recognition: View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	To understand basic knowledge, theories and methods in image processing and computer vision.	CL2
CO2	To implement basic and some advanced image processing techniques in Open CV.	CL3
CO3	To apply 2D a feature-based based image alignment, segmentation and motion estimations.	CL3
CO4	To apply 3D image reconstruction techniques.	CL3
CO5	To design and develop innovative image processing and computer vision applications.	CL4

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1	1	1				2	1	3	2	2	1
CO2	3	3	3	2	3		1		2	1	2	2	3	1
CO3	3	3	2	2	3				1	1	2	2	3	2
CO4	2	3	3	2	3				2	1	2	3	2	2
CO5	2	3	3	2	2	2			3	1	2	3	3	3

3: Substantial (High)	2: Moderate (Medium)	1: Poor (Low)

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		

Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	**30%**	**30%**	**100%**	**100%**
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
4. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
5. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

REFERENCE WEB LINKS AND VIDEO LECTURES (E - RESOURCES):

1. https://opencv.org/opencv-free-course/
2. https:// docs.opencv.org

CRYPTOGRAPHY AND NETWORK SECURITY
(Effective from the Academic Year 2023 – 2024)
VI SEMESTER

Course Code	**21IS653**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Cryptography Theories and Network security.

COURSE OBJECTIVES:

- This course is aimed at providing students with a practical and theoretical knowledge of cryptography and network security.
- To develop an understanding of different cryptographic protocols and techniques.
- To understand methods for authentication, access control, intrusion detection and prevention.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I	
Introduction to Network Security: Introduction - Need for Security, Security Approaches, Principles of Security, Security services, Types of Attacks – General View - Technical View, Programs that Attack, Specific Attacks.	**8 Hours**
MODULE - II	
Basics of Cryptography and Encryption: Introduction to Cryptography, Plain Text and Cipher Text, Symmetric Cipher Model, Cryptography, Cryptanalysis, Brute Force Attacks, Substitution Techniques - Caesar Cipher and Modified Caesar Cipher, Mono Alphabetic cipher, Poly-Alphabetic Cipher, Playfair Cipher, Transposition Techniques- Rail Fence technique, Simple Columnar transposition Technique.	**8 Hours**
MODULE - III	
Block ciphers and Data encryption standards: Stream ciphers Block ciphers, Data Encryption Standard, a DES example, AES- structure, AES transformation functions.	**8 Hours**
MODULE - IV	
Public key cryptography and RSA: Principles of public key cryptosystems - public key cryptosystems - applications for public key cryptosystems, RSA algorithm - algorithm and example. **Cryptographic Data integrity algorithms** - Cryptographic Hash functions - applications, Message Authentication – Requirements and Functions.	**8 Hours**

MODULE - V	
Applications of network and internet security: Cloud computing- Data protection on the cloud, cloud security as a service, Web/Internet security protocols- HTTPS, SSL, SSH, Wireless network security, Mobile device security, Email Security-Pretty good privacy, S/MIME. **Legal and Ethical issues-** Introduction to Cybercrime & computer crime, Intellectual property, Privacy, Ethical issues.	**8 Hours**

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities	CL2
CO2	Apply the different cryptographic operations of symmetric cryptographic algorithms.	CL3
CO3	Apply the different cryptographic operations of public key cryptography	CL3
CO4	Apply the various Authentication schemes to simulate different applications.	CL3
CO5	Understand various Security practices and System security standards.	CL4

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1	1	1				2	1	3	2	2	1
CO2	3	3	3	2	3		1		2	1	2	2	3	1
CO3	3	3	2	2	3				1	1	2	2	3	2
CO4	2	3	3	2	3				2	1	2	3	2	2
CO5	2	3	3	2	2	2			3	1	2	3	3	3
3: Substantial (High)					2: Moderate (Medium)					1: Poor (Low)				

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment/ Activities (40%)	
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI

MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

TEXT BOOKS:

1. AtulKahate, Cryptography and Network Security, 4th Edition,2019
2. William Stallings, Cryptography and Network Security: Principles and Practices, 7th Edition,2019.
3. Nina Godbole and SunitBelapure, Cyber Security, 1st Edition, 2019.

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21CS654**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental software development life cycle, Object orientation principles and modeling

COURSE OBJECTIVES:

- Learn How to add functionality to designs while minimizing complexity.
- What code qualities are required to maintain to keep code flexible?
- To Understand the common design patterns.
- To explore the appropriate patterns for design problems

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

Introduction to design pattern: Describing, the catalog of, organizing the catalog, solve design problems, select and how to use - design pattern. A Notation for Describing Object-Oriented Systems **Analysis a System:** overview of the analysis phase, gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation.	**8 Hours**

MODULE – II	
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.	**8 Hours**
MODULE - III	
Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Template Method	**8 Hours**
MODULE - IV	
Interactive systems and the MVC architecture: Introduction, The MVC architectural pattern, analysing a simple drawing program, designing the system, designing of the subsystems, getting into implementation, implementing undo operation, drawing incomplete items, adding a new feature, pattern-based solutions. Case study on Moving from MVVM to MVC Architecture: A Case Study in Android	**8 Hours**
MODULE – V	
Designing with Distributed Objects: Client server system, java remote method invocation (RMI), implementing an object-oriented system on the web. Web Services versus Distributed Objects: A Case Study of Performance and Interface Design.	**8 Hours**

COURSE OUTCOMES

Upon the completion of this course, the student shall be able to:

CO No.	CO Description	Bloom's Taxonomy Level
CO1	Understand the basic concepts of design pattern and identify state & behavior of real-world objects.	CL2
CO2	Interpret the Structural design patterns for developing design pattern catalog.	CL2
CO3	Interpret the Behavioral design patterns for developing design pattern catalog.	CL2
CO4	Explain interactive system and illustrate the roles of MVC in real world problems	CL3
CO5	Describe client server, RMI and implementation of OOS on the web.	CL3

CO-PO-PSO MAPPING

CO No.	PROGRAM OUTCOMES (POs)												PROGRAM SPECIFIC OUTCOMES (PSOs)	
	1	2	3	4	5	6	7	8	9	10	11	12		
CO1	2	1				1		2	1	1		2		
CO2	2	2	2		2	1		2	2	2	2	2		
CO3	2	2	2	1	2			2	2	2	1	2		
CO4	2	2	2	1	2			2	3	3	2	2		
CO5	2	2	2	1	2		2	2	3	3	2	2		

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20

2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)				
Continuous Internal Evaluation (CIE (60%)			Assignment/ Activities (40%)	Semester End Exam (SEE) (50%)
I	II	III		
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

Note: For Examinations (both CIE and SEE), the question papers shall contain the questions mapped to the appropriate Bloom's Level. Any COs mapped with higher cognitive Bloom's Level may also be assessed through the assignments.

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer - to - Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10
9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

Note: The assignments mentioned above may be provided appropriately to the students belonging to different bands

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules
- There will be 2 full questions from each module. Every question will carry a maximum of 20 marks.
- Each full question may have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

REFERENCE BOOKS:

1. Erich Gamma, Richard Helan, Ralph Johman, John Vlissides, Design Patterns, Pearson Publication,2013.
2. Brahma Dathan, Sarnath Ramnath, Object-oriented analysis, design and implementation, Universities Press,2013
3. Frank Bachmann, Regine Meunier, Hans Rohnert "Pattern Oriented Software Architecture" –Volume 1, 1996.
4. William J Brown et al., "Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis", John Wiley, 1998.

REFERENCE LINKS:

1. https://darrenfinch.com/moving-from-mvvm-to-mvc-architecture-a-case-study-in-android/2.221587296_Web_Services_versus_Distributed_Objects_A_Case_Study_of_Performance_and_Interface_Design

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
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MANGALURU

MACHINE LEARNING LABORATORY

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21AIL66**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Fundamental knowledge of statistics, probability, artificial intelligence and Python/Java programming.
- The algorithms can be written in Python/Java programming languages.

COURSE OBJECTIVES:

- To understand the basic concepts and techniques of Machine Learning through python programming.
- To develop skills of using recent Machine Learning packages for solving practical problems.
- To gain experience of doing independent study and research.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporate for the Course Delivery

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

LIST OF EXPERIMENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Implement and demonstrate the Find-S algorithm for finding the most specific hypothesis.	CO1	CL3
2.	Implement and demonstrate the Candidate Elimination algorithm using adata set stored as a .CSV file.	CO1	CL3
3.	Demonstrate data Preprocessing (Data Cleaning, Integration and Transformation) operations on a suitable data.	CO2	CL3
4.	Demonstrate the working of SVM classifier for a suitable dataset.	CO3	CL3
5.	Implement and demonstrate the working of the Decision Tree algorithm.	CO3	CL3
6.	Implement Randon Forest classifier using python programming.	CO3	CL3

7.	Demonstrate the text classifier using Naive Bayes classifier algorithm.	CO4	CL3
8.	Implement the Naive Bayesian classifier for a sample training data set stored as a .CSV file.	CO4	CL3
9.	Construct a Bayesian network to analyze the diagnosis of heart patients using heart diseases dataset.	CO4	CL4
10.	Implement KNN classification algorithm with an appropriate dataset and analyze the results.	CO5	CL4

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate the concept learning problems with the hypothesis.	CL3
CO2	Illustrate data pre-processing operations on datasets.	CL3
CO3	Implement and evaluate the performance of machine learning models.	CL3
CO4	Analyze the use of Bayesian learning concepts in solving real-world problems.	CL4
CO5	Design and analyze data classification using the KNN algorithm.	CL4

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2		2				1	1		1		
CO2	3	3	2		2	1			1	1		1		
CO3	3	3	2	1	2	1			1	1		1		
CO4	3	3	3		2	1			1	1		1		
CO5	3	3	3		2	1			1	1		1		
3: Substantial (High)					**2: Moderate (Medium)**					**1: Poor (Low)**				

ASSESSMENT STRATEGY

Assessment will be both CIA and SEE. Students learning will be assessed using Direct and Indirect methods:

Sl. No.	Assessment Description	Weightage (%)	Max. Marks

1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

I. In Laboratory Courses where (B) and (C) are not the components of the assessment pattern, then (A) will have 100% weightage (50 Marks).

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

II. In Laboratory Courses where (C) is not a component of the assessment pattern, then (A) will have 50% weightage (25 Marks), and (B) will have 50% weightage (25 Marks).

Assessment Mode: The marks will be awarded based on the Continuous Internal Assessment (Weekly Assessment) (A) and One Laboratory Test (B).

- In Weekly Assessment, the student will be evaluated in each laboratory session for 25 marks. The average marks obtained across all the experiments will be the marks obtained for (A).
- A Laboratory Test, similar to the SEE exam is conducted towards the end of the Semester/Course, whichever is earlier. The obtained marks are scaled down to 25 Marks (B)

The Sum of marks obtained across (A) and (B) will be the Final CIA marks.

III. In Laboratory Courses where (C) is a component of the assessment pattern, then assessment will be done by considering the weightages given above, i.e. (A) – 25 Marks (Weekly Assessment), (B) – 15 Marks (Laboratory Examination), (C) – 10 marks (Open Ended Experiments/Mini Projects)

- The respective course instructor will design the assessment criteria for the said assessment components.
- The assessment components will be made known to the students by the respective Course Coordinators prior to the commencement of the Laboratory Work.

In all the cases, the assessments will be done based on the criteria designed by the Course Coordinator.

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.

Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

REFERENCE WEB LINKS AND VIDEO LECTURES (E – RESOURCES):

4. https://onlinecourses.nptel.ac.in/noc23_cs18
5. https://onlinecourses.nptel.ac.in/noc23_cs87