SOFTWARE ENGINEERING & PROJECT MANAGEMENT
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code1	**CS622T1C**	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, Negotiating Requirements, Validating Requirements, Software Requirement Document.	**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.	**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, Activity on Nodes Network. **Software Quality:** Introduction, the place of software quality in project planning, Importance	8 Hours

of software quality, software quality models, ISO 9126, quality management systems, process capability models, techniques to enhance software quality, quality plans.	

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	Understand the Concepts of project planning and contract management in software development	CL2
CO5	Illustrate the importance of activity planning and its models and develop network models for project specification.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	1	2	6	1	2	9	1	2	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
Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
2	Assignments	40 %	20

ASSESSMENT DETAILS

Continuous Internal Assessment (CIA) (50%)	Continuous Internal Assessment

Continuous Internal Evaluation (CIE) (60%)			Continuous Internal Evaluation (CIE) (60%)	(CIA) (50%) Continuous Internal Evaluation (CIE) (60%)
I	I	I	I	I
Syllabus Coverage			Syllabus Coverage	Syllabus Coverage
40%	40%	40%	40%	40%
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	Real time Case Studies	50 %	10
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.

REFRENECE 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. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.
6. 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)

BIG DATA ANALYTICS
(Effective from the Academic Year 2023- 2024)
SEMESTER - VI

Course Code	**IS622I2I**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	**40 L + 20 P**	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Fundamental knowledge of database management systems and any programming language.

COURSE OBJECTIVES:

- To understand the need of Big Data, challenges and different analytical architectures
- Installation and understanding of Hadoop Architecture and its ecosystems
- Processing of Big Data with Advanced architectures like Spark.
- Describe graphs and streaming data in Spark.

TEACHING - LEARNING STRATEGY:

These are some sample strategies, which course faculty members can incorporate in the Teaching Learning Process:

- 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/Laboratory Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

MODULE - I

Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis, Big Data Analytics Applications and Case Studies.	**8 Hours**

MODULE - II

Introduction to Hadoop: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. **Hadoop Distributed File System Basics:** HDFS Design Features, Components, HDFS User Commands. Essential Hadoop Tools.	**8 Hours**

MODULE - III	
NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.	**8 Hours**
MODULE - IV	
MapReduce , Hive and Pig : Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig..	**8 Hours**
MODULE - V	
Spark and Big Data Analytics: Introduction, Spark, Data Analysis with Spark, Programming using RDD and MLIB, Data ETL, Introduction to Analytics, Reporting and Visualizing.	**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 fundamental concepts of Big Data analytics with its various applications and overview of data sources, pre-processing and storing.	CL2
CO2	Summarize the conceptualization of Hadoop and its ecosystem, Hadoop Distributed File system and discuss various essential Hadoop Tools.	CL2
CO3	Illustrate the concepts and applications of No SQL for Bigdata Analytics using MongoDB and Cassandra.	CL3
CO4	Demonstrate the Map Reduce programming model to process the big data along with Hadoop tools.	CL3
CO5	Examine overview and applications of spark used for Bigdata Analytics.	CL3

LABORATORY CONTENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).	CO1	CL2
2.	Write a program to analyze the Web server log stream data using Apache Flume Framework.	CO2	CL3
3.	Write a program to implement MongoDB CRUD operations.	CO3	CL3

4.	Develop a MapReduce program to calculate the frequency of a given word in a given file.	CO4	CL3
5.	Develop a MapReduce program to find the maximum temperature in each year.	CO4	CL3
6.	Develop a MapReduce program to find the grades of students.	CO4	CL3
7.	Write Pig Latin scripts to implement sort, group, join, project and filter the data operations.	CO4	CL3
8.	Use Hive to Create, alter and drop databases, tables, views, functions and Indexes.	CO4	CL3
9.	Implement clustering techniques using SPARK.	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	2	1		3							2	3	1
CO2	3	2	1	1	3							2	3	1
CO3	3	2	1	2	3							2	3	1
CO4	3	2	1	2	3							2	3	1
CO5	3	3	2	2	3							2	3	1

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

CO - Assessment Mapping:

Course Outcomes	Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE) (60%)			Practical Sessions (40%)	
	I	II	III		
	Syllabus Coverage				
	40%	30%	30%	100%	100%
CO1	MI			MI	MI
CO2	MII	MII		MII	MII
CO3		MIII		MIII	MIII
CO4			MIV	MIV	MIV
CO4			MV	MV	MV

ASSESSMENT STRATEGY:

- 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 may also be included for Theory SEE.

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

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

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. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and MachineLearning”, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1 stEdition, Pearson Education, 2016. ISBN13: 978- 9332570351
3. Tom White, Hadoop: The Definitive Guide, O’Reilly Media, Inc., Fourth Edition, 2015.
4. Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
6. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011
7. Alan Gates, "Programming Pig", O'Reilley, 2011

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

1. https://onlinecourses.nptel.ac.in/noc20_cs92

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code:	**IS622T3I**	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 concepts like probability.

COURSE OBJECTIVES:

- To Gain a historical perspective of AI and its foundations
- To understand the basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
- To describe Artificial Intelligence and Machine Learning algorithms and evaluate their performance
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To Illustrate AI and ML algorithm and their use in appropriate applications.
- To Describe the applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models
- To apply the classification, clustering and regression-based machine learning algorithms techniques to solve real time problems.
- To apply the algorithms to a real-world 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 to AI: Intelligent systems, Foundations and Sub area of AI, Applications, Tic-Tac-Toe Game playing, Currents trend and developments of AI, General problem solving, Characteristics of problem, Constraint satisfaction.	**8 Hours**

MODULE - II

Heuristic search techniques: Generate and Test, Hill Climbing, Best First Search, Problem Reduction. Knowledge representation issues: Representation and Mapping, Approaches to Knowledge Representation.	**8 Hours**

MODULE - III

Introduction: Machine Learning, Types of Machine Learning, Main challenges of Machine Learning, Testing and Validating, Performance measures, Concept Learning tasks, Concept Learning as search, Find S algorithm, Version Spaces and Candidate Elimination algorithm. **Decision Tree Learning:** Introduction, Decision tree representation, Appropriate problems, ID3 algorithm.	**8 Hours**

MODULE - IV

Artificial Neural Network: Introduction, NN representation, Appropriate problems, Perceptron, Back propagation algorithm. **Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and concept learning, Naive Bayes Classifier, Bayesian Belief Network (BBN).	**8 Hours**

MODULE - V

Unsupervised Learning Techniques: Clustering algorithms: K-Means. **Instance-Base Learning:** Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Linear SVM classification, Nonlinear SVM classification, SVM Regression. **Reinforcement Learning:** Introduction, The 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	Illustrate the theory of artificial intelligence for various problem-solving techniques.	CL3
CO2	Apply artificial intelligence concepts in Heuristic Search Techniques and knowledge representation.	CL3
CO3	Demonstrate the ability to evaluate concept learning tasks and decision tree algorithms to solve classification problems.	CL3
CO4	Apply the concept of neural networks for learning linear and non-linear activation functions and Bayesian classifier to label data.	CL3
CO5	Illustrate clustering, instant based and reinforcement learning algorithms and identify its applicability in real life problems.	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	1						1	1	2	1	2	2
CO2	3	3	1						1	1	2	1	2	2
CO3	3	3	1						1	1	2	1	2	2
CO4	3	3	1						1	1	2	1	2	2
CO5	3	3	1						1	1	2	1	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. Elaine Rich,KevinKandSBNair,**"ArtificialInteligence",**3rdEdition,McGrawHillEducation,2017
2. Aurelien Geron, Hands-on Machine Learning with Scikit-Learn &TensorFlow, O'Reilly Media Publications, 3rd Edition, 2022, ISBN: 978-93-5542-198-2
3. Tom M Mitchell,**"MachineLerning",**1stEdition,McGrawHillEducation,2017.
4. Saroj Kaushik, Artificial Intelligence, Cengage learning
5. Stuart Rusell, Peter Norving,ArtificialIntelligence:AModernApproach,PearsonEducation2ndEdition
6. Aur Èlien GÈron,"Hands-On Machine Learning with Scikit Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems",1stEdition, Shroff/O'ReillyMedia, 2017.
7. Trevor Hastie, Robert Tibshirani,Jerome Friedmanh The Elements of Statistical Learning,2nd edition, springer series in statistics.
8. Ethem Alpaydın, Introduction To machine learning, second edition, MIT press
9. Srinvivasa K G and Sridhar, "Artificial Intelligence and Machine Learning",Cengage

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

1. https://www.youtube.com/watch?v=wnqkfpCpK1g
2. https://www.youtube.com/watch?v=t4K6lney7Zw
3. https://www.youtube.com/watch?v=VOaoabf3LPM

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BLOCKCHAIN AND APPLICATIONS
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code:	**CS62214CA**	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, Cryptography

COURSE OBJECTIVES:

-

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 , Hashfucntions, 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 , Bitcoin improvement proposals (BIPs).	**8 Hours**
MODULE - IV	

Ethereum, Ethereum block chain, Etherium 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 Etherium : 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 usage of Bitcoin and Alternative coin	CL3
CO4	Demonstrate Application development using Ethereum	CL3
CO5	Interpret the usage of Smart contract and 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							1		
CO2	3	3	2		1							1		
CO3	3	3	2		3							1		
CO4	3	3	2		3							1		
CO5	3	3	2		3							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. Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd Revised edition. Birmingham: Packt 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

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COMPUTER VISION
(Effective from the Academic Year 2024 - 2025)
VI SEMESTER

Course Code	**IS62214IB**	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 neighbourhood 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 energy-based methods.	**8 Hours**

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

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

Course Code	**IS62214IC**	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. dns spoofing	**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%)				
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.AtulKahate, Cryptography and Network Security, 4th Edition,2019
2. William Stallings, Cryptography and Network Security: Principles and Practices, 7th Edition,2019.

1. Nina Godbole and SunitBelapure, Cyber Security, 1st Edition, 2019.

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

1. https://www.geeksforgeeks.org/cryptography-and-network-security-principles
2. https://www.codingninjas.com/studio/library/cryptography-and-network-security

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**CS62214CD**	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 C++ Programming
- Fundamental Knowledge of Object-Oriented Programming Concepts
- Fundamental concepts of Software Engineering

COURSE OBJECTIVES:

- Learn and apply various modeling techniques used for the design of Object-Oriented systems
- Learn various UML diagrams used for the design of Object-Oriented systems
- Identify and apply various design patterns for building the structure of the Object-oriented systems
- Identify and apply various design patterns for specifying the behaviors of the components of an Object-oriented system
- Learn and apply the MVC architecture for building applications

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

Class Modeling: Advanced Object and Class Concepts, N-ary Associations, Aggregation, Abstract Classes, Packages. **State Modeling:** Events, States, Transitions and Conditions, State Diagram, State Diagram Behaviors, Nested State Diagrams, Nested States, Concurrency **Interaction Modeling:** Use Case Models, Sequence models, Activity Models, Use-Case relationships, Procedural Sequence Model, Special Construct for Activity Models	**8 Hours**

MODULE – II

Analysing a System: Overview of Analysis Phase, Stage-1: Gathering Requirements, Functional Requirement Specification, Defining Conceptual Classes and Relationships, Design and Implementation **The Unified Modeling Language:** Communication Diagrams, Timing Diagrams, Activity Diagrams, Interaction overview Diagrams, Component Diagrams, Composite Structure Diagrams, Package Diagrams, Object Diagrams, Deployment Diagrams	**8 Hours**
MODULE - III	
Design Patterns: Design Pattern and its Description, Catalog of Design pattern, organizing the catalog, how design patterns solve design problems, Selecting Design Pattern, Using Design patterns. **Structural patterns:** Adapter, bridge, composite, decorator, facade, flyweight, proxy.	**8 Hours**
MODULE - IV	
Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Template Method	**8 Hours**
MODULE – V	
Interactive systems and the MVC architecture: Introduction, The MVC architectural pattern, analyzing 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.	**8 Hours**

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. Michael R Blaha, James R Rumbaugh, “Object Oriented Modeling and Design with UML”, 2nd Edition, 2005 (Twelfth Impression, 2012)
2. Brahma Dathan, Sarnath Ramnath, “Object Oriented Analysis, Design and Implementation: An Integrated Approach”, Second Edition, Universities Press (India) Private Limited, 2010 (Reprinted 2018)
3. Erich Gamma, Richard Helm, “Design Patterns – Elements of Reusable Object-Oriented Software”, Pearson Education, 2006 (Fifteenth Impression)
4. Craig Larman, “Applying UML and Patterns – An Introduction to Object Oriented Analysis & Design and the Unified Process”, Second Edition.

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FUNDAMENTALS OF OPERATING SYSTEM
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**IS62225IA**	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 Unix and of operating system.

COURSE OBJECTIVES:

- Explain the fundamentals of operating system
- Comprehend multithreaded programming, process management, memory management and
- storage management.
- Familiar with various types of operating 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

Introduction: What OS do, Computer system organization, architecture, structure, Operations, Process, memory and storage management, Protection and security, Distributed systems, Special purpose systems, computing environments. **System Structure:** OS Services, User OSI, System calls, Types of system calls, System programs, OS design and implementation, OS structure, Virtual machines, OS generation, system boot	**8 Hours**

MODULE - II

Process Concept: Overview, Process scheduling, Operations on process, IPC, Examples in IPC, Communication in client-server systems. Multithreaded Programming: Overview, Models, Libraries, Issues, OS Examples	**8 Hours**

MODULE - III	
Process Scheduling: Basic concept, Scheduling criteria, Algorithm, multiple processor scheduling, thread scheduling, OS Examples, Algorithm Evaluation. **Synchronization:** Background, the critical section problem, Petersons solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Monitors, Synchronization examples, Atomic transactions	**8 Hours**
MODULE - IV	
Deadlocks: System model, Deadlock characterization, Method of handling deadlock, Deadlock prevention, Avoidance, Detection, Recovery from deadlock **Memory management strategies:** Background, swapping, contiguous memory allocation, paging, structure of page table, segmentation	**8 Hours**
MODULE - V	
Virtual Memory management: Background, Demand paging, Copy-on-write, Page replacement, allocation of frames, Trashing, Memory mapped files, Allocating Kernel memory, Operating system examples **File system:** File concept, Access methods, Directory structure, File system mounting, File sharing, protection	**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	Explain the fundamentals of operating system	CL2
CO2	Comprehend process management, memory management and storage management.	CL2
CO3	Familiar with various types of operating systems	CL2
CO4	Explore the concept of memory management, working of various page replacement algorithms and file system operations.	CL2
CO5	Analyze Disk Storage Structures and the concepts of OS protection.	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	2	1	1	1	1	1	2	1	1		2	2	1
CO2	2	2	1	1	2	1		2	1	1		2	2	
CO3	2	2	1	1	1	1		2	1	1		2	1	
CO4	3	2	1	1	1	1		2	1	1		2	1	
CO5	2	2	1	1	1	1		2	1	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. A. Silberschatz, P B Galvin, G Gagne, Operating systems, 7th edition, John Wiley and sons.
2. William Stalling,"Operating Systems: Internals and Design Principles", Pearson Education, 1st Edition, 2018.
3. Andrew S Tanenbaum, Herbert BOS, "Modern Operating Systems", Pearson Education, 4th Edition, 2016

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INTRODUCTION TO JAVA PROGRAMMING
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**IS62225IB**	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 and Programming.

COURSE OBJECTIVES:

- To define the object-oriented concepts of Java.
- To illustrate the Java fundamentals using programming constructs.
- To understand the usage of Java classes, objects, and interfaces.
- To develop computer programs to solve real world problems in Java.

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

The Background: Java's Lineage, The Creation of Java, How Java Changed the Internet, Java's Magic: The Bytecode, The Java Buzzwords, The Evolution of Java, A Culture of Innovation. **Overview of Java:** Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries	**8 Hours**

MODULE - II

Data Types, Variables Java Is a Strongly Typed Language, Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions.	**8 Hours**

Arrays, Strings: One-dimensional Arrays, Multidimensional Arrays, A Few Words About Strings.	
MODULE - III	
Java Operators and Control Statements: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The? Operator, Operator Precedence, Using Parentheses, **Control Statements**: Java's Selection Statements, Iteration Statements, and Jump Statements.	**8 Hours**
MODULE - IV	
Introducing Classes and Objects: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize() method. **Closer Look at Methods and Classes:** Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited.	**8 Hours**
MODULE - V	
Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class. **Packages and Interfaces:** Packages, Access Protection, Importing Packages, Interfaces, Defining Interfaces, Implementing Interfaces, Nested Interfaces. **Exception Handling:** Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally.	**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 Object Oriented Programming and **Illustrate** the diverse Java programming constructs.	CL3
CO2	**Develop** the Java programming constructs to show the use of Java Data types, Variables, Arrays and Strings in Object Oriented Programming.	CL3
CO3	**Illustrate** the usage of Operators and Control Statements in developing Java programming applications.	CL3
CO4	**Apply** the concepts of classes and objects to find solutions for the real world situations.	CL3
CO5	**Demonstrate** how to achieve reusability using Inheritance, apply the concepts of	CL3

	Packages and Interfaces and examine the use of different Exception Handling mechanisms.	

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		
CO2	3	3	2					2				2		
CO3	3	3	3					2				2		
CO4	3	3	3					2				2		
CO5	3	3	3					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. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.
2. Cay S Horstmann, "Core Java - Vol. 1 Fundamentals", Pearson Education, 10th Edition, 2016.
3. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Java 8 in Action", Dreamtech Press/Manning Press, 1st Edition, 2014.

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

1. https://www.youtube.com/watch?v=GoXwIVyNvX0
2. https://www.youtube.com/watch?v=mG4NLNZ37y4

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INTRODUCTION to HIGH PERFORMANCE COMPUTING
(Effective from the Academic Year 2022 - 2023)
VI SEMESTER

Course Code	**IS62225IC**	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 and Programming.

COURSE OBJECTIVES:

- To define the object-oriented concepts of Java.
- To illustrate the Java fundamentals using programming constructs.
- To understand the usage of Java classes, objects, and interfaces.
- To develop computer programs to solve real world problems in Java.

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 Parallel Computing: Motivating Parallelism, Scope of Parallel Computing. **Parallel Programming Platforms:** Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.	**8 Hours**

MODULE - II

Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods	**8 Hours**

for Containing Interaction Overheads, Parallel Algorithm Models. **Basic Communication Operations:** One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations	
MODULE - III	
Analytical Modeling of Parallel Programs: Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems. Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs Section 5.7. Other Scalability Metrics, **Programming Using the Message-Passing Paradigm:** Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators	**8 Hours**
MODULE - IV	
Programming Shared Address Space Platforms: Thread Basics, Why Threads? The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, 08 Composite Synchronization Constructs, Tips for Designing Asynchronous Programs, **OpenMP:** A Standard for Directive Based Parallel Programming **Dense Matrix Algorithms:** Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Solving a System of Linear Equations **Sorting:** Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort.	**8 Hours**
MODULE - V	
Graph Algorithms: Definitions and Representation, Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graphs, **Search Algorithms for Discrete Optimization Problems:** Definitions and Examples, Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Speedup, Anomalies in Parallel Search Algorithms	**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 the concepts of parallel computing to address and resolve computational problems that require parallelism.	CL3
CO2	Use decomposition techniques and basic communication operations to develop efficient parallel algorithms.	CL3
CO3	Illustrate the performance metrics and scalability factors to optimize the execution of parallel programs.	CL3
CO4	Apply parallel programs using threading and synchronization constructs, including POSIX Threads and OpenMP.	CL3
CO5	Execute parallel algorithms to solve graph-related problems and assess their performance in terms of efficiency and scalability.	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		
CO2	3	3	2					2				2		
CO3	3	3	3					2				2		
CO4	3	3	3					2				2		
CO5	3	3	3					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. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.
2. Grama, A. Gupta, G. Karypis, V. Kumar, An Introduction to Parallel Computing, Design and Analysis of Algorithms: 2/e, Addison-Wesley, 2003.
3. G.E. Karniadakis, R.M. Kirby II, Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation, Cambridge University Press,2003.
4. Wilkinson and M. Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2/E, Prentice Hall, 2005.
5. M.J. Quinn, Parallel Programming in C with MPI and OpenMP, McGraw-Hill, 2004.
6. G.S. Almasi and A. Gottlieb, Highly Parallel Computing, 2/E, Addison-Wesley, 1994.
7. David Culler Jaswinder Pal Singh,"Parallel Computer Architecture: A hardware/Software Approach", Morgan Kaufmann, 1999.
8. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998.

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

3. https://www.youtube.com/watch?v=GoXwIVyNvX0
4. https://www.youtube.com/watch?v=mG4NLNZ37y4

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INTRODUCTION TO DATA SCIENCE
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**IS62225ID**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS –

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, Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.	**8 Hours**

MODULE - II

Working with data: Getting Data, stdin and stdout, Reading Files, Scraping the Web, Using APIs, Exploring the Data, Using NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, An Aside: tqdm, Dimensionality Reduction. The Curse of Dimensionality, PCA	**8 Hours**
MODULE - III	
Training: Gradient Descent, The Idea Behind Gradient Descent, Estimating the Gradient, Batch Gradient Descent, Stochastic Gradient Descent, Mini-batch Gradient Descent, Linear Regression, Multiple Regression.	**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	**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, MapReduce, Why MapReduce, MapReduce more generally.	**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, polynomial regression and logistic regression effectively.	CL3
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

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.

REFERENCE BOOKS:

1. Joel Grus, Data Science from Scratch-First Principles with Python, O' Reilly Publications, 2nd Edition, 2019, ISBN: 978-9352138326.
2. Emily Robinson, Jacqueline Nolis, Build a Career in Data Science, Manning Publications, 1st Edition, 2020, ISBN: 9781638350156.
3. 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

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**IS622L71**	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:

- Basic Knowledge of Python programming and mathematics concepts like probability.

Description

1. The programs can be implemented in either JAVA or Python.
2. Data sets can be taken from standard repositories

COURSE OBJECTIVES:

- To Learn basic concepts of Python through illustrative examples and small exercises
- To prepare students to become Familiarity with the Python programming in AI environment.
- To train Students with python programming as to comprehend, analyze, design and create AI platforms and solutions for the real-life 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

LIST OF EXPERIMENTS

Sl. No.	Description	CO No.
1	Write a program to implement Tic-Tac-Toe game.	CO1
2	Write a program to implement A* Search Algorithm.	CO1

3	Implement and demonstrate the FIND-S Algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	CO2
4	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	CO2
5	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. Built-in Java classes/API can be used to write the program.	CO3
6	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	CO3
7	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.	CO4
8	Demonstrate the working of SVM classifier for a suitable dataset.	CO4
9	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.	CO5
10	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	CO5

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Implement and demonstrate artificial intelligence algorithms problem-solving skills.	CL3
CO2	Apply FIND-S and Candidate-Elimination for hypothesis generation and refinement using real-world datasets.	CL3
CO3	Demonstrate proficiency in implementing Decision Tree-based ID3 and Artificial Neural Networks using backpropagation for classification tasks.	CL3
CO4	Demonstrate the implementation of Naïve Bayesian Classifier and Support Vector Machine (SVM) to evaluate, and interpret classification models through performance	CL3

	metrics analysis.	
CO5	Implement and evaluate non-parametric machine learning algorithms such as k-Nearest Neighbor and Locally Weighted Regression to visualize and interpret model performance.	CL3

CO-PO-PSO MAPPING

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

1. https://www.edureka.co/blog/artificial-intelligence-with-python/
2. https://www.youtube.com/watch?v=c8W7dRPdIPE
3. https://www.youtube.com/watch?v=YcETNp4ea-Y

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MongoDB
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**CS62298CA**	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	02

CREDITS – 1

PREREQUISITES:

- Fundamental knowledge of any programming language
- Basic understanding of any database, SQL, and query language for databases
- Working knowledge of Linux or Unix-based systems (recommended, but not mandatory)

COURSE OBJECTIVES:

- Able to demonstrate a solid understanding of MongoDB fundamentals, including its NoSQL architecture, key features, and the advantages it offers over traditional relational databases.
- Acquire the skills to perform advanced data manipulation using MongoDB, including CRUD operations, indexing strategies, and complex querying techniques.
- Develop practical skills in MongoDB application development, integrating MongoDB with popular programming languages.

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

Sl. No.	Description
1	MongoDB installation and configuration in windows.
2	Demonstrate how to create and drop database in MongoDB.
3	Creating the Collection in MongoDB.
4	Creating collection with options before inserting the documents and drop the collection created.
5	MogoDB Insert Document a. Insert single document.

	b. Insert multiple documents in collection.
6	Querying all the documents in json format and Querying based on the criteria.
7	MongoDB update document a. Using update() method. b. Using save() method.
8	MongoDB delete document from a collection. a. Using remove() method. b. Remove only one document matching your criteria c. Remove all documents.
9	MongoDB Projection
10	limit() ,skip(), sort() methods in MongoDB
11	MongoDB indexing a. Create index in MongoDB b. Finding the indexes in a collection c. Drop indexes in a collection d. Drop all the indexes

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate MongoDB fundamentals, including creating and dropping databases and collections.	CL3
CO2	Demonstrate the significance of document manipulation operations in MongoDB, such as inserting, querying, updating, and deleting documents.	CL3
CO3	Illustrate collections with specific options, project and filter data based on criteria, and perform advanced collection manipulations.	CL3
CO4	Apply limit, skip, and sort methods to demonstrate their ability to control and enhance data retrieval.	CL3
CO5	Demonstrate indexing in MongoDB.	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	2	3		2						1	1	1	1
CO2	3	2	3		2						1	1	1	1
CO3	3	2	3		2						1	1	1	1
CO4	3	2	3		2						1	1	1	1
CO5	3	2	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%.
4. 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):

1. https://www.youtube.com/watch?v=8eJJe4Slnik&ab_channel=Simplilearn
2. https://www.youtube.com/watch?v=ExcRbA7fy_A
3. https://www.youtube.com/watch?app=desktop&v=Www6cTUymCY&ab_channel=Amigoscode
4. https://www.mongodb.com/docs/manual/tutorial/

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GAME DEVELOPMENT
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**CS62298CB**	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	02

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of Mathematics and programming skills.

COURSE OBJECTIVES:

- To install Unity and Unreal engine and become proficient in their GUI for game development.
- Develop the ability to conceptualize and define engaging themes for 2D games.
- To acquire skills in character design, sprite creation, character control and movement to create functional 2D gameplay.
- To design interactive game environments with tiles, interactive objects, and collectibles to enhance player engagement.
- To explore the design of player world interactions, with the option of using physics engines, for immersive
- and dynamic gameplay experiences.

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

Sl. No.	Description
1	Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI. Conceptualize the theme for a 2D game.
2	Character design, sprites, movement and character control.
3	Level design: design of the world in the form of tiles along with interactive and collectible objects.
4	Design of interaction between the player and the world, optionally using the physics engine.
5	Developing a 2D interactive using Pygame.
6	Developing a multiplayer experience.
7	Design of menus and user interaction in mobile platforms.
8	Developing a 3D Game using Unreal

9	Developing a Multiplayer game using unity.

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply game engine expertise to install and navigate game engines like unity and unreal engine.	CL3
CO2	Create conceptually sound 2D game themes.	CL3
CO3	Implement 2D game elements by executing their character design, character control, and movement to construct functional game play experiences.	CL3
CO4	Design interactive game environments through the creation of game worlds using tiles, interactive objects, and collectibles.	CL3
CO5	Implement 3D environment, animation and behaviour along with physics based and shooter based 3D game mechanics.	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	2	3		2							1	1	1
CO2	3	2	3		2							1	1	1
CO3	3	2	3		2							1	1	1
CO4	3	2	3		2							1	1	1
CO5	3	2	3		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**
	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%.
4. 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):

1. https://getstream.io/blog/unreal-unity-engine/
2. https://logicsimplified.com/newgames/unity3d-vs-unreal-engine-which-game-engine-is-the-best-fit-for-your-game/

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CISCO PACKET TRACER
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**IS62298IC**	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:

- Basic Knowledge of Mathematics and Embedded Systems.

COURSE OBJECTIVES:

- To conduct experiments to assess the performance of various LAN configurations and protocols employing Cisco Packet Tracer to analyse network behaviour.
- To design and construct VLANs, configuring switches and PCs to enable communication within a VLAN.
- To create and configure inter VLAN routing solutions to facilitate communication between devices in different VLANs
- To set up and configure wireless LANs including access points and wireless devices.
- To remotely access and manage routers using TELNET and SSH protocols, ensuring secure and efficient network administrative practices.

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

Sl. No.	Description
1	To analyze the performance of various configurations and protocols in LAN
2	To construct a VLAN and make the PC's communicate among a VLAN
3	To construct a Inter - VLAN and make the PC's communicate among a VLAN
4	To construct a Wireless LAN and make the PC's communicate wirelessly
5	To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP)
6	To understand the concept and operation of Routing Information Protocol (RIP)
7	To construct multiple router networks and understand the operation of OSPF Protocol
8	To construct multiple router networks and understand the operation of EIGRP Protocol

9	To understand the operation of TELNET by accessing the router in server room from a PC in IT office.
10	To understand the operation of SSH by accessing the routers remotely by PCs

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply knowledge of various LAN configurations and protocols to analyse network performance using cisco packet tracer.	CL3
CO2	Design and implement VLANS and configure switches to enable communication among devices within a VLAN.	CL3
CO3	Implement inter VLAN routing solutions to enable communication among devices in different VLANs	CL3
CO4	Configure wireless LANs including access points and wireless devices, facilitating wireless communication between devices.	CL3
CO5	Apply understanding of OSPF and EIGRP protocols to construct and manage multiple router networks.	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	2	3		2							1		
CO2	3	2	3		2							1		
CO3	3	2	3		2							1		
CO4	3	2	3		2							1		
CO5	3	2	3		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**
	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%.
4. 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.

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JULIA
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**IS62298I**	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	02

CREDITS – 1

COURSE PREREQUISITES:

- Knowledge of Python/Java/R

COURSE OBJECTIVES:

- To introduce the basics of Julia programming language
- To illustrate the data structures of Julia programming language
- To make use of built-in functions and packages

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

Sl. No.	Description
1	a. Develop a Julia program to simulate a calculator (for integer and real numbers). b. Develop a Julia program to add, subtract, multiply and divide complex numbers. c. Develop a Julia program to evaluate expressions having mixed data types (integer, real, floating-point number and complex).
2	a. Develop a Julia program for the following problem: A computer repair shop charges $100 per hour for labour plus the cost of any parts used in the repair. However, the minimum charge for any job is $150. Prompt for the number of hours worked and the cost of parts (which could be $0) and print the charge for the job. b. Develop a Julia program to calculate a person's regular pay, overtime pay and gross pay based on the following: If hours worked is less than or equal to 40, regular pay is calculated by multiplying hours worked by rate of pay, and overtime pay is 0. If hours worked is greater than 40, regular pay is calculated by multiplying 40 by the rate of pay, and overtime pay is calculated by multiplying the hours in excess of 40 by the rate of pay by 1.5. Gross pay is calculated by adding regular pay and overtime pay.
3	a. An amount of money P (for principal) is put into an account which earns interest at r% per

	annum. So, at the end of one year, the amount becomes P + P×r/100. This becomes the principal for the next year. Develop a Julia program to print the amount at the end of each year for the next 10 years. However, if the amount ever exceeds 2P, stop any further printing. Your program should prompt for the values of P and r. b. Develop a Julia program which reads numbers from a file (input.txt) and finds the largest number, smallest number, count, sum and average of numbers.
4	a. Develop a Julia program and two separate functions to calculate GCD and LCM. b. Develop a Julia program and a recursive function to calculate factorial of a number. Develop a Julia program and a recursive function to generate Fibonacci series.
5	a. Develop a Julia program which reads a string (word) and prints whether the word is palindrome. b. Develop a Julia program which reads and prints the words present in a file (input.txt) having Random Data in which words are dispersed randomly (Assumption: a word is a contiguous sequence of letters. A word is delimited by any non-letter character or end-of-line).
6	a. Develop a Julia program to determine and print the frequency with which each letter of the alphabet is used in a given line of text. b. A survey of 10 pop artists is made. Each person votes for an artist by specifying the number of the artist (a value from 1 to 10). Develop a Julia program to read the names of the artists, followed by the votes, and find out which artist is the most popular.
7	a. Given a line of text as input, develop a Julia program to determine the frequency with which each letter of the alphabet is used (make use of dictionary) b. Develop a Julia program to fetch words from a file with arbitrary punctuation and keep track of all the different words found (make use of set and ignore the case of the letters: e.g. to and To are treated as the same word).
8	a. Develop a Julia program to evaluate expressions consisting of rational, irrational number and floating- point numbers) b. Develop a Julia program to determine the following properties of a matrix: determinant, inverse, rank, upper & lower triangular matrix, diagonal elements, Euclidean norm and Square Root of a Matrix.
9	a. Develop a Julia program to determine addition and subtraction of two matrices (element -wise). b. Develop a Julia program to perform multiplication operation on matrices: scalar multiplication, element-wise multiplication, dot product, cross product.
10	a. Develop a Julia program to generate a plot of (solid & dotted) a function: $y=x^2$ (use suitable data points for x). b. Develop a Julia program to generate a plot of mathematical equation: y = sin(x) + sin(2x). c. Develop a Julia program to generate multiple plots of mathematical equations: y = sin(x) + sin(2x) and y = sin(2x) + sin(3x).

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply concepts of data-types, selection and looping constructs of Julia	CL3

	programming language.	
CO2	Demonstrate the use of strings, functions, arrays and matrix operations in solving problems.	CL3
CO3	Develop programs involving data structures to handle multi-valued data items.	CL3
CO4	Make use of packages to generate plots of mathematical functions and equations.	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	2	3		2							1		
CO2	3	2	3		2							1		
CO3	3	2	3		2							1		
CO4	3	2	3		2							1		
CO5	3	2	3		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**
	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:

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up.

Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.

- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

SEE QUESTION PAPER PATTERN:

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made

zero.

The minimum duration of SEE is 02 hours

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

1. https://doi.org/10.1007/978-3-030-73936-2, 2021.

2: https://doi.org/10.1007/978-1-4842-3171-5, 2017.