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

Course Code	**21CS61**	CIA Marks	50
Number of Contact Hours/Week (L:T:P:S)	3:0:0:0	SEE Marks	50
Total Contact Hours	40	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 importance of Agile Software Development.
- 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,	**8 Hours**

Evolutionary process models, Specialized process models.	
MODULE - II	
What is Object orientation? What is OO- development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling, abstraction, The Three models. Class Modelling: 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. Software Quality: Introduction, the place of software quality in project planning, Importance of software quality, software quality models, ISO 9126, quality management systems, process capability models, techniques to enhance software quality, quality plans.	**8 Hours**

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand the activities involved in software engineering and analyse the role of various process models	CL2
CO2	Explain the basics of object-oriented concepts and build a suitable class model using modelling techniques	CL2
CO3	Describe various software testing methods and to understand the importance of agile methodology.	CL2
CO4	Illustrate the role of project planning and quality management in software development	CL3
CO5	Understand the activities involved in software engineering and analyse the role of various process models	CL2

CO-PO-PSO MAPPING

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

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

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03
5	Peer-to-Peer Learning	10 %	02
6	Activity Based Learning	50 %	10
7	Project Based Learning	50 %	10
8	Field Work + Report	50 %	10

9	Industry Visit + Report	50 %	10
10	NPTEL/MOOC Courses – Registration and Assignment Submissions	50 %	10
	NPTEL Certification	75 %	15
11	Any other Innovative Assignments (CL4 and above)	50 %	10

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

SEE QUESTION PAPER PATTERN:

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

REFERENCE BOOKS:

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

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

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

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

SYSTEM SOFTWARE AND COMPILER DESIGN
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**21CS62**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Computer Orgainzation , Theory of Computation, Operating System, Knowledge of programming language (C, C++, java)

COURSE OBJECTIVES:

- Define System Software.
- Familiarize with source file, object file and executable file structures and libraries
- Describe the front-end and back-end phases of compiler and their importance to students

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 System Software, Machine Architecture of SIC and SIC/XE. Assemblers: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options. Basic Loader Functions	**8 Hours**
MODULE - II	
Introduction: Language Processors, The structure of a compiler, The evaluation of programming languages, The science of building a compiler, Applications of compiler technology. **Lexical Analysis**: The role of lexical analyser, Input buffering, Specifications of token, recognition of tokens.	**8 Hours**
MODULE - III	
Syntax Analysis: Introduction, Context Free Grammars, Writing a grammar, TopDown Parsers, Bottom-Up Parsers	**8 Hours**
MODULE - IV	
Syntax Directed Translation, Intermediate code generation, Code generation	**8 Hours**

MODULE – V	
Lex and Yacc –The Simplest Lex Program, Grammars, Parser-Lexer Communication, A YACC Parser, The Rules Section, Running LEX and YACC, LEX and Hand- Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program, Using YACC – Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity.	**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 system software and make use of it to generate machine codes	CL3
CO2	Make use of the functionality of each phase involved in compilation process and construct the grammar for the given regular expressions	CL3
CO3	Apply the parsing techniques for the given programming construct described in context free grammar	CL3
CO4	Construct syntax directed tree and develop machine level codes	CL3
CO5	Make use of LEX and YACC tool to describe the concept of lexer and parser	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Write a LEX program to recognize valid arithmetic expression. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately.	CO2	CL3
2.	Develop, Implement and Execute a program using YACC tool to recognize all strings ending with b preceded by n a's using the grammar a n b (note: input n value)	CO3	CL3
3.	Design, develop and implement YACC/C program to construct Predictive / LL(1) Parsing Table for the grammar rules: A →aBa , B →bB | ε. Use this table to parse the sentence: abba$	CO3	CL3
4.	Design, develop and implement YACC/C program to demonstrate Shift Reduce Parsing technique for the grammar rules: E →E+T | T, T →T*F | F, F →(E) | id and parse the sentence: id + id * id.	CO3	CL3
5.	Design, develop and implement a C/Java program to generate the machine code using Triples for the statement A = -B * (C +D) whose intermediate code in three-address form: T1 = -B T2 = C + D T3 = T1 + T2 A = T3	CO1	CL3
6.	Write a LEX program to eliminate comment lines in a C program and copy the resulting program into a separate file.	CO4	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	3
CO1	3	2		1									1		1
CO2	2	1		1											
CO3	2	2		1		1							1	1	1
CO4	3					1									1
CO5	2	2		1									1	1	

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

ASSESSMENT STRATEGY

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

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Continuous Internal Evaluation (CIE)	60 %	30
	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. System Software by Leland. L. Beck, D Manjula, 3rd edition, 2012
2. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman , Compilers-Principles, Techniques and Tools, Pearson, 2nd edition, 2007
3. Doug Brown, John Levine, Tony Mason, lex & yacc, O'Reilly Media, October 2012.
4. Systems programming – Srimanta Pal , Oxford university press, 2016
5. System programming and Compiler Design, K C Louden, Cengage Learning
6. System software and operating system by D. M. Dhamdhere TMG
7. Compiler Design, K Muneeswaran, Oxford University Press 2013.

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

1. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=17&lesson=18
2. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=26&lesson=27
3. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=43&lesson=44
4. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=52&lesson=53
5. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=75&lesson=76

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

COMPUTER GRAPHICS AND FUNDAMENTALS OF IMAGE PROCESSING

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21CS63**	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:

- Basic knowledge of mathematics

COURSE OBJECTIVES:

- Overview of Computer Graphics along with its applications.
- Exploring 2D and 3D graphics mathematics along with OpenGL API's.
- Use of Computer graphics principles for animation and design of GUI's .
- Introduction to Image processing and Open CV.
- Image segmentation using Open CV

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

Overview: Computer Graphics and OpenGL: Computer Graphics: Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Refresh cathode ray tube, Random Scan and Raster Scan displays, color CRT monitor, graphics software. OpenGL: Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms (DDA, Bresenham‟s), circle generation algorithms (Bresenham‟s)	**8 Hours**

MODULE - II

2D and 3D graphics with OpenGL: 2D Geometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates, 2D Composite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations functions **3D Geometric Transformations:** Translation, rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions	**8 Hours**

Color models: color model, RGB color model, CMY color model	
MODULE - III	
Interactive Input Methods and Graphical User Interfaces: Graphical Input Data, Logical Classification of Input Devices, Input Functions for Graphical Data, Interactive Picture-Construction Techniques, Virtual-Reality Environments, OpenGL Interactive Input-Device Functions, OpenGL Menu Functions, Designing a Graphical User Interface. **Computer Animation:** Raster Method for computer animation, Design of Animation Sequences, Traditional Animation Techniques, General Computer-Animation Functions, Computer-Animation Languages, Character Animation, Periodic Motions, OpenGL Animation Procedures	**8 Hours**
MODULE - IV	
Introduction of image processing: Overview of image processing, Nature of image processing, Digital image representation, types of images, digital image processing operations, Fundamentals steps in image processing. **Digital Image Processing Operations:** Basic relationships and distance metrics, Classification of Image processing Operations, Image interpolation Techniques	**8 Hours**
MODULE - V	
Image Segmentation: Introduction, classification, detection of discontinuities, Edge detection (up to canny edge detection(included)). **Image Morphology:** Need of Morphological Processing, Morphological operators, Hit or miss transform.	**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	Graphics encompasses fundamentals, display technologies, and OpenGL proficiency, covering coordinate systems, reference frames, point and line functions, attributes, and drawing algorithms.	CL3
CO2	Illustrate 2D and 3D geometric transformations using OpenGL.	CL3
CO3	Design GUI with necessary techniques required to animate the created objects	CL3
CO4	Apply OpenCV for developing Image processing applications.	CL3
CO5	Apply Image segmentation and morphology techniques along with programming, using OpenCV, for developing simple applications.	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	3
CO1	1	3	1	2	3						2	3			
CO2	2	3	2	2	3				2		3	3	3		2
CO3	2	3	2	3	3				2		3	3	3		3
CO4	2	3	2	3	3				2		3	3	3		3
CO5	2	3	2	3	3				2		3	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. Donald D Hearn, M Pauline Baker and Warren Carithers: Computer Graphics with OpenGL 4th Edition, Pearson, 2014
2. S. Sridhar, Digital Image Processing, second edition, Oxford University press 2016.
3. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008
4. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: Pearson education

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

1. https://nptel.ac.in/courses/106/106/106106090/
2. https://nptel.ac.in/courses/106/102/106102063/
3. https://nptel.ac.in/courses/106/103/106103224/
4. https://nptel.ac.in/courses/106/102/106102065/
5. https://www.tutorialspoint.com/opencv/ (Tutorial, Types of Images, Drawing Functions)

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

Course Code	**21CS641**	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:

- Knowledge of software engineering fundamentals.

COURSE OBJECTIVES:

- Interpret the concept of agile software engineering and its advantages in software development.
- Analyze the core practices behind several specific agile methodologies
- Identify the roles and responsibilities in agile projects and their difference from projects following traditional methodologies.

TEACHING - LEARNING STRATEGY:

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

- Chalk and Talk Method/Blended Mode Method
- PowerPoint 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: Need of Agile software development, agile context– Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges. Business benefits of software agility.	**8 Hours**

MODULE – II

Project Planning: Recognizing the structure of an agile team– Programmers, Managers, Customers. User stories– Definition, Characteristics, and content. Estimation– Planning poker, Prioritizing, and selecting user stories with the customer, projecting team velocity for releases and iterations.	**8 Hours**

MODULE – III

Project Design: Fundamentals, Design principles–Single responsibility, Open-closed, Liskov substitution, Dependency-inversion, Interface-segregation.	**8 Hours**

MODULE – IV

Design Methodologies: Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team. Extreme Programming- Core	**8 Hours**

principles, values and practices. Kanban, Feature-driven development, Lean software development.	

MODULE – V

Testing: The Agile lifecycle and its impact on testing, Test driven development–Acceptance tests and verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation.	**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	Interpret the concept of agile software engineering and its advantages in software development.	CL2
CO2	Illustrate the core practices behind several specific agile methodologies.	CL2
CO3	Summarize the roles and responsibilities in agile projects and their difference from projects following traditional methodologies.	CL2
CO4	Apply functional testing, unit testing, and continuous integration.	CL3
CO5	Determine the role of design principles in agile software design and Make use of various tools available to agile teams to facilitate the project.	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	3
CO1	2							2		2		2	1	1	
CO2	2	2	2			1		2		2	2	2	2	1	2
CO3	2	2	2					2	2	3	1	2	3	1	2
CO4	2	2	2		3			2	2	3	1	2	3	1	
CO5	2	2	2		3	3	3	2	2	3	1	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/	

I	II	III	Activities (40%)	
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. Ken Schawber, Mike Beedle, "Agile Software Development with Scrum", International Edition, Pearson.
2. Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", First International Edition, Prentice Hall.
3. Pedro M. Santos, Marco Consolaro, and Alessandro Di Gioia, "Agile Technical Practices Distilled: A learning journey in technical practices and principles of software design", First edition, Packt Publisher

4. Lisa Crispin, Janet Gregory, “Agile Testing: A Practical Guide for Testers and Agile Teams”, International edition, Addison Wesley.
5. Alistair Cockburn, “Agile Software Development: The Cooperative Game”, 2nd Edition, Addison-Wesley

NATURAL LANGUAGE PROCESSING
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**21CS642**	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 Automata Theory and Basic knowledge of English Grammar.

COURSE OBJECTIVES:

- Define the natural language and analyze the importance of natural language.
- Analyze spelling error detection and correction methods and parsing techniques in NLP.
- Understand the Applications of natural language processing.
- Illustrate the information retrieval models in natural language processing.

TEACHING - LEARNING STRATEGY:

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

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

COURSE CONTENTS

MODULE - I	
Overview and language modeling: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications, **Language Modeling**: Statistical Language Model- N-gram model- (**unigram, bigram**), Paninion Framework, Karaka theory, Smoothing Technique.	**8 Hours**
MODULE - II	
Word Level Analysis: Regular Expressions, Finite State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes-Part-of Speech Tagging. **Syntactic Analysis:** Context-free Grammar, Constituency, top-down and bottom-up Parsing, CYK parsing.	**8 Hours**
MODULE - III	
Naive Bayes and Sentiment Classification: Naive Bayes Classifiers, Training the Naive Bayes Classifier, Worked example, Optimizing for Sentiment Analysis, Naive Bayes for other text classification tasks, Naive Bayes as a Language Model	**8 Hours**

MODULE - IV	
Information Retrieval and Lexical Resources: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval- Custer model, Fuzzy model, LSTM model**,** Major Issues in Information Retrieval. **Lexical Resources**: World Net, Frame Net, Stemmers, POS Tagger- Research Corpora.	**8 Hours**
MODULE - V	
Machine Translation: Language Divergences and Typology, Machine Translation using Encoder-Decoder, Details of the Encoder-Decoder Model, Translating in low-resource situations, MT Evaluation, Bias and 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	Discuss the concepts of NLP and demonstrate the statistical-based language models and smoothing techniques	
CO2	Demonstrate the use of morphological analysis and parsing using Finite State Transducers, spelling error detection and correction, parts of speech tagging, context-free grammar, and different parsing approaches	
CO3	Apply the Naïve Bayes classifier and sentiment analysis for Natural language problems and text classifications.	
CO4	Illustrate the use of Information Retrieval in the context of NLP and understand the concept of lexical semantics, lexical dictionaries such as WordNet, lexical computational semantics, distributional word similarity.	
CO5	Develop the Machine Translation applications using Encoder and Decoder model.	

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	3
CO1	2							2		2		2	1	1	
CO2	2	2	2			1		2		2	2	2	2	1	2
CO3	2	2	2					2	2	3	1	2	3	1	2
CO4	2	2	2		3			2	2	3	1	2	3	1	
CO5	2	2	2		3	3	3	2	2	3	1	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. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

2. D. Jurafsky, J. H. Martin, “Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition (3e)”, Pearson Education, 2023.
3. Akshay Kulkarni, Adarsha Shivananda, “Natural Language Processing Recipes - Unlocking Text Data with Machine Learning and Deep Learning using Python”, Apress, 2019
4. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummings publishing company, 1995.
5. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer Academic Publishers, 2000

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

1. https://www.youtube.com/watch?v=M7SWr5xObkA
2. https://youtu.be/02QWRAhGc7g
3. https://www.youtube.com/watch?v=CMrHM8a3hqw

SOCIAL NETWORK ANALYSIS
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

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

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematics, Data Structures and algorithms.

COURSE OBJECTIVES:

This course will enable students to:

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

TEACHING - LEARNING STRATEGY:

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

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

COURSE CONTENTS

MODULE – I

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

MODULE – II

Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and between-ness centrality. Eigenvector centrality and PageRank, Algorithm HITS.	**8 Hours**

MODULE – III

Network communities and Affiliation networks: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems.	**8 Hours**

MODULE – IV	
Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in the network. Network visualization and graph layouts. Graph sampling. Low -dimensional projections**.**	**8 Hours**
MODULE – V	
Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets.	**8 Hours**

COURSE OUTCOMES

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

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

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1				2				2		1	
CO2	3	3	2					2				2	1		
CO3	3	3	3					2				2	1		
CO4	3	3	3					2				2	2		
CO5	3	3	3					2				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. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010.
2. Eric Kolaczyk, Gabor Csardi. Statistical Analysis of Network Data with R (Use R!). Springer, 2014.

3. Stanley Wasserman and Katherine Faust. “Social Network Analysis. Methods and Applications.” Cambridge University Press, 1994.

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

DATA SCIENCE AND APPLICATION
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**21CS644**	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:

COURSE OBJECTIVES:

- To learn data collection and preprocessing techniques for data science
- To Understand and practice analytical methods for solving real life problems.
- To study data exploration techniques
- To learn different types of data and its visualization
- To map element of visualization well to perceive information

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 data Science: Brief History of Data Science, Data Science role and skill tracks, What kind of question can Data sceice solve ,Structure of Data Science Team, Data science roles.	**8 Hours**
MODULE – II	
Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation **Probability :** Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution.	**8 Hours**
MODULE – III	
Data Analysis : Getting Data ,Working with Data ,KNN, Simple Linear regression, Multiple regression.	**8 Hours**
MODULE – IV	
Visualizing Data: Numpy , Pandas, Matplotlib,Bar, chart,Line chart,Scatter Plot.	**8 Hours**

MODULE – V	
Simplifying Visualizations using Seaborn: Introduction, Advantages of Seaborn Controlling Figure Aesthetics: Seaborn Figure Styles, Removing Axes Spines, Contexts; Color Palettes: Categorical Color Palettes, Sequential Color Palettes, Diverging Color Palettes; Interesting Plots in Seaborn: Bar Plots, Kernel Density Estimation, Plotting Bivariate Distributions, Visualizing Pairwise Relationships, Violin Plots	**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 data preprocessing methods on open access data and generate quality data for analysis	CL3
CO2	Apply and analyze classification and regression data analytical methods for real life Problems.	CL3
CO3	Implement analytical methods using Python/R.	CL3
CO4	Apply different data visualization techniques to understand the data.	CL3
CO5	Analyze the data using suitable method, visualize using the open source tool.	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	3
CO1	2	2		2	2				2	2	2	2	2		2
CO2	2	2		2	2				2	2	2	2	2		2
CO3	2	2		2	2				2	2	2	2	2		2
CO4	2	2		2	2				2	2	2	2	2		2
CO5	2	2		2	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**
	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

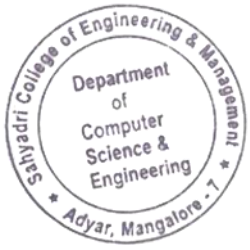
SEE QUESTION PAPER PATTERN:

- 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. Data Science from Scratch : Joel Grus, O'Reilly Media Inc., ISBN: 9781491901427
2. Data Visualisation Workshop, Tim Grobmann and Mario Dobler , Packt Publishing
3. Practitioner's Guide to Data Science : Hui Lin and Ming Li
4. Big data black book, Dream tech publication
5. Getting Started with Business Analytics: Insightful Decision-Making , David Roi Hardoon, GalitShmueli, CRC Press

6. Business Analytics , James R Evans, Pearson
7. Python Data science Handbook, Jake VanderPlas, Orielly publication
8. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, Vovost Foster, Fawcett Tom



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

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

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematics, Data Structures, Networking

COURSE OBJECTIVES:

- Define and explain the fundamentals of Block chain
- Illustrate the technologies of Block chain
- Describe the models of Block chain
- Analyze and demonstrate the Ethereum

TEACHING - LEARNING STRATEGY:

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

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

COURSE CONTENTS

MODULE - I	
Introduction to Blockchain Technology: Distributed systems, The history of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain, Decentralization using blockchain, Methods of decentralization, Routes to decentralization.	**8 Hours**
MODULE - II	
Cryptography in Blockchain: Introduction, cryptographic primitives, Asymmetric cryptography, public and private keys, RSA, ECC, Hash functions, financial markets and trading	**8 Hours**
MODULE - III	
Bit Coin Introduction, Transactions: Structure, Transactions types, The structure of a block, The genesis block, The bitcoin network, Wallets and its types, Bitcoin payments, Bitcoin investment and buying and selling bitcoins, Bitcoin installation, Bitcoin programming and the command-line interface, Bitcoin improvement proposals (BIPs).	**8 Hours**
MODULE - IV	
Ethereum: Ethereum block chain, Ethereum network, Components of the Ethereum ecosystem, Keys and Addresses, Accounts and its types, Transactions and Messages, Contract	**8 Hours**

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.	

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 the cryptography techniques in Blockchain	CL3
CO3	Demonstrate the structure, usage, wallet transaction and installation of Bitcoin	CL3
CO4	Demonstrate Application development using Ethereum	CL3
CO5	Illustrate the usage of Smart contract and architecture of Hyperledger	CL3

CO-PO-PSO MAPPING

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

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

ASSESSMENT STRATEGY

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

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

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

SEE QUESTION PAPER PATTERN:

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

REFERENCE BOOKS:

1. 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

INTERNET OF THINGS
(Effective from the Academic Year 2023 - 2024)
VI SEMESTER

Course Code	**21CS652**	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 embedded system and computer communication

COURSE OBJECTIVES:

- Familiarize genesis and impact of IoT applications, architectures
- Familiarize the diverse methods of deploying smart objects and connect them to networks.
- Familiarize the IoT protocols and Security

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 IoT: Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.	**8 Hours**
MODULE - II	
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	**8 Hours**
MODULE - III	
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.	**8 Hours**
MODULE - IV	
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.	**8 Hours**

MODULE - V	
IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints -RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT 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	Assess the genesis and impact of IoT applications, architectures in the real world.	CL3
CO2	Illustrate diverse methods of deploying smart objects and connect them to networks.	CL3
CO3	Appraise the role of IoT protocols for efficient network communication.	CL3
CO4	Elaborate the need for Data Analytics and Security in IoT.	CL3
CO5	Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.	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	3
CO1	3	3	3	2	3					2			3	3	2
CO2	3	3	3	2	3					2			3	3	2
CO3	3	3	3	2	3					2			3	3	2
CO4	3	3	3	2	3					2			3	3	2
CO5	3	3	3	2	3					2			3	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
	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) (100%)			
I	II	III	
Syllabus Coverage			Syllabus Coverage
40%	30%	30%	100%
MI			MI
MII	MII		MII
	MIII		MIII
		MIV	MIV
		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. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017
3. S Vijay Madisetti and Arshdeep Bahga, **"Internet of Things (A Hands-on-Approach)",** 1st Edition, VPT, 2014. (**ISBN:** 978-8173719547)
4. Raj Kamal, **"Internet of Things: Architecture and Design Principles",** 1st Edition, McGraw Hill Education, 2017. (**ISBN:** 978-9352605224)

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

1. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=17&lesson=18
2. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=26&lesson=27
3. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=43&lesson=44
4. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=52&lesson=53
5. https://onlinecourses.nptel.ac.in/noc22_cs93/unit?unit=75&lesson=76

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

Course Code	**21CS653**	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 OS, Data Structures.

COURSE OBJECTIVES:

- Introduce students the design, analysis, and implementation, of high performance computational science and engineering applications.
- Illustrate on advanced computer architectures, parallel algorithms, parallel languages, and performance-oriented computing.

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 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	**8 Hours**

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. 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, 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.	**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	Demonstrate understanding of Parallel Computing Ecosystem.	CL2
CO2	Showcase expertise in parallel algorithm design by developing a robust understanding of parallel algorithm models and their implications on design.	CL3
CO3	Identify and analyze sources of overhead in parallel programs, recognizing their impact on performance; assess performance metrics for parallel systems, gaining expertise in MPI.	CL4
CO4	Master Thread-Based Parallel Programming, utilizing the OpenMP Standard for directive-based parallel programming, with a focus on dense matrix algorithms and addressing challenges in sorting on parallel computers.	CL4
CO5	Excel in Graph Algorithm by demonstrating proficiency in both sequential and parallel search algorithms.	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**	**3**
CO1	3	3	3	3	2	2			2	1	1	3	3	3	
CO2	3	3	3	3	2		1	1	2	1	1	3	3	3	
CO3	3	3	3	3	2				2	1	1	3	3	3	
CO4	3	3	3	3	2				2	1	1	3	3	3	
CO5	3	3	3	3	2				2	1	1	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. Introduction to Parallel Computing, Ananth Grama, 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):

1. https://www.youtube.com/watch?v=gY0MwGLq9W8&list=PLyqSpQzTE6M9DKhN7z2fOpKTJWu-639_P
2. https://www.youtube.com/watch?v=5Y8Lfsreeck&list=PL7DC83C6B3312DF1E
3. https://www.youtube.com/watch?v=S47aSEqm_0I&list=PLgj_V-ZKxRKrxgFyOutPJpoLFBaQMOpK-

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

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

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

CREDITS – 3

COURSE PREREQUISITES:

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

COURSE OBJECTIVES:

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

TEACHING - LEARNING STRATEGY:

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

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

COURSE CONTENTS

MODULE - I	
Introduction to design pattern: Describing, the catalog of, organizing the catalog, solve design problems, select and how to use - design pattern. A Notation for Describing Object-Oriented Systems **Analysis a System**: overview of the analysis phase, gathering the requirements functional requirements specification, defining conceptual classes and relationships, using the knowledge of the domain. Design and Implementation.	**8 Hours**
MODULE - II	
Design Pattern Catalog: Structural patterns, Adapter, bridge, composite, decorator, facade, flyweight, proxy.	**8 Hours**
MODULE - III	
Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Template Method	**8 Hours**
MODULE - IV	
Interactive systems and the MVC architecture: Introduction, The MVC architectural pattern, analysing a simple drawing program, designing the system, designing of the subsystems, getting into implementation, implementing undo operation, drawing incomplete	**8 Hours**

items, adding a new feature, pattern-based solutions. Case study on Moving from MVVM to MVC Architecture: A Case Study in Android	

MODULE - V

Designing with Distributed Objects: Client server system, java remote method invocation (RMI), implementing an object-oriented system on the web. Web Services versus Distributed Objects:A Case Study of Performance and Interface Design.	**8 Hours**

COURSE OUTCOMES

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

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

CO-PO-PSO MAPPING

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

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

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

SEE QUESTION PAPER PATTERN:

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

REFERENCE BOOKS:

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

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

1. https://darrenfinch.com/moving-from-mvvm-to-mvc-architecture-a-case-study-in-android/
2. 221587296_Web_Services_versus_Distributed_Objects_A_Case_Study_of_Performance_and_Interface_Design

COMPUTER GRAPHICS AND IMAGE PROCESSING LABORATORY
(Effective from the Academic Year 2023- 2024)
VI SEMESTER

Course Code	**21CSL66**	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 C

COURSE OBJECTIVES:

- Demonstrate the use of Open GL.
- Demonstrate the different geometric object drawing using openGL
- Demonstration of 2D/3D transformation on simple objects.
- Demonstration of lighting effects on the created objects.
- Demonstration of Image processing operations on image/s.

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	Implement Brenham's line drawing algorithm for all types of slopes.
2	Write a program in OpenGL that demonstrates basic 2D geometric transformations such as translation, rotation, and scaling. Allow the user to interactively apply these transformations to a 2D object.
3	Develop a program to demonstrate 3D transformation on 3D objects
4	Write a program that takes an RGB color as input and converts it to its corresponding CMY values.
5	Create a program that captures user input to dynamically adjust the properties of a shape (e.g., size, color).
6	Write a Program to read a digital image. Split and display image into 4 quadrants, up, down, right and left
7	Read an image and extract and display low-level features such as edges, textures using filtering techniques
8	Write a program to blur and smoothing an image.

9	Write a program for image segmentation by using edge based segmentation

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 basic concepts of Computer Graphics	CL3
CO2	Analyze the necessity mathematics and demonstrate basic geometric transformation techniques	CL3
CO3	Demonstrate the ability to design and develop input interactive techniques.	CL3
CO4	Apply the concepts to develop user friendly applications using Graphics and IP concepts	CL3
CO5	Apply the basics of image processing	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	3
CO1	1	2	2	3	3				2	2	3	3	1	1	
CO2	2	2	3	3	3				3	2	3	3	2	2	
CO3	2	2	3	3	3				3	2	3	3	2	2	2
CO4	2	2	3	3	3				3	2	3	3	2	2	3
CO5	2	2	3	3	3				3	2	3	3	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 BOOKS:

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd/4th Edition, Pearson Education,2011
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: Pearson education

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

1. https://nptel.ac.in/courses/106/106/106106090/
2. https://nptel.ac.in/courses/106/102/106102063/
3. https://nptel.ac.in/courses/106/103/106103224/
4. https://nptel.ac.in/courses/106/102/106102065/
5. https://www.tutorialspoint.com/opencv/
6. https://medium.com/analytics-vidhya/introduction-to-computer-vision-opencv-in-pythonfb722e805e8b

CLOUD COMPUTING AND SECURITY
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**21CS71**	CIA Marks	50
Number of Contact Hours/Week (L:T:P:S)	3:0:2:0	SEE Marks	50
Total Contact Hours	40	Exam Hours	03

CREDITS - 4

COURSE PREREQUISITES:

- Fundamental knowledge of databases, Operating Systems and Networking

COURSE OBJECTIVES:

This course will enable students to:

- Discuss the concepts, characteristics, delivery models and benefits of cloud computing.
- Explore the key technical, organizational and compliance challenges of cloud computing.
- Explore the security issues that arise from cloud computing architectures intended for delivering Cloud based enterprise IT services.

TEACHING - LEARNING STRATEGY:

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

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

COURSE CONTENTS

MODULE - I

Introduction: The Evolution of Cloud Computing; **What Is Cloud Computing?:** Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model, Cloud Deployment Models, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise.	**8 Hours**

MODULE - II

Infrastructure Security: Infrastructure Security: The Network Level, Infrastructure Security: The Host Level, Infrastructure Security: The Application Level. **Data Security and Storage:** Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security.	**8 Hours**

MODULE - III

Identity and Access Management: Trust Boundaries and IAM, Why IAM?, IAM Challenges, IAM Definitions, IAM Architecture and Practice, Relevant IAM Standards and Protocols for Cloud Services, IAM Standards, Protocols, and Specifications for Consumers, Comparison of	**8 Hours**

Enterprise and Consumer Authentication Standards and Protocols, IAM Practices in the Cloud, Cloud Authorization Management, Cloud Service Provider IAM Practice	
MODULE - IV	
Security Management in the Cloud: Introduction, Security Management Standards, Security Management in the Cloud, Availability Management, SaaS Availability Management, PaaS Availability Management, IaaS Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management.	**8 Hours**
MODULE - V	
Privacy: What Is Privacy?, What Is the Data Life Cycle?, What Are the Key Privacy Concerns in the Cloud?, Who Is Responsible for Protecting Privacy? Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations. **Audit and Compliance:** Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Illustrative Control Objectives for Cloud Computing, Incremental CSP-Specific Control Objectives, Additional Key Management Control Objectives, Control Considerations for CSP Users, Regulatory/External Compliance, Other Requirements, Cloud Security Alliance, Auditing the Cloud for Compliance.	**8 Hours**

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Create a simple web application that gets a token from KMS or Keycloak (open source). The token exchange should be enabled by cacerts verification. The token should be valid for a session only and set expiration timer. Validate by trying to access the application. **Cloud Security Feature:** Web application security on Cloud using Tokens and Oauth **Expected Outcome:** When session closed or token expired, user should get invalid token or permissions error.	CO2	CL3
2.	Develop a small Java client server application that sends messages and receives acknowledgement. Encrypt the message using AECS or equivalent mechanism. Decrypt at the server and provide appropriate response. Validate by sending non-encrypted messages. **Cloud Security Feature:** Secure messaging over Cloud **Expected Outcome:** Only encrypted messages should be processed.	CO2	CL3
3.	Create a public cloud account (AWS/Azure/GCP) with free trial credit. Create IAM roles; define policies for admin, developers, customer and maintainer. Create users for each role and validate if users access are within defined limits. **(Optional:** Write a Java program to access AWS service)	CO3	CL3

	Cloud Security Feature: Authentication and Authorization **Expected Outcome:** Only admin should have complete access. Other users should have limited accesses.		
4.	On the VPC and VM created in experiment #2, deploy a "Hello World" Java web application. Control the application by creating a load balancer and API gateway or service registry. Define rules to limit access to few users. Validate the rules are working, by trying to access the webpage. **Cloud Security Feature:** Cloud application access **Expected Outcome:** Application should be working for only users with access. Others should get access denied.	CO3	CL3
5.	Create a VPC, create a small VM, provision disk storage, and store a file in the storage. Define VPC rules, security groups for VM, access controls for storage Validate the defined security controls by creating different users. **Cloud Security Feature:** Cloud infrastructure access control **Expected Outcome:** Only admin and users with particular access should be able to connect to the VM, get file on disk. Other users should be denied.	CO4	CL3

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Outline the concept of cloud computing and discuss the types of services offered through cloud computing.	CL2
CO2	Describe the IT infrastructure security capabilities offered by the cloud services. Also identify the current state of data security and the data storage in the cloud.	CL3
CO3	Explain the identity and access management (IAM) practice and make use of capabilities for Authentication, authorization, and auditing of users who access cloud services.	CL3
CO4	Identify the security management frameworks and the standards that are relevant for the Cloud.	CL3
CO5	Outline the privacy aspects to consider within the context of cloud computing and illustrate the importance of audit and compliance functions within the cloud.	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**	**3**
CO1	3	3	2	2								2	2	2	
CO2	3	3	2	2	3							2	3	3	

CO3	3	3	3	2	3						2	2	3	2	
CO4	3	3	3	2	3						2	2	3	3	
CO5	3	3	3	2							2	2	3	3	

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

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

NOTE:

- 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:

- 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. Tim Mather, Subra Kumaraswamy, Shahed Latif: “Cloud Security and Privacy, An Enterprise Perspective on Risks and Compliance”, Oreilly Media, 2009
2. Vic (J.R.) Winkler: ”Securing the Cloud, Cloud Computer Security Techniques and Tactics”, Syngress, 2011

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

1. https://www.digimat.in/nptel/courses/video/106105167/L01.html
2. https://www.youtube.com/watch?v=44IBhZwa4ZM
3. https://www.digimat.in/nptel/courses/video/106104182/L01.html

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

Course Code	**21CS72**	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:

- Basics of SQL

COURSE OBJECTIVES:

- Understand the fundamentals and applications of Big Data analytics
- Explore the Hadoop framework and Hadoop Distributed File system and essential Hadoop Ecosystem Tools
- Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
- Employ MapReduce programming model to process the big data
- Understand various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis.

TEACHING - LEARNING STRATEGY:

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

- Chalk and Talk Method/Blended Mode Method
- PowerPoint 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 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. **MapReduce:** Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms,	**8 Hours**

Hadoop Distributed File System Basics: HDFS Design Features, Components, HDFS User Commands. **Essential Hadoop Tools:** Using Apache Pig, Hive, Sqoop, Flume, Oozie, HBase.	
MODULE - III	
NoSQL Big Data Management: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, **MongoDB and Cassandra:** MongoDB and Cassandra Databases.	**8 Hours**
MODULE - IV	
Hive: Introduction to Hive, Main features of Hive, Hive Characteristics, Hive Architecture, Hive Installation, Comparison with RDBMS, Hive Data Types and File Formats, Hive Data Model, Hive Integration and Workflow Steps, Hive Built-in Functions, HiveQL. **Pig:** Introduction to Pig, Features, Pig Architecture, Installing Pig, Pig Latin Data Model, Pig Latin and Development Pig Latin Scripts.	**8 Hours**
MODULE - V	
Machine Learning Algorithms for Big Data Analytics: Introduction, Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering, Frequent Itemsets and Association Rule Mining. **Text, Web Content, Link, and Social Network Analytics:** Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics.	**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 fundamentals of big data analytics and discuss some case studies.	CL 2
CO2	Interpret the Hadoop framework and understand the concepts of Hadoop Distributed File system, Map Reduce Programming Model.	CL 2
CO3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.	CL 3
CO4	Apply Map Reduce, Hive, HiveQL, Pig programming model to understand processing of big data.	CL 3
CO5	Make use of various machine learning algorithms for Big Data Analytics, Web Mining and Social Network Analysis.	CL 3

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	3
CO1	3	3	2	2	1	1						2	2	2	
CO2	3	3	2	2	2	1			1			2	2	2	
CO3	3	3	2	2	3	1			2			2	2	2	1
CO4	3	3	2	2	2	1			1			2	2	2	1

CO5	3	3	3	3	2	1				2		2	2	2	
3: Substantial (High)					**2: Moderate (Medium)**					**1: Poor (Low)**					

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

SEE QUESTION PAPER PATTERN:

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

REFERENCE BOOKS:

1. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", 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", 1stEdition, Pearson Education, 2016. ISBN-13: 978-9332570351
3. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O"Reilly Media, 2015.ISBN-13: 978-9352130672
4. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1stEdition, Wrox Press, 2014 ISBN-13: 978-8126551071
5. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1stEdition, O'Reilly Media, 2012.ISBN-13: 978-9350239261
6. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

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

1. https://www.youtube.com/watch?v=n_Krer6YWY4
2. https://onlinecourses.nptel.ac.in/noc20_cs92/preview
3. https://www.digimat.in/nptel/courses/video/106104189/L01.html

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

ROBOTIC PROCESS AUTOMATION
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**21CS731**	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 any programming language

COURSE OBJECTIVES:

This course will enable students to:

- To understand basic concepts of RPA.
- To Describe RPA, where it can be applied and how its implemented
- To Describe the different types of variables, Control Flow and data manipulation techniques
- To Understand Image, Text and Data Tables Automation
- To Describe various types of Exceptions and strategies to handle

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 ROBOTIC PROCESS AUTOMATION - Scope and techniques of automation, Robotic process automation - What can RPA do?, Benefits of RPA, Components of RPA, RPA platforms, The future of automation. Record and Play-UI Stack-Downloading and installing UI Path Studio-Learning UI Path Studio-Task Recorder-Step-by-Step Examples using the Recorder.	**8 Hours**

MODULE – II

INTRODUCTION TO RPA TOOL - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity	**8 Hours**

- The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data	
MODULE – III	
ADVANCED AUTOMATION CONCEPTS & TECHNIQUES: Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel – Extracting, Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.	**8 Hours**
MODULE – IV	
HANDLING USER EVENTS & ASSISTANT BOTS, EXCEPTION HANDLING: What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event. **EXCEPTION HANDLING**: Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.	**8 Hours**
MODULE – V	
DEPLOYING AND MAINTAINING THE BOT: Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages.	**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** RPA's potential and impact on automation from basics to advanced concepts	CL2
CO2	**Illustrate** user interface navigation to variables, control flow, and data manipulation for efficient process automation	CL3
CO3	**Demonstrate** various automation techniques, including recording methods, selectors, debugging, Citrix automation, and data manipulation, to excel in RPA implementations	CL3
CO4	**Illustrate** user event handling, assistant bot creation, and effective exception handling techniques for seamless RPA operation	CL3
CO5	Learn to **Apply**, maintain, and update bots efficiently using server control and package management techniques	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	3
CO1	3	3	2							1	1	1	3	1	1
CO2	3	3	2		2					1	1	1	3	1	1
CO3	3	3	3	1	2					1	1	1	3	1	1
CO4	3	3	3	1	2					1	1	1	3	1	1
CO5	3	3	3	1	2					1	1	1	3	1	1
3: Substantial (High)					2: Moderate (Medium)					1: Poor (Low)					

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05
2	Quiz	10 %	02
3	Case Studies	25 %	05
4	Seminar/Presentation	15 %	03

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

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

SEE QUESTION PAPER PATTERN:

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

REFERENCE BOOKS:

1. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9787788470940.
2. Tom I'aulli, The Robotic Process Automation handbook: A Guide to Implementing RPA Systems,2020, lSBN-13 (electronic):978-7-4842-5729-6, Publisher: A press
3. Frank Casale, Rebecca Dilla, Iieidi Jaynes,Lauren Livingston,"Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation.
4. Richard Murdoch, I{robotic Process Automation: Guide to Building Software robots, Automate Repetitive Tasks & Become An RPA Consultant
5. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation

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

1. https://www.uipath.com/

CYBER SECURITY MANAGEMENT, COMPLIANCE AND GOVERNANCE

(Effective from the Academic Year 2023 - 2024)

VII SEMESTER

Course Code	**21CS732**	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:

- It is recommended that students must have Basics of Internet

COURSE OBJECTIVES:

- This course provides an overview of the broad and constantly emerging field of cybersecurity policy, governance, law and compliance. The importance of the role of security policy is discussed

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: Concepts of cybersecurity, its relationship with network and information security, cybercrime, cyber defence, and related definitions. Concepts of policy, governance, related law and compliance, and the relationships between them. Principles: Information security components and concepts, confidentiality, integrity, availability.	**8 Hours**
MODULE – II	
Policy: definition, role of policy in an organization, statement of management purpose and organizational objectives, description of organizational approach, standards, baselines, guidelines, procedures Law: Relevant laws and legal/regulatory frameworks on the national, European and international level. Different types of law related to cyberattacks – computer as the means, computer as a victim. Problems of jurisdiction, borderless nature of cybercrime, relevance and importance of data protection and privacy, investigations.	**8 Hours**

MODULE – III	
IT and Law: Introduction, Terminology, and the Nature of Cyberspace and Threats. Cyber-regulation and cyber-regulatory theory. Cyberproperty and Intellectual Property. Cyber-rights, Speech Harm, Crime and Control. Roles of International Law, the State, and the Private Sector in Cyberspace. Authentication and Identity Management. Speech, Privacy and Anonymity in Cyberspace. Trust.	**8 Hours**
MODULE – IV	
Governance: Role of cybersecurity and information security in the organization, levels of responsibility, the different personnel roles: information owner, information custodian, administrator, solution provider, change control, human resources, user. Certification and accreditation.	**8 Hours**
MODULE – V	
Compliance: Reasons for specific cybersecurity legislation beyond cybercrime, compliance requirements, self-assessment, auditing principles, audit process. Business case study and lecture: Lecture by invited experts from the cybersecurity industry. Discussion normally focuses on reasons behind and expected benefits of compliance requirements and on recent/future developments.	**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 concepts relating to organizational cybersecurity policy, governance mechanisms, and applicable legislation and compliance requirements for information security.	CL2
CO2	Interpret the different components of a comprehensive organizational cybersecurity policy.	CL3
CO3	Interpret the role of security policy within an organization and its position with relation to other controls within a comprehensive cybersecurity environment.	CL3
CO4	Describe the role of corporate governance with regards to cybersecurity, and the business reasons for implementing a cybersecurity function.	CL3
CO5	Explain compliance requirements in relation to cybersecurity, information security, privacy data protection and critical information infrastructure protection	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	3
CO1	3											2		2	
CO2	2	2	2	2								2		2	
CO3	2	2	2	2	1							2		2	
CO4	2	2	2	1								2		2	

CO5	2	2	2	1	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. Cybersecurity for Beginners - Raef Meeuwisse.
2. Enterprise Cybersecurity by Scott Donaldson and Stanley Siegel.
3. How to Measure Anything in Cybersecurity Risk by Douglas W. Hubbard and Richard Seierse.
4. CSX Cybersecurity Fundamentals Study Guide by ISACA.

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

4. https://www.youtube.com/watch?v=SSE4M0gcmvE
5. https://www.youtube.com/watch?v=_Fn5HYfK858
6. https://www.youtube.com/watch?v=6n1eOf6VJDg
7. https://www.youtube.com/watch?v=FFzdXJ49KAI

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

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

Course Code	**21CS733**	CIA Marks	40
Number of Contact Hours/Week (L: T: P: S)	3:0:0:0	SEE Marks	60
Total Hours of Pedagogy	**40L**	Exam Hours	03

CREDITS – 3

COURSE PREREQUISITES:

- Knowledge of mathematical principles, such as linear algebra, number theory, and combinatorics.

COURSE OBJECTIVES:

- Understand the concept of Cyber security.
- Obtain the knowledge of classical cryptography algorithms.

TEACHING - LEARNING STRATEGY:

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

- Chalk and Talk Method/Blended Mode Method
- PowerPoint 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

Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard**: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm	**8 Hours**

MODULE – II

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems**: Diffie-Hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems.	**8 Hours**

MODULE – III	
Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves overGF(2m), Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA. **Key Management and Distribution**: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates.	**8 Hours**
MODULE – IV	
X-509 certificates. Certificates, X-509 version 3, public key infrastructure. User Authentication: Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication **Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, EMail threats, DKIM strategy, DKIM functional flow.	**8 Hours**
MODULE – V	
IP Security: IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service **Transport and tunnel modes**, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits.	**8 Hours**

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate cryptography and its principles	CL2
CO2	Summarize cryptography algorithms and its need to various applications	CL2
CO3	Illustrate Public and Private key cryptography	CL2
CO4	Explain Key management, distribution and certification	CL2
CO5	Interpret authentication protocols and IPSec	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	3
CO1	2	2				3			3			2	2		3
CO2	3	2	3	3		3		3	1			2	3	2	3
CO3	2	3	2	3	2	3		3	3	2		2	1	1	3
CO4	2	1	2	2	2	3		3	3	2		2	2	1	
CO5	2	2	3	2	3	3		3	3	2		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:

- William Stallings: Cryptography and Network Security, Pearson 6th edition.
- V K Pachghare: Cryptography and Information Security, PHI 2nd Edition
- Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.

DEEP LEARNING

(Effective from the Academic Year 2023 - 2024)

VII SEMESTER

Course Code	**21CS734**	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:

- It is recommended that students have a strong mathematical background (linear algebra, calculus especially taking partial derivatives, and probabilities & statistics) and at least an introductory course in Machine Learning. Strong programming skills (specifically Python) are necessary to complete the assignments.

COURSE OBJECTIVES:

- Develop and Train Deep Neural Networks.
- Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition
- Build and train RNNs, work with NLP and Word Embeddings
- The internal structure of LSTM and GRU and the differences between them
- The Auto Encoders for Image Processing

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

Foundations of Neural Networks and Deep Learning: Neural Networks, Training Neural Networks, Activation Functions, Loss Functions, Hyperparameters, Defining Deep Learning: What Is Deep Learning?, Common Architectural Principles of Deep Networks: Parameters, Layers, Activation Functions, Loss Functions, Optimization Algorithms, Hyperparameters, Building Blocks of Deep Networks: RBMs, Autoencoders, Variational Autoencoders	**8 Hours**

MODULE – II

Architetcures of Deep Networks: Unsupervised Pretrained Networks, Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural Networks.	**8 Hours**

MODULE – III

Building Deep Networks: Matching Deep Networks to the Right Problem, The DL4J Suite of Tools, Basic Concepts of the DL4J API, Modeling CSV Data with Multilayer Perceptron Networks, Modeling Handwritten Images Using CNNs, Modeling Sequence Data by Using Recurrent Neural Networks, Using Autoencoders for Anomaly Detection, Using Variational Autoencoders to Reconstruct MNIST Digits.	**8 Hours**

MODULE – IV

Tuning Deep Networks: Basic Concepts in Tuning Deep Networks, Matching Input Data and Network Architectures, Relating Model Goal and Output Layers, Working with Layer Count, Parameter Count, and Memory, Weight Initialization Strategies, Using Activation Functions, Applying Loss Functions, Understanding Learning Rates, How Sparsity Affects Learning, Applying Methods of Optimization, Using Parallelization and GPUs for Faster Training.	**8 Hours**

MODULE – V

Tuning Deep Network Architectures: Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Restricted Boltzmann Machines, DBNs.	**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 Neural Networks and Deep Learning	CL2
CO2	Implement the Unsupervised algorithms like Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural Networks (RNN).	CL3
CO3	Apply Deep Networks to the Right Problem using the DL4J Suite of Tools by Using Recurrent Neural Networks	CL3
CO4	Interpret Tuning of Deep Networks using Activation Functions by applying optimization methods.	CL3
CO5	Implement tuning of Deep Network Architectures for Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Restricted Boltzmann Machines, DBNs.	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	3
CO1	3											2			1
CO2	3	2	2	3	2							2	2		
CO3	3	2	2	3	2							2	2		
CO4	3	2	2	2	2							2	2		
CO5	3	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**
	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:

6. Deep Learning A Practitioner's Approach Josh Patterson and Adam Gibson O'Reilly Media, Inc.2017
7. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018.
8. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020.
9. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND, 2017.
10. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress, 2017.

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

1. https://www.youtube.com/watch?v=FbxTVRfQFuI
2. https://www.youtube.com/watch?v=uQ764z6twBo
3. https://www.youtube.com/watch?v=aircAruvnKk
4. https://www.youtube.com/watch?v=KBftoy0DPxI

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

PROGRAMMING IN PYTHON
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**21CS741**	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:

- Programming Experience: A strong foundation in programming using languages like Java, Python, or C/C++ is essential.
- Understanding of Web Concepts
- Basic Security Concepts

COURSE OBJECTIVES:

- Learn Syntax and Semantics and create Functions in Python.
- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programmingin Python..

TEACHING - LEARNING STRATEGY:

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

- Chalk and Talk Method/Blended Mode Method
- PowerPoint 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	
Why should you learn to write programs, Variables, expressions, and statements, Conditional execution, Functions	**8 Hours**
MODULE - II	
Iteration, Strings, Files	**8 Hours**
MODULE - III	
Lists, Dictionaries, Tuples, Regular Expressions	**8 Hours**
MODULE - IV	
Classes and objects, Classes and functions, Classes and methods	**8 Hours**
MODULE - V	
Networked programs, Using databases and SQL	**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	Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.	CL3
CO2	Demonstrate proficiency in handling Strings and File Systems.	CL3
CO3	Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.	CL3
CO4	Interpret the concepts of Object-Oriented Programming as used in Python.	CL3
CO5	Implement exemplary applications related to Network Programming and Databases.	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	3
CO1	3	2	2		2				2			2	3		
CO2	3	2	2		2				2			2	3		
CO3	3	2	2		2				2			2	3		
CO4	3	2	2		2				2			2	3		
CO5	3	2	2		2				2			2	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. Charles R. Severance, 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.drchuck. com/pythonlearn/EN_us/pythonlearn.pdf)
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Download pdf files from the above links)
3. Charles Dierbach, "Introduction to Computer Science Using Python",1st Edition, Wiley India Pvt Ltd, 2015. ISBN-13: 978-8126556014
4. Gowrishankar S, Veena A, 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372
5. Mark Lutz, 4th 2011.ISBN-13: 978-9350232873
6. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich,Algorithms in Python 1stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176
7. Reema Thareja, Oxford university press, 2017. ISBN-13: 978-0199480173

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

1. https://docs.python.org/3/
2. https://pandas.pydata.org/docs/
3. https://www.youtube.com/playlist?list=PL-osiE80TeTt2d9bfVyTiXJA-UTHn6WwU
4. https://www.youtube.com/playlist?list=PLQVvvaa0QuDeAams7fkdcwOGBpGdHpXln

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

INTRODUCTION TO BIG DATA

(Effective from the Academic Year 2023 - 2024)

VII SEMESTER

Course Code	**21CS742**	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:

- NIL

COURSE OBJECTIVES:

- Understand Hadoop Distributed File system and examine MapReduce Programming
- Employ MapReduce programming model to process the big data
- Explore Hadoop tools and manage Hadoop with Sqoop.
- Appraise the role of data mining and its applications across industries
- Identify various Text Mining techniques

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

Big Data: Introduction, Defining Big Data, Need of Big Data, Business Implications of Big Data, Big Data Analytics Applications and Case Studies. **Hadoop Distributed file system:** HDFS Design Features, HDFS Components, HDFS user commands, Hadoop. **Hadoop MapReduce Framework:** The MapReduce Model, Map-reduce Parallel Data Flow, Map Reduce Programming	**8 Hours**

MODULE - II

Essential Hadoop Tools: Using apache Pig, Using Apache Hive, Using Apache Sqoop, Using Apache Apache Flume, Apache H Base	**8 Hours**

MODULE - III

Data Warehousing: Introduction, Design Consideration, DW Development Approaches, DW Architectures **Data Mining:** Introduction, Gathering, and Selection, data cleaning and preparation, outputs of Data Mining, Data Mining Techniques. **Data Visualization:** Introduction, Excellence in Visualization, Types of Charts, Visualization Example	**8 Hours**

MODULE - IV

Decision Trees: Introduction, Decision Tree Problem, Decision Tree Constructions, Lessons from Construction Trees. Decision Tree Algorithm. **Regressions:** Introduction, Correlations and Relationships, Non-Linear Regression, Logistic Regression, Advantages and disadvantages.	**8 Hours**

MODULE - V

Text Mining: Introduction, Text Mining Applications, Text Mining Process, Term Document Matrix, Mining the TDM, Comparison, Best Practices. **Naïve-Bayes Analysis, Support Vector Machines.** **Web Mining: Introduction,** Web Content Mining, Web Structured Mining, Web Usage Mining, Web Mining 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	Understand fundamentals and applications of Big Data. Interpret the concepts of Hadoop framework and Hadoop Distributed File system and Map Reduce framework	CL3
CO2	Illustrate the Hadoop related tools for Big Data Analytics and perform basic Hadoop Administration	CL3
CO3	Demonstrate the role of Business Intelligence, Data warehousing and Visualization	CL3
CO4	Demonstrate the importance of data mining techniques for data analytics.	CL3
CO5	Compare and contrast different Text Mining Techniques	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	3
CO1	3	3	2	2	1	1						2	2	2	
CO2	3	3	2	2	2	1			1			2	2	2	
CO3	3	3	2	2	3	1			2			2	2	2	1
CO4	3	3	2	2	2	1			1			2	2	2	1
CO5	3	3	3	3	2	1				2		2	2	2	

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

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

SEE QUESTION PAPER PATTERN:

- The question paper will have **TEN** full questions from **FIVE** Modules

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

REFERENCE BOOKS:

1. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1st Edition, Pearson Education, 2016.
2. Anil Maheshwari, “Data Analytics”, 1st Edition, McGraw Hill Education, 2017
3. Tom White, “Hadoop: The Definitive Guide”, 4th Edition, O‟Reilly Media, 2015.ISBN-13: 978-935213067
4. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1stEdition, Wrox Press, 2014 ISBN-13: 978-8126551071
5. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1stEdition, O'Reilly Media, 2012 ISBN-13: 978-9350239261
6. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577

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

1. https://nptel.ac.in/courses/106/104/106104189/
2. https://www.youtube.com/watch?v=mNP44rZYiAU
3. https://www.youtube.com/watch?v=qr_awo5vz0g
4. https://www.youtube.com/watch?v=rr17cbPGWGA
5. https://www.youtube.com/watch?v=G4NYQox4n2g
6. https://www.youtube.com/watch?v=owI7zxCqNY0
7. https://www.youtube.com/watch?v=FuJVLsZYkuE

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

Course Code	**21CS743**	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.

COURSE OBJECTIVES:

- To provide a foundation in data Science terminologies
- To familiarize data science process and steps
- To Demonstrate the data visualization tools
- To analyze the data science applicability in real time 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

Preparing And Gathering Data And Knowledge: Philosophies Of Data Science, Data science in a big data world - Benefits and uses of data science and big data - facts of data: Structured data, Unstructured data, Natural Language, Machine generated data, Audio, Image and video streaming data - The Big data Eco system: Distributed file system, Distributed Programming framework, Data Integration frame work, Machine learning Framework, NoSQL Databases, Scheduling tools, Benchmarking Tools, System Deployment, Service programming and Security.	**8 Hours**

MODULE - II

The Data Science Process: Overview of the data science process- defining research goals and creating project charter, retrieving data, cleansing, integrating and transforming data, exploratory data analysis, Build the models.	**8 Hours**

MODULE - III

Machine Learning: Application for machine learning in data science- Tools used in machine learning Modeling Process – Training model – Validating model.	**8 Hours**

MODULE - IV	
Visualization–Introduction to data visualization – Data visualization options – Filters – MapReduce – Dashboard development tools.	**8 Hours**
MODULE - V	
Case Studies: Distributing data storage and processing with frameworks - Case study: e.g, Assessing risk when lending money.	**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 data science terminologies.	CL2
CO2	Apply the Data Science process on real time scenario.	CL3
CO3	Apply Machine Learning algorithm.	CL3
CO4	Analyze data visualization tools.	CL3
CO5	Apply Data storage and processing with frameworks.	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	3
CO1	2	2			2				2	2	2	2	2	2	1
CO2	2	2			2				2	2	2	2	2	2	1
CO3	2	2			2				2	2	2	2	2	2	1
CO4	2	2			2				2	2	2	2	2	2	1
CO5	2	2			2				2	2	2	2	2	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. Introducing Data Science, Davy Cielen, Arno D. B. Meysman and Mohamed Ali,Manning Publications, 2016.
2. Doing Data Science, Straight Talk from the Frontline, Cathy O'Neil, Rachel Schutt, O' Reilly, 1st edition, 2013.
3. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Cambridge University Press, 2nd edition, 2014.
4. An Introduction to Statistical Learning: with Applications in R, Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Springer, 1st edition, 2013.
5. Think Like a Data Scientist, Brian Godsey, Manning Publications, 2017.

PROGRAMMING IN JAVA
(Effective from the Academic Year 2023 - 2024)
VII SEMESTER

Course Code	**21CS744**	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 of programming

COURSE OBJECTIVES:

- Learn fundamental features of object-oriented language and JAVA
- Set up Java JDK environment to create, debug and run simple Java programs.
- Learn object-oriented concepts using programming examples.
- Study the concepts of importing of packages and exception handling mechanism.
- Discuss the String Handling examples with Object Oriented concepts

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

An 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, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings	**8 Hours**

MODULE - II

Operators: 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, Jump Statements.	**8 Hours**

MODULE - III

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A 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, 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.	**8 Hours**

MODULE - IV

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java‟s Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions.	**8 Hours**

MODULE - V

Enumerations, Type Wrappers, String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf(), Changing the Case of Characters Within a String , Additional String Methods, String Buffer, StringBuilder.	**8 Hours**

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Describe the fundamental features of java as an object-oriented programming language.	CL3
CO2	Develop and execute simple java programs using basic operators and control statements.	CL3
CO3	Develop re-usable programs for real-world applications involving inheritance	CL3
CO4	Use packages, interfaces and write exception free application programs.	CL3
CO5	Use enumeration and String concept to develop computer programs to solve real world problems in Java	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	3
CO1	3	3	3		2							2	2	2	2
CO2	3	3	3		2							2	2	2	2
CO3	3	3	3		2		1	1				2	2	2	2
CO4	3	3	3		2	2	1	1				2	2	2	2
CO5	3	3	3		2	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**
	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. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,13,15)
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.

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

Course Code	**21CSL75**	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 JAVA Programming Language, SQL

COURSE OBJECTIVES:

- Familiarize with Hadoop distributions, configuring Hadoop and performing File management tasks
- To implement MapReduce programs for processing big data.
- Implement MapReduce programs in variety applications
- To understand concepts of NoSQL using MongoDB, Hive.
- To analyze big data using machine learning techniques such as Decision tree classification and clustering.

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
	Install, configure and run Hadoop and HDFS.
1	Visualize data using basic plotting techniques in Python.
2	Implement word count program using Map Reduce.
3	Implement a Map Reduce program to find the maximum temperature in each year.
4	Implement a Map Reduce program to • Find the grades of student's. • Matrix Multiplication Using One Map-Reduce Step.
5	Implement NoSQL Database Operations: CRUD operations, Arrays using MongoDB & Cassandra.
6	Implement Functions: Count – Sort – Limit – Skip – Aggregate using MongoDB.
7	Implement database operations on Hive.
8	Write queries to sort and aggregate the data in a table using HiveQL.
9	Implement clustering techniques using SPARK.

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate the Hadoop framework and understand the concepts of Hadoop Distributed File system	CL3
CO2	Apply MapReduce programming model to understand Map Reduce Paradigm and processing of big data	CL3
CO3	Demonstrate the concepts of NoSQL using MongoDB and Cassandra for Big Data	CL3
CO4	To analyze big data using machine learning techniques	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	3
CO1	3	3	2	2	1	1			2			2	2	2	1
CO2	3	3	2	2	2	1			2		1	2	2	2	1
CO3	3	3	2	2	3	1			2		1	2	2	2	1
CO4	3	3	2	2	2	1			2		1	2	2	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.

REFERENCE BOOKS:

1. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1st Edition, Pearson Education, 2016.
2. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966

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

1. https://youtu.be/r5k-_RLIpuA?si=zmHcoLvpBxhmc09U
2. https://youtu.be/-hdx-P5Xoxs?si=2l_SOCKF2w9htHgd
3. https://youtu.be/pWbMrx5rVBE?si=ZOui3AUi1NJMJmJS