SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

B.E. IN COMPUTER SCIENCE & ENGINEERING (AI&ML)

SCHEME OF TEACHING AND EVALUATION 2021
OUTCOME BASED EDUCATION (OBE) AND CHOICE BASED CREDIT SYSTEM (CBCS)
(2021 SCHEME: EFFECTIVE FROM THE ACADEMIC YEAR 2023 - 24)

V SEMESTER

Sl. No.	Course	Course Code	Course Title	Teaching Department (TD)	Question Paper Setting Board (PSB)	Teaching Hours / Week				Examination				Credits
						Theory Lecture	Tutorial	Practical / Drawing	Self - Study	Duration in hours	CIA Marks	SEE Marks	Total Marks	
						L	T	P	S					
1	IPCC	21AI51	Principles of Artificial Intelligence	AIML/AIDS/CSE(DS)	CSE	03	00	02	00	3	50	50	100	4
2	IPCC	21AI52	Mathematics for Machine Learning	AIML/AIDS	CSE	03	00	02	00	3	50	50	100	4
3	PCC	21CS53	Automata Theory and Computability	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
4	PCC	21CS54	Database Management Systems	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
5	PCC (Lab)	21CSL55	Database Management Systems Laboratory	CSE and Allied	CSE	00	00	02	00	3	50	50	100	1
6	PROJ	21AIMP56	Mini Project Work	AIML	CSE	00	00	04	00	3	50	---	50	2
7	AEC	21IPR57	Research Methodology and Intellectual Property Rights	AIML	CSE	02	00	00	00	3	50	50	100	1
8	HSMC	21ENV58	Environmental Studies	AIML	CSE	01	00	00	00	1	50	50	100	1
9	AEC	21CS59X	**Ability Enhancement Course V**	CSE and Allied	CSE	01	00	00	00	1	50	50	100	1
10	**Scheduled activities for III to VI semesters**	21NS83	National Service Scheme (NSS)	NSS / PED / Yoga		00	00	02	00	Activities to be carried out by the student in the registered course				0
		21PE83	Physical Education (PE) (Sports and Athletics)											
		21YO83	Yoga											
											450	**400**	**850**	**20**

ABILITY ENHANCEMENT COURSE – V			
21CS591	MongoDB	21CS593	Game Development
21CS592	Mobile Application Development	21CS594	GitHub : AI-Powered Developer Platform

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course, **MP:** Mini Project

L – Lecture, **T –** Tutorial, P- Practical/ Drawing, **S –** Self -Study Component, **CIA:** Continuous Internal Assessment, **SEE:** Semester End Examination, **TD-** Teaching Department, **PSB**: Paper Setting department.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIA and SEE. The practical part shall be evaluated by only CIA (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

Mini Project Work:

Mini Project is a hands-on course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. The mini-project requires the students to carry out interdisciplinary work either as an individual student or to a group having not more than FOUR students.

1. The mini-project work will carry only the CIA component and will not have SEE component.
2. The mini project needs to be mandatorily done as Interdisciplinary work.
3. The Circuit branches (CSE/ISE/CSE-DS/CSE-CY/AI-DS/AI-ML) need to do the mini-project with non-circuit branches (ME/RA/ECE).
4. The circuit branches cannot do the mini-project with another Circuit branch, i.e. CSE with ISE/CSE-DS/CSE-CY/AI-DS/AI-ML.
5. The Start-up companies and LLPs may be involved in carrying out the Mini-project work.
6. The evaluation of the mini-project work will be done by two faculty members one faculty member from parent stream and another faculty member from the inter-disciplinary stream

BoS SPECIFIED NPTEL COURSES

(APPLICABLE ONLY TO THE STUDENTS WHO FAIL IN A COURSE MORE THAN FOUR TIMES)

Course Code	Course Name	Alternative NPTEL Courses*
A		
B		
C		

***subjected to change depending on the courses offered by the NPTEL.**

Note:

- The student has to provide the evidences for registering to the course, assignment submission, attending the examination and the certificate provided by NPTEL indicating the clearance of the Course by the candidate.
- Only on submitting the valid documents, the student will be awarded with the credits mentioned against the course(s)

Innovation/ Entrepreneurship/ Societal Internship: Students who missed the internship due to the Supplementary Semester have to complete the mandatory 4-week internship during the intervening period of the FIFTH and SIXTH semesters. The students need to satisfy all the requirements of the internship parameters. The evaluation of the Innovation/ Entrepreneurship/ Societal Internship will be done in the SIXTH semesters and the grades will be included in the SIXTH semester Grade card. In case, if the student fails to meet the internship requirements, they will be awarded with 'F' grade and will have to re-register and complete the same whenever offered.

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OUTCOME BASED EDUCATION (OBE) AND CHOICE BASED CREDIT SYSTEM (CBCS)
(2021 SCHEME: EFFECTIVE FROM THE ACADEMIC YEAR 2023 - 24)

VI SEMESTER

Sl. No.	Course	Course Code	Course Title	Teaching Department (TD)	Question Paper Setting Board (PSB)	Teaching Hours / Week				Examination				Credits
						Theory Lecture	Tutorial	Practical / Drawing	Self - Study	Duration in hours	CIA Marks	SEE Marks	Total Marks	
						L	T	P	S					
1	HSMC	21CS61	Software Engineering and Project Management	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
2	IPCC	21AI62	Natural Language Processing	AIML	CSE	03	00	02	00	3	50	50	100	4
3	PCC	21AI63	Machine Learning	AIML/ CSE(DS)	CSE	03	00	00	00	3	50	50	100	3
4	PEC	21CS64X/ 21AI64X	Professional Elective Course I	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
5	PEC	21CS65X/ 21AI65X	Professional Elective Course II	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
6	PCC (Lab)	21AIL66	Machine Learning Laboratory	AIML/ CSE(DS)	CSE	00	00	02	00	3	50	50	100	1
7	PROJ	21AIP67	Project Work Phase I	AIML	CSE	00	00	04	00	---	50	---	50	2
8	INT	21INT68	Innovation/ Entrepreneurship/ Societal Internship			Completed during the intervening period of IV and V Semester					100	---	100	3
9	**Scheduled activities for III to VI semesters**	21NS83	National Service Scheme (NSS)	NSS / PED / Yoga		Completed during the intervening period of III and VI Semester					50	---	50	0
		21PE83	Physical Education (PE) (Sports and Athletics)											
		21YO83	Yoga											
											500	**300**	**800**	**22**

PROFESSIONAL ELECTIVE COURSE I			
21AI641	Computer Networking Concepts	21CS643	Social Network Analysis
21AI642	Pattern Recognition	21AI644	Data Mining and Data Warehousing
PROFESSIONAL ELECTIVE COURSE II			
21CS651	Block Chain and Applications	21AI653	NO SQL Database
21AI652	Cloud Computing and Applications	21AI654	IoT Technologies

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **PEC**–Professional Elective Course. **OEC:** Open Elective Course

L – Lecture, **T –** Tutorial, P- Practical/ Drawing, **S –** Self -Study Component, **CIA:** Continuous Internal Assessment, **SEE:** Semester End Examination, **TD-** Teaching Department, **PSB**: Paper Setting department.

Professional Elective Course (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses (OEC): Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an Open Elective shall not be allowed if,

i. The candidate has studied the same course during the previous semesters of the program.
ii. The syllabus content of open electives is similar to that of the Departmental core courses or Professional Elective courses.
iii. A similar course, under any category, is prescribed in the higher semesters of the program.
iv. In case, if any department is interested in offering courses from streams such as Law, Business (MBA), Medicine, Arts, Commerce etc. need to get the necessary approval from the respective Board of Studies and the Academic Council.

The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Non-Credit Mandatory Courses (NCMC):

National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

1) Securing 40% or more in CIA, 40% or more marks in SEE and 40% or more in the sum total of CIA + SEE leads to successful completion of the registered course.
2) In case, students fail to secure 40 % marks in SEE, they have to appear for SEE during the subsequent examinations and obtain the minimum requirement.
3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum requirements as mentioned in (B).1, they shall be awarded with NP Grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s.
4) Successful completion of the course shall be indicated with a PP Grade in the grade card.
5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

BoS SPECIFIED NPTEL COURSES (APPLICABLE ONLY TO THE STUDENTS WHO FAIL IN A COURSE MORE THAN FOUR TIMES)		
Course Code	**Course Name**	**Alternative NPTEL Courses***
A		
B		
***subjected to change depending on the courses offered by the NPTEL.**		

Note:

- The student has to provide the evidences for registering to the course, assignment submission, attending the examination and the certificate provided by NPTEL indicating the clearance of the Course by the candidate.
- Only on submitting the valid documents, the student will be awarded with the credits mentioned against the course(s)

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(2021 SCHEME: EFFECTIVE FROM THE ACADEMIC YEAR 2024 - 25)

VII SEMESTER

Sl. No.	Course	Course Code	Course Title	Teaching Department (TD)	Question Paper Setting Board (PSB)	Teaching Hours / Week				Examination				Credits
						Theory Lecture	Tutorial	Practical / Drawing	Self - Study	Duration in hours	CIA Marks	SEE Marks	Total Marks	
						L	T	P	S					
1	IPCC	21AI71	Digital Image Processing	AIML	CSE	03	00	02	00	3	50	50	100	4
2	PCC	21AI72	Neural Networks and Deep Learning	AIML	CSE	03	00	00	00	3	50	50	100	3
3	PEC	21CS73X/ 21AI73X	Professional Elective Course III	CSE and Allied	CSE	03	00	00	00	3	50	50	100	3
4	OEC	21AI74X	Open Elective Course I	AIML	CSE	03	00	00	00	3	50	50	100	3
5	PCCL	21AIL75	Neural Networks and Deep Learning Laboratory	AIML	CSE	00	00	02	00	3	50	50	100	1
6	PROJ	21AIP76	Project Work Phase- II	AIML	CSE	00	00	16	00	3	100	100	200	8
											350	**350**	**700**	**22**

PROFESSIONAL ELECTIVE COURSE III

21CS731	Robotic Process Automation	21AI733	Business Intelligence
21AI732	Augmented Reality and Virtual Reality	21AI734	Data Science and Analytics

OPEN ELECTIVE COURSE

21AI741	Introduction to AI and ML	21CS743	Introduction to Data Science
21CS742	Introduction to Bigdata	21AI744	Python Data Structures

Note: PCC: Professional Core Course, **PEC**–Professional Elective Course. **OEC:** Open Elective Course, **PROJ:** Project Work

L – Lecture, **T –** Tutorial, P- Practical/ Drawing, **S –** Self -Study Component, **CIA:** Continuous Internal Assessment, **SEE:** Semester End Examination, **TD-** Teaching Department, **PSB**: Paper Setting department.

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Selection of an Open Elective shall not be allowed if,

i. The candidate has studied the same course during the previous semesters of the program.
ii. The syllabus content of open electives is similar to that of the Departmental core courses or Professional Elective courses.
iii. A similar course, under any category, is prescribed in the higher semesters of the program.

In case, if any department is interested in offering courses from streams such as Law, Business (MBA), Medicine, Arts, Commerce etc. need to get the necessary approval from the respective Board of Studies and the Academic Council.

The minimum numbers of student's strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Work:

The objective of the Project Work is to

i. Encourage independent learning and the innovative attitude of the students
ii. Develop interactive attitude, communication skills, Organization, Time Management and Presentation Skills.
iii. Impart Flexibility and Adaptability
iv. Inspire Team working
v. Expand Intellectual capacity, credibility, judgement and intuition
vi. Adhere to Punctuality, setting and meeting deadlines
vii. Install responsibilities to oneself and others
viii. Train students to present the topic of Project work without any fear, face the audience confidently, enhance communication skills, involve in group discussions to present and exchange ideas.

The CIA and SEE evaluation procedure for the Project work will be as provided by the Board of Studies in line with SCEM Academic Statute 2021 and approved by the Academic Council of SCEM.

BoS SPECIFIED NPTEL COURSES

(APPLICABLE ONLY TO THE STUDENTS WHO FAIL IN A COURSE MORE THAN FOUR TIMES)

Course Code	Course Name	Alternative NPTEL Courses*
A		

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VIII SEMESTER

Sl. No.	Course	Course Code	Course Title	Teaching Department (TD)	Question Paper Setting Board (PSB)	Teaching Hours / Week				Examination				Credits
						Theory Lecture	Tutorial	Practical / Drawing	Self - Study	Duration in hours	CIA Marks	SEE Marks	Total Marks	
						L	T	P	S					
1	SEM	21AIS81	Technical Seminar	AIML	CSE	One Contact hour per Week for interactions between the faculty and students				---	100	---	100	1
2	INT	21INT82	Research Internship/ Industrial Internship/ Rural Internship	AIML	CSE	Two Contact hours per week for interactions between Students and faculty members				3	100	100	200	15
											200	**100**	**300**	**16**

Note: INT: Internship, **PCC:** Professional Core Course, **PEC**–Professional Elective Course. **OEC:** Open Elective Course

L – Lecture, **T –** Tutorial, P- Practical/ Drawing, **S –** Self -Study Component, **CIA:** Continuous Internal Assessment, **SEE:** Semester End Examination, **TD-** Teaching Department, **PSB**: Paper Setting department.

Technical Seminar: In order to make the student aware of the technological and research application in various domains of the society, a comprehensive presentation need to be provided with all the supporting evidences for the claims in the presentation.

- The objective of the Technical Seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas.
- Each student, under the guidance of a Faculty, shall choose a topic, preferably a recent topic in their interested specializations.
- The student has to
  i. Carry out a detailed Literature survey, systematically organize the content
  ii. Prepare the report as per their own intuition, without cut-paste activities.
  iii. Use tools for writing equations, drawings etc. and gain proficiency of the tools used.
  iv. Present the topics effectively through appropriate digital media.
  v. Answer the queries posed and involve in healthy debates/discussions
  vi. Submit a report in an error-free and professional way
  vii. Present the findings of the seminar in the reputed Conferences/Journals for possible publications.

The evaluation procedure for the Technical Seminar will be as provided by the Board of Studies and approved by the Academic Council of SCEM.

21INT82 Research Internship/Industry Internship/Rural Internship

- **Research Internship:** This is intended to offer the flavor of current research happening in the Research fields. It helps students to get familiarize with the field and imparts the skill required for carrying out research.
- **Industry Internship:** An extended period of work experience undertaken by the students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate the organizations, perspectives and cultures. Dealing with contingencies helps the students recognize, appreciate and adapt to the organizational realities by tempering their knowledge with practical constraints.
- **Rural Internship:** A long term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.
- The student may take up Interdisciplinary Research Internship or Industry Internship.
- The Faculty Mentor need to monitor the student's internship progress and interact with them to guide them for the successful completion of the internship requirements
- The students are permitted to carry out internship anywhere in India or Abroad. However, the institute will not bear any expenses incurred with respect to the internship.

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PRINCIPLES OF ARTIFICIAL INTELLIGENCE

(Effective from the Academic Year 2023 - 2024)

V SEMESTER

Course Code	**21AI51**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

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

COURSE OBJECTIVES:

- Gain a historical perspective of AI and its foundations.
- Learn the methods of solving problems using AI.
- Learn the knowledge representation techniques, logic concepts and planning.
- Investigate applications of AI techniques in expert systems.

TEACHING - LEARNING STRATEGY:

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

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

COURSE CONTENTS

MODULE - I	
Introduction to AI: Intelligent systems, Foundations and Sub area of AI, Applications, Tic-Tac-Toe Game playing, Currents trend and developments of AI, General problem solving, Characteristics of problem, Constraint satisfaction.	**8 Hours**
MODULE - II	
Search Techniques and Game playing: Exhaustive searches, Heuristic search techniques, Game playing, Bounded look-ahead strategy, Alpha-beta pruning, Two-player perfect information games.	**8 Hours**
MODULE - III	
Logic concepts and Prolog Programming concepts: Propositional calculus, Propositional logic, Natural deduction system, Axiomatic system, Semantic tableau system in Propositional logic, Prolog program, Control strategy of prolog, Programming techniques in prolog, List manipulation in prolog, Structuring of data in prolog, Recursive data types in prolog.	**8 Hours**
MODULE - IV	
Planning and Knowledge Representation: Types of planning systems, Block world problem, Logic based planning, Linear planning using Goal stack, Means-Ends analysis, Approaches to knowledge representation, Knowledge representation using semantic network, Knowledge representation using frames.	**8 Hours**
MODULE - V	
Expert system and Applications: Phases in building expert systems, Architecture of expert system, Expert system versus traditional systems, Rule-based expert systems, Blackboard systems, Truth maintenance systems, Application of expert systems.	**8 Hours**

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate the fundamental understanding of AI and its foundations.	CL3
CO2	Apply the knowledge of AI in search techniques and game playing.	CL3
CO3	Demonstrate the Logic concepts and Logic programming in AI.	CL3
CO4	Apply principles of AI in knowledge representation and planning.	CL3
CO5	Apply AI techniques to develop intelligent systems.	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1	Design and implement Tic-Tac-Toe game using Python programming.	CO1	CL3
2	Demonstrate Nim game using Python programming.	CO2	CL3
3	Write a program to implement A* Algorithm.	CO2	CL3
4	Write a python program to demonstrate the working of Alpha-Beta Pruning.	CO2	CL3
5	Demonstrate the Union and Intersection of two fuzzy Sets using python programming.	CO3	CL3
6	Write a program in Prolog to implement simple arithmetic.	CO3	CL3
7	Design and implement a Cross word puzzle using Python programming.	CO4	CL3
8	Demonstrate a simple Chatbot with minimum 10 conversations.	CO5	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2		2				1	1	1	1		
CO2	3	3	2	1	2					1		1		
CO3	3	3	2		2					1				
CO4	3	3	2		2					1				
CO5	3	3	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. Saroj Kaushik, Artificial Intelligence, Cengage Learning India Private Limited, 1st Edition, 2011, ISBN: 978-8131510995.
2. Elaine Rich and Kevin Knight, Artificial Intelligence, Tata McGraw Hill Publications, 3rd Edition, 2019, ISBN: 9780070087705.
3. Stuart Jonathan Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Publications, 3rd Edition, 2016, ISBN: 9781292153964.

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

1. https://onlinecourses.nptel.ac.in/noc22_cs56
2. https://onlinecourses.nptel.ac.in/noc23_ge40

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MATHEMATICS FOR MACHINE LEARNING

(Effective from the Academic Year 2023 - 2024)

V SEMESTER

Course Code	**21AI52**	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:

- Fundamentals of Statistics, Linear algebra and Vector algebra.

COURSE OBJECTIVES:

- Enable the students to understand the advance concepts of Linear algebra
- Familiarize the importance of vector calculus associated with one variable and two variables for engineering.
- Understand the concept of probability and enable the students to predict the outcome of simple experiments
- Understand the concept of optimization 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

Linear Algebra-Part1: Introduction, Matrices, System of Linear Equations, Vector Spaces, Linear Dependence and Independence, Gaussian Elimination, Basis and basis set, Rank, Norms, Inner Products, Lengths and Distances, Angles.	**8 Hours**

MODULE - II

Linear Algebra-Part2: Orthogonality, Orthonormal Basis, Orthogonal Complement Rotations, Determinant and Trace, Eigenvalues and Eigenvectors – its interpretations, Projections, Regression, Diagonalization, Singular Value Decomposition	**8 Hours**

MODULE - III

Vector Calculus: Introduction, Differentiation of Uni-variate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Backpropagation.	**8 Hours**

MODULE - IV

Probability and Distribution: Probability concepts, Conditional probability, Bayes' Theorem, Discrete and Continuous Random Variables and Distributions, Expectation and its Interpretations, Standard discrete and continuous distribution functions, Central Limit theorem	**8 Hours**

MODULE - V

Optimization: Introduction, Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization.	**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	Employ foundational linear algebra concepts to data science tasks, in dimensional reduction, and regression analysis.	CL3
CO2	Apply advanced linear algebra concepts to analyze data, perform dimensional reduction, and optimize machine learning models.	CL3
CO3	Illustrate advanced vector calculus techniques, including gradients and back propagation, to optimize machine learning algorithms in data science.	CL3
CO4	Determine advanced probability model for machine learning algorithms and predictive analytics.	CL3
CO5	Establish optimization techniques, including gradient descent, Lagrange multipliers, and convex optimization, in machine learning models	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Given the following data on the amount of advertising and the sales for the past 10 years, can you use linear regression to predict the sales for the next year?	CO1	CL3
2.	Implement a Python program to perform linear regression on a dataset of heights and weights, predicting weight based on height.	CO2	CL3
3.	Implement a program in Python to compress an image using the Principal Component Analysis (PCA) method.	CO2	CL3
4.	A company has collected data on the ratings of their products by customers. They want to use SVD to identify the most important factors that affect the ratings.	CO2	CL3
5	Implement Gradient Descent for Linear Regression and show how does it help to find the best-fit line.	CO3	CL3
5.	Write a program that can calculate the probability of a player winning a chess game given the current position of the pieces.	CO4	CL3
6.	Write a program that can classify whether a patient has cancer or not based on their medical history and test results.	CO4	CL3
7.	Write a program that can classify a document as either spam or ham based on the words that appear in the document.	CO4	CL3
8.	Write a program to demonstrate how Lagrange Multiplier can be used for consumer Utility Maximization. (Consumer utility maximization: how a consumer can maximize their satisfaction by allocating income to different goods and services while staying within a budget constraint)	CO5	CL3

year	Advertising	Sales
2013	100000	100000
2014	120000	120000
2015	140000	140000
2016	160000	160000
2017	220000	220000

CO-PO-PSO MAPPING

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

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

ASSESSMENT STRATEGY

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

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	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. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong. "Mathematics for Machine Learning" Published by Cambridge University Press, Copyright 2020.
2. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong. "Mathematics for Machine Learning" , Published by Cambridge University Press, Copyright 2020
3. Sheldon Axler, "Linear Algebra Done Right" third edition, 2015, Springer
4. David C. Lay, "Linear Algebra and its Applications," 3rd edition, Pearson Education (Asia) Pte. Ltd,2005.
5. Gilbert Strang, "Linear Algebra and its Applications", 3rd edition, Thomson Learning Asia, 2003.
6. D. Chatterjee, "Analytical Geometry: Two and Three Dimensions", Alpha Science International Limited, 2009

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

1. https://www.youtube.com/watch?v=8Kg21jBCm-k
2. https://www.youtube.com/watch?v=Wa6kaCwyYRk
3. http://nptel.ac.in/courses.php?disciplineID=111
4. http://www.class-central.com/subject/math(MOOCs)
5. http://academicearth.org/
6. http://www.bookstreet.in.
7. VTU e-Shikshana Program

AUTOMATA THEORY AND COMPUTABILITY

(Effective from the Academic Year 2023 - 2024)

V SEMESTER

Course Code	21CS53	**CIA Marks**	50
Number of Contact Hours/Week (L:T:P:S)	3:0:0:0	**SEE Marks**	50
Total Contact Hours	40	**Exam Hours**	03

CREDITS - 3

Prerequisites:

- Knowledge of Discrete Mathematics and Data Structures

Course Objectives:

This course will enable students to:

- Outline the need to study formal languages and automata theory and design the finite automata for a given language.
- Write the regular expressions for a given language and the finite automata and examine the properties of regular languages.
- Construct and simplify the context-free grammars and design the pushdown automata for a given language.
- Explore the properties of context-free languages and design the turing machine for a given language.
- Describe the turing machine extensions and examine the decidability of the computational problems.

Teaching-Learning Strategy:

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

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

COURSE CONTENTS

MODULE - I

Introduction to Automata Theory: Overview and Applications of Automata Theory, The Central Concepts of Automata Theory. **Finite Automata:** Deterministic Finite Automata; Nondeterministic Finite Automata, Equivalence of Deterministic and Nondeterministic Finite Automata, An Application of Finite Automata: Text Search, Finite Automata with Epsilon-transitions.	**8 Hours**

MODULE - II	
Regular Expressions and Languages: Regular Expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions. **Properties of Regular Languages:** Proving Languages Not To Be Regular; Closure Properties of Regular Languages; Equivalence and Minimization of Automata.	**8 Hours**
MODULE - III	
Context-Free Grammars and Languages: Context-Free Grammars; Parse Trees; Applications of Context-Free Grammars, Ambiguity in Grammars and Languages. **Pushdown Automata:** Definition of the Pushdown Automaton (PDA); The Languages of a PDA; Design of PDA; Equivalence of PDA's and CFG's – Conversion from CFG to PDA and vice versa; Deterministic Pushdown Automata.	**8 Hours**
MODULE - IV	
Properties of Context-Free Languages: Normal Forms for Context-Free Grammars; The Pumping Lemma for Context-Free Languages; Closure Properties of Context-Free Languages. **Turing Machine:** Turning Machine Model; Representation of Turing Machine, Language Acceptability by Turing Machine, Design of Turing Machines, Techniques for Turning Machine Construction.	**8 Hours**
MODULE - V	
Variants of Turing Machines (TM): Nondeterministic Turing Machine, Multi Tape Turing Machine, The Model of Linear Bounded Automaton. **Decidability and Recursively Enumerable Languages:** Decidability, Decidable Languages, Undecidable Languages, Halting Problem of Turing Machine, The Post Correspondence Problem. **Complexity:** Growth Rate of Functions, The Classes of P and NP, Quantum Computation - Quantum Computers, Church-Turing Thesis**.**	**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	Make use of central concepts of automata theory to solve the finite automata for different formal languages and identify the equivalence between different models of finite automata.	CL3
CO2	Build the regular expression for a given formal language and identify the equivalence between finite automata and regular expressions. Also, explore the properties of regular languages.	CL3
CO3	Construct the context-free grammar and pushdown automata for the different formal languages and also, identify the equivalence between pushdown automata and context-free grammar.	CL3
CO4	Show the properties of context-free languages by simplifying the context-free grammar and build the turing machine for the given formal language.	CL3
CO5	Outline the concepts of turing machine variants and identify the decidability and intractability of computational problems.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3		2						2	2	1	
CO2	3	3	3	3	2						2	2	2	1
CO3	3	3	3		2						2	2	2	1
CO4	3	3	3	3	2							2	1	
CO5	2	2	2	2								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. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education. **(Chapters: 1, 2, 3, 4, 5, 6, 7)**
2. K L P Mishra, N Chandrasekaran, 3rd Edition, Theory of Computer Science, PhI. **(Chapters: 9, 10, 12)**
3. Elaine Rich, Automata, Computability and Complexity, 1st Edition, Pearson Education, 2012/2013
4. Michael Sipser: Introduction to the Theory of Computation, 3rd Edition, Cengage Learning, 2013
5. John C Martin, Introduction to Languages and The Theory of Computation, 3rd Edition, Tata McGraw–Hill Publishing Company Limited, 2013
6. Peter Linz, "An Introduction to Formal Languages and Automata", 3rd Edition, Narosa Publishers, 1998
7. Basavaraj S. Anami, Karibasappa K G, Formal Languages and Automata Theory, Wiley India, 2012
8. C K Nagpal, Formal Languages and Automata Theory, Oxford University Press, 2012.

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

1. https://nptel.ac.in/courses/106106049
2. https://www.jflap.org/

DATABASE MANAGEMENT SYSTEMS

(Effective from the Academic Year 2023 - 2024)

V SEMESTER

Course Code	**21CS54**	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 Data Structures

COURSE OBJECTIVES:

- Provide a Strong foundation in Database concepts, Technology and practice.
- Practice SQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in database.
- Design and build database applications for real world 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
- Virtual Lab
- Expert Talk/Webinar/Seminar
- Peer-to-Peer Activities
- Problem Based Learning
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I

8 Hours

Introduction to Databases: Overview, Characteristics of database approach, Actors on the Scene, Workers behind the Scene, Advantages of using the DBMS approach, History of database applications (Self Study).

Database System Concepts and Architecture: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

Basic SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL.

MODULE - II

8 Hours

Data Modeling Using the Entity-Relationship (ER) Model: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, Relationship Types of Degree Higher than Two, Examples.

Relational Database Design by ER-to-Relational Mapping: Relational Database Design using ER-to-Relational mapping.

The Relational Data Model and Relational Database Constraints: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

MODULE - III

8 Hours

The Relational Algebra: Unary Relational Operation**s:** SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional relational operations (aggregate, grouping, etc.), Examples of Queries in relational algebra.

Advanced SQL: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.

MODULE - IV

Basics of Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form. **Relational Database Design Algorithms and Further Dependencies:** Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design.	**8 Hours**

MODULE - V

Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL**.** **Concurrency Control Techniques:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering. **Introduction to NOSQL Databases:** Emergence of NOSQL Systems, Characteristics of NOSQL Systems, Categories of NOSQL Systems**.**	**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 database technology and illustrate the Structured Query Language (SQL) for database manipulation.	CL3
CO2	Make use of Entity Relationship (ER) model to illustrate conceptual database design and describe the basic principles of relational model.	CL3
CO3	Examine the concepts of relational algebra and advanced SQL in database application development	CL3
CO4	Apply the functional dependency to measure the appropriateness of attribute groupings into relation schemas and discuss the process of normalization with its algorithms.	CL3
CO5	Explain the concepts and theory needed for transaction processing, concurrency control in database applications. Describe the NOSQL database with its categories.	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	1								2		
CO2	3	3	3	1								2		
CO3	3	3	3	1								2		
CO4	3	3	3	1								2		
CO5	3	3	3	1								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. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill.
3. Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
4. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

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

1. https://www.youtube.com/watch?v=6Iu45VZGQDk&list=PLBlnK6fEyqRi_CUQ-FXxgzKQ1dwr_ZJWZ
2. https://www.youtube.com/watch?v=IoL9Ve2SRwQ&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh
3. https://www.youtube.com/watch?v=OMwgGL3lHlI&list=PLBlnK6fEyqRiyryTrbKHX1Sh9luYI0dhX
4. https://onlinecourses.nptel.ac.in/noc23_cs41/preview
5. http://vlabs.iitkgp.ernet.in/se/4/

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

DATABASE MANAGEMENT SYSTEMS LABORATORY

(Effective from the Academic Year 2023 - 2024)

V SEMESTER

Course Code	**21CSL55**	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:

- Basics of SQL

COURSE OBJECTIVES:

- Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
- Strong practice in SQL programming through a variety of database problems.
- Develop database applications using front-end tools and back-end DBMS.

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
Pre-requisite: Introduction to SQL. Demonstrate the Basic Database operations.	
	Part-A
1	Consider the following schema for Bank Database: **BRANCH(bid: varchar, bname:string, branch-city:string, assets:integer)** **ACCOUNT(accno:int, branch-name:string, balance:integer)** **DEPOSITOR(customer-name:string, accno:int)** **CUSTOMER(Cid:varchar, customer-name:string, customer-street:string, customer-city:string)** **LOAN(loan-number:int, branch-name:string, amount:integer, cid:varchar)** Write SQL queries to 1. Find all the customers who have at least one account at the “Mangaluru” branch. 2. Find all the customers who have an account at all the branches located in a specific city. 3. Retrieve the Customer name and loan amount of a customer who borrowed a loan more than 5,00,000. 4. Retrieve the details of bank branch with maximum assets. 5. Demonstrate how you delete all account tuples at every branch located in a specific city
2	Consider the following schema for a Library Database: **BOOK(Book_id:varchar, Title:string, Publisher_Name:string, Pub_Year:integer)**

	BOOK_AUTHORS(Book_id:varchar, Author_Name:string) **PUBLISHER(Name:string, Address:string, Phone:integer)** **BOOK_COPIES(Book_id:varchar, Programme_id:varchar, No-of_Copies:integer)** **BOOK_LENDING(Book_id:varchar, Programme_id:varchar, Card_No:varchar, Date_Out:date, Due_Date:date)** **LIBRARY_PROGRAMME(Programme_id:varchar, Programme_Name:string, Address:string)** Write SQL queries to 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2023 to Jun 2023. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library	
3	Consider the schema for College Database: **STUDENT(USN, SName, Address, Phone, Gender)** **SEMSEC(SSID, Sem, Sec)** **CLASS(USN, SSID)** **COURSE(Subcode, Title, Sem, Credits)** **IAMARKS(USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)** Write SQL queries to 1. List all the student details studying in fourth semester „C" section. 2. Compute the total number of male and female students in each semester and in each section. 3. Create a view of Test1 marks of student USN "4SF20CD001" in all Courses. 4. Calculate the FinalIA (average of three test marks) and update the corresponding table for all students. 5. Categorize students based on the following criterion: If FinalIA = 45 to 50 then CAT = "Outstanding" If FinalIA= 40 to 45 then CAT= "Good" If FinalIA = 30 to 40 then CAT = "Average" If FinalIA< 30 then CAT = "Weak" Give these details only for 8th semester A, B, and C section students.	
4	Consider the schema for Company Database: **EMPLOYEE (Eid:varchar, Name:string, Address: string, Gender:string, Salary: integer, SuperEid: varchar, Dno: varchar)** **DEPARTMENT (Dnum: varchar, Dname: string, DMgr_id:varchar, Mgr_start_date: date)** **DLOCATION (Dno: varchar, Dlocation:string)** **PROJECT (Pnum:varchar, Pname: string, Plocation:string, Dno:varchar)** **WORKS_ON (Eid: varchar, Pno: varchar, Hours: integer)** **DEPENDENT (Empid: varchar, Dep_name:string, Gender:string, Bdate:date, Relationship:String)** Write SQL queries to 1. Make a list of all project numbers for projects that involve an employee whose name is "Rahul", either as a worker or as a manager of the department that controls the project. 2. Show the resulting salaries if every employee working on the "IoT" project is given a 10 percent raise.	

	3. Find the sum of the salaries of all employees of the "Accounts" department, as well as the maximum salary, the minimum salary, and the average salary in this department. 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. Create a view Dept_info that gives details of department name, Number of employees and total salary of each department.
5	Consider the schema for Airline Database: **Flights (fno: varchar, from: string, to: string, distance: integer, departs: time, arrives: time, price: integer)** **Aircraft (aid: varchar, aname: string, cruisingrange: integer)** **Certified (eid: varchar, aid: varchar)** **Employees (eid: varchar, ename: string, salary: integer)** **Note:** The Employees relation describes pilots and other kinds of employees as well; Every pilot is certified for some aircraft, and only pilots are certified to fly. Write SQL queries to 1. Find the names of aircraft such that all pilots certified to operate them have salaries more than Rs.80, 000. 2. For each pilot who is certified for more than three aircrafts, find the eid and the maximum cruisingrange of the aircraft for which she or he is certified. 3. Find the names of pilots whose salary is less than the price of the cheapest route from Bengaluru to Mumbai. 4. Find the aids of all aircraft that can be used on routes from Bengaluru to New Delhi. 5. Find the employee name and salary earning second highest salary.
Part-B: Mini Project	
	• For any societal problem statement selected. • Make sure that the application should have five or more tables, one trigger and one Stored Procedure. • Mobile Applications are strictly prohibited. • The mini project team may consist of maximum two members. • The areas for problem statement may include, but not limited to the following : □ Educational sector □ Environmental issues □ Healthcare □ Women empowerment □ Child care □ Banking sector

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Use SQL programming and different concepts of DBMS to create, update and query on the Bank and Library databases.	CL3
CO2	Demonstrate SQL programming and different concepts of DBMS to create, update and query on the College database.	CL3
CO3	Illustrate the concepts of SQL programming and DBMS to create, update and query on the Company database.	CL3
CO4	Create, update and query on the Airline database by using different concepts of DBMS and SQL programming.	CL3

CO5	Design, implement and demonstrate a database application using front end tools and Compile the working with well document using modern tool.	CL6

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	2	2			1				2		
CO2	3	3	3	2	2			1				2		
CO3	3	3	3	2	2			1				2		
CO4	3	3	3	2	2			1				2		
CO5	3	3	3	3	3	2		3	3	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**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

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

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

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

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

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

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

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

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

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

SEE QUESTION PAPER PATTERN:

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

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

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

1. https://www.youtube.com/watch?v=6Iu45VZGQDk&list=PLBlnK6fEyqRi_CUQ-FXxgzKQ1dwr_ZJWZ
2. https://www.youtube.com/watch?v=IoL9Ve2SRwQ&list=PLIwC9bZ0rmjSkm1VRJROX4vP2YMIf4Ebh
3. https://www.youtube.com/watch?v=OMwgGL3lHlI&list=PLBlnK6fEyqRiyryTrbKHX1Sh9luYI0dhX
4. https://onlinecourses.nptel.ac.in/noc23_cs41/preview
5. http://vlabs.iitkgp.ernet.in/se/4/

RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS
(Effective from the Academic Year 2023- 2024)
V SEMESTER

Course Code	**21IPR57**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	1:2:0:0	SEE Marks	50
Total Hours of Pedagogy	30L	Exam Hours	03

CREDITS – 2

COURSE PREREQUISITES:

- A foundational understanding of research and knowledge of research problem formulation, familiarity with academic ethics, a basic understanding of statistics and data analysis, ability to search and evaluate academic sources, basic writing and communication skills, critical thinking skills, time management skills and awareness of ethical considerations in research.

COURSE OBJECTIVES:

- Understand the basic concepts, principles, and types of research methodologies
- Collect, analyze, and interpret data using relevant techniques.
- Ethically conduct research and adhere to academic integrity.
- Communicate research findings effectively through written and oral presentations.
- Understand the intellectual property rights and the types of IPR.

TEACHING - LEARNING STRATEGY:

Following are some sample strategies that can be incorporated into 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 Research Methodology and Literature Review **Introduction to Research Methodology:** Meaning of research, Objectives of research, Types of research, Importance of scientific research in decision making, Defining the research problem, techniques involved in defining a problem**.** Research Design: Meaning of research design, need for research design, Features of good design. **Literature Review:** Significance of literature review, Sources for literature: Books, Journals, Proceedings, Thesis and Dissertations. Online databases: Web of Science, Google and Google Scholar. Quality research papers**.** Research metrics: Citation, Citation Index, Impact Factor, H-index, i10-index, Google index and their significance.	**6 Hours**

MODULE - II

Data Collection, Analysis and Report Writing **Data Collection:** Introduction, collection of primary data: observation method, questionnaires and case study method, collection of secondary data, Selection of an appropriate method for data collection. **Data Analysis**: Introduction, Data analysis process, Types of data analysis, Methods of data analysis: Qualitative analysis, Quantitative analysis. Tools for data analysis.	**6 Hours**

Report Writing: Effective technical writing, Steps for writing a report, structure of the research report, method of writing a research article (manuscript)/ research report, crafting effective project proposals, Paper writing for National and international journals, Submitting papers to journals (Scopus Indexed Journals, Science Citation Indexed journals), preparation of effective slides, pictures, and graphs for presentation.	
MODULE - III	
Ethics in Research Ethics with respect to research, ethical principles, the importance of adhering to ethical norms in research, research misconducts, plagiarism, penalties for plagiarism, publication ethics, conflict of interest, publication misconduct, violation of publication ethics and authorships, identification of publication misconduct, complaints and appeals (examples) and Open Access Publishing.	**6 Hours**
MODULE - IV	
Intellectual Property Rights, Patents and Industrial Designs: **Intellectual Property Rights**: Introduction to intellectual property and intellectual property rights, objectives of IPR, History of IPR in India, Role of WIPO and WTO in IPR establishments, Types of Intellectual property rights. **Patents:** Introduction to patent, need and importance of a patent, requirements of patent, types of patents, few famous examples of patent, patentable and non-patentable items, Duration, limitations of a patent, the Indian Patent Act-1970, Rights associated with patents, Enforcement of patent rights, Patent infringements. Case Studies on Patents**:** Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent **Industrial Designs:** Design introduction, Features of Design, Design law 2000, Registration of Design, Need for registration of Design, Procedure for registration of Design, Infringement of Design. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.	**6 Hours**
MODULE - V	
Copyrights, Trademarks and Geographical Indications: **Copyrights:** Introduction to copyright, characteristics of copyright, copyright-National Vs international, Indian copyright Act-1957, Indian perspective on copyright, Term/duration of copyright, registration of copyright, copyright symbol, procedure of copyright certification, benefits of copyright registration, copyright infringement, limitations of copyright. **Trademarks:** Introduction to Trademark, signs which may serve as Trademarks, functions of Trademark, Essential features of Trademark, Types of Trademark, the validity of the trademark, Unfair competition, Trademark Act 1999, Infringement of Trademark, Famous case law: Coca-Cola Company vs. Bisleri International Pvt. Ltd. **Geographical Indications:** Introduction to G.I, History of G.I, G.I Act 1999, Registration of G.I, Registration process of G.I, Duration of G.I Tag, Infringement of G.I, Some important G.I Tags.	**6 Hours**

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Comprehend the process of research methodology to define a research problem.	CL2
CO2	Understand the analytical tools for the analysis and interpretation of data.	CL2
CO3	Understand the research ethics and adhere to ethical norms in the research process.	CL2

CO4	Illustrate the significance of Intellectual property rights and of research projects for economic growth and social benefits.	CL2
CO5	Demonstrate the copyright laws, subject matters of copyrights and Trademarks.	CL2

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	1			1		1	1		2			
CO2	3	2	1	1	1	1		1	1		2			
CO3	3	1	1			2		3	1	1	1	2		
CO4	3	2	2	2	1	2		3	1	1	1	2		
CO5	3	2	2	2	1	2		3	1	1	1	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
	Assignment	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

CO - ASSESSMENT MAPPING

Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
Continuous Internal Evaluation (CIE) (60%)			Assignment (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 assignment of the IPCC shall be for CIE only.
- The Theory component of the IPCC shall be for both CIA and SEE respectively.

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. Kothari C R and Gaurav Garg, Research Methodology Methods and Techniques, Fourth Edition by, New Age International, 2019.
2. Ranjit Kumar, Research Methodology- A step by step guide for beginners, Pearson Education, Australia, 2005.
3. Pratim Ray, Partha "A Guide to Research and Publication Ethics" First edition, New Delhi Publishers c2022.
4. Deborah E Bouchoux, Intellectual Property Rights by CENGAGE Learning.
5. Rupinder Tewari and Mamta Bhardwa, Intellectual Property A Primer for Academia.
6. David V. Thiel “Research Methods for Engineers” Cambridge University Press, 978-1-107-03488-4.
7. Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007.
8. Acharya N K, Intellectual Property Rights, Asia Law House 6th Edition. ISBN: 978-93-81849-30-9

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

1. https://nptel.ac.in/courses/106/105/106105077/
2. https://youtu.be/oPXyj3mAEKg
3. https://youtu.be/E2gGF1rburw
4. https://www.youtube.com/watch?v=VzIgPfAd0Fs&list=RDCMUCLVol4Vq_9CKVYNv4tDZhXw&start_radio=1&rv=VzIgPfAd0Fs&t=0

Assignments:

1. **Case Study:** Conduct a literature survey on a suitable research topic and prepare a report with a minimum of 10 references that adheres to standard journal specifications.
2. **Case Study:** Download 5 quality research papers published within the last five years from reputed journals on the topic of your choice and provide your analysis and perspective on the chosen topic
3. **Case Study:** Conduct a prior art search using free online databases and prepare a report.

ENVIRONMENTAL STUDIES

(Effective from the Academic Year 2023 - 2024)

V SEMESTER

Course Code	**21ENV58**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	**16L**	Exam Hours	01

CREDITS – 1

COURSE PREREQUISITES:

- Fundamental knowledge of Ecosystems, Environment Pollution and its effects.

COURSE OBJECTIVES:

- To create environmental and sustainability awareness among the students.
- To educate the students to understand the various environmental pollutants, waste management techniques, and the legal framework governing environmental protection.

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	
Ecosystem and Sustainability: Structure and Function of ecosystems in Forest, Desert, Wetlands, River, Oceanic and Lakes. Sustainability: 17 SDGs- History, targets, implementation, Capacity Development. Success stories - Best practices related to ecosystem conservation and sustainable computing and IT practices.	**3 Hours**
MODULE - II	
Advances in Energy Systems and Sustainable Practices: Hydrogen, Solar, OTEC, Tidal, and Wind energy systems: Merits and Demerits. Global status and applications of renewable energy sources. Concepts and case studies in disaster management with a focus on technology and data-driven solutions. Sustainable mining practices and their environmental impact. Carbon trading and its role in reducing carbon emissions in the IT industry.	**3 Hours**
MODULE - III	
Environmental Pollution, Global Issues, and Health Environmental Pollution: Sources, impacts, and control of surface and ground water pollutants. Soil pollutants and their effects on ecosystems. Air pollutants and their consequences on air quality. Radon and fluoride concentration in drinking water and potential health risks. Environmental toxicology - causes and control measures.	**4 Hours**
MODULE - IV	
E-Waste and Plastic Waste Management Solid waste management: sources, characteristics, health hazards, and disposal methods of E-Waste and Plastic waste. Different approaches of recycling and metal recovery from E-Waste. Role of stake holders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies). Strategies for plastic	**3 Hours**

pollution control.	

MODULE - V

Sustainable Green Technologies Sustainable agriculture practices and green technologies. Waste-to-Energy Technologies. Introduction to circular economy principles and green data center technologies in IT sectors. Green certification. Marine conservation.	**3 Hours**

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Summarize the role of IT Engineers in maintaining the ecosystem functionalities and sustainable development in the field of environmental science.	CL2
CO2	Understand the advances in energy systems and approaches relevant to natural resource management.	CL2
CO3	Illustrate the sources, impacts & control of environmental pollution and understand the process involved in sustainable agriculture and marine conservation.	CL2
CO4	Identify the sources of environmental pollution, measures for control and understand the process involved in E-Waste management.	CL2
CO5	Understand the importance of Eco- friendly Technologies in the conservation of biological diversity	CL2

SEE QUESTION PAPER PATTERN:

- The Question paper will have **FIFTY** multiple choice questions covering the entire five module syllabus.
- Each question may have a maximum of four sub-questions and each question will be for 01 mark.
- Examination will be **ONLINE** and students will have to answer all the questions.
- The Duration of the Exam will be 01 hour.

REFERENCE BOOKS:

1. Environmental Studies, Benny Joseph, Tata Mc Graw – Hill., 2ndEdition, 2012.
2. Environmental Studies, S M Prakash, Pristine Publishing House, Mangalore, 3rdEdition, 2018.
3. Environmental Studies – From Crisis to Cure, R Rajagopalan, Oxford Publisher, 2005

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

Field work: Visit to Zero Waste Management Plant / Solid waste management plant/Biogas production plant.

MongoDB

(Effective from the Academic Year 2023 - 2024)

V SEMESTER

Course Code	**21CS591**	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

PREREQUISITES:

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

COURSE OBJECTIVES:

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

TEACHING - LEARNING STRATEGY:

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

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

LIST OF EXPERIMENTS

Sl. No.	Description
1	MongoDB installation and configuration in windows.
2	Demonstrate how to create and drop database in MongoDB.
3	Creating the Collection in MongoDB.
4	Creating collection with options before inserting the documents and drop the collection created.
5	MogoDB Insert Document a. Insert single document. b. Insert multiple documents in collection.
6	Querying all the documents in json format and Querying based on the criteria.

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

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Illustrate the process of MongoDB installation, configuration, database creation in windows environment.	CL3
CO2	Demonstrate various MongoDB operations for handling collections and documents.	CL3
CO3	Examine the document updation methods in MongoDB.	CL3
CO4	Demonstrate MongoDB Projection operation.	CL3
CO5	Illustrate process involved in managing various data in MongoDB using indexing.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3		2						1	1		
CO2	3	2	3		2						1	1		
CO3	3	2	3		2						1	1		
CO4	3	2	3		2						1	1		
CO5	3	2	3		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**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

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

Assessment Mode: Weekly Assessment of Laboratory Work (50 Marks) - the marks will be awarded based on

the Continuous Internal Assessment (Weekly Assessment, each of 25 marks) of the students in each laboratory session. The average of all the marks obtained across the sessions will be the Final CIA marks.

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

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

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

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

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

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

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

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

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

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

MOBILE APPLICATION DEVELOPMENT

(Effective from the Academic Year 2023 - 2024)

V SEMESTER

Course Code	**21CS592**	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
- Installation procedure of the Android Studio software

COURSE OBJECTIVES:

- Learn and acquire the art of Android Programming.
- Configure Android studio to run the applications.
- Understand and implement Android's User interface functions.
- Inspect different methods of sharing data using services.

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
1a	Create an application to design a Visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone number.
1b	Develop an android application to design a student ID card for the students of a College as per the below requirements. The ID card should have two virtual partitions divided by a horizontal divider. In the first partition, the institute logo should be placed at the top aligned to the center. Institute name should be displayed below the logo in capital letters. In the next level the students department must appear in capital letters. The second partition should begin with students photo aligned to the center. Student Name, USN, Phone Number and Address should appear below the photo in a uniform order. Design the UI according to the requirements defined. Also write the corresponding java program.
2	Develop an Android application using controls like Button, Text View, Edit Text for designing a calculator having basic functionality like Addition, Subtraction, Multiplication and Division.
3	Create a SIGN Up activity with Username and Password. Validation of password should happen based on the following rules: • Minimum length of the password is 8 • Password should contain letters, numbers and special characters. • Password should contain minimum one uppercase letter, lowercase letter, number and special character On successful SIGN UP proceed to the next Login activity. Here the user should SIGN IN using the Username

	and Password created during signup activity. If the Username and Password are matched then navigate to the next activity which displays a message saying "Successful Login" or else display a toast message saying "Login Failed". The user is given only two attempts and after that display a toast message saying "Failed Login Attempts" and disable the SIGN IN button. Use Bundle to transfer information from one activity to another.
4	Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds.
5	Write a program to create an activity with two buttons START and STOP. On pressing of the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter value in a Text View control.
6	Create two files of XML and JSON type with values for City Name, Latitude, Longitude, Temperature and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side.
7	Develop a simple application with one Edit Text so that the user can write some text in it. Create a button called "Convert Text to Speech" that converts the user input text into voice.
8	Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts.

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Demonstrate various Android Applications by setting up Android development environment with necessary virtual devices using Android Virtual Device Manager.	CL3
CO2	Illustrate process of developing an Android Application for user authentication.	CL3
CO3	Demonstrate adaptive, responsive user interfaces that work across a wide range of devices and analyse the various APIs used in developing responsive Android Applications	CL3
CO4	Demonstrate various APIs and methods used for storing, sharing and retrieving data in Android applications.	CL3
CO5	Examine the different permissions and Security Aspects available for Android applications and discuss its roles in different use cases.	CL3

CO-PO-PSO MAPPING

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

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

ASSESSMENT STRATEGY

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

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

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

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

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

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

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

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

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

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

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

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

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

1. J. F. DiMarzio, Beginning Android Programming with Android Studio, 4thEdition, 2017.
2. Google Developer Training, "Android Developer Fundamentals Course-Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/googledeveloper-training/android-developer-fundamentals-course-concepts/details.

GAME DEVELOPMENT

(Effective from the Academic Year 2023 - 2024)

V SEMESTER

Course Code	**21CS593**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of Mathematics and programming skills.

COURSE OBJECTIVES:

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

TEACHING - LEARNING STRATEGY:

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

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

LIST OF EXPERIMENTS

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

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply game engine expertise to install and navigate game engines like unity and unreal engine.	CL3
CO2	Create conceptually sound 2D game themes.	CL3
CO3	Implement 2D game elements by executing their character design, character control, and movement to construct functional game play experiences.	CL3
CO4	Design interactive game environments through the creation of game worlds using tiles, interactive objects, and collectibles.	CL3
CO5	Implement 2D interactives with Pygame, optimize menus, and user interactions for mobile platforms.	CL3

CO-PO-PSO MAPPING

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

ASSESSMENT STRATEGY

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

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

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

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

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

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

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

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

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

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

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

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

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

1. https://www.gamedesigning.org/learn/make-a-game-engine/
2. https://medium.com/@sahilsahilbhatia/build-2-d-game-in-python-f5b6e98530c5
3. https://gamedevacademy.org/unreal-engine-tutorial/

GitHub : AI-Powered Developer Platform

(Effective from the Academic Year 2023 - 2024)

V SEMESTER

Course Code	**21CS594**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	24	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of Programming.

COURSE OBJECTIVES:

- To familiar with basic command of Git
- To create and manage branches
- To understand how to collaborate and work with Remote Repositories
- To familiar with virion controlling commands

TEACHING - LEARNING STRATEGY:

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

- Chalk and Talk Method/Blended Mode Method
- Practical Based Learning
- 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.	Experiment
1	**Setting Up and Basic Commands** Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message.
2	**Creating and Managing Branches** a) Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master." b) Write the commands to stash your changes, switch branches, and then apply the stashed changes.
3	**Collaboration and Remote Repositories** a) Clone a remote Git repository to your local machine. b) Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.

	c) Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
4	**Git Tags and Releases** Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.
5	**Advanced Git Operations** Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
6	**Analysing and Changing Git History** a) Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message? b) Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31." c) Write the command to display the last five commits in the repository's history. d) Write the command to undo the changes introduced by the commit with the ID "abc123".

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Use the basics commands related to git repository	CL3
CO2	Create and manage the branches	CL3
CO3	Apply commands related to Collaboration and Remote Repositories	CL3
CO4	Use the commands related to Git Tags, Releases and advanced git operations	CL3
CO5	Analyze and change the git history	CL3

CO-PO-PSO MAPPING

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

Suggested Learning Resources:

1. Version Control with Git, 3rd Edition, by Prem Kumar Ponuthorai, Jon Loeliger Released October 2022, Publisher(s): O'Reilly Media, Inc.
2. Pro Git book, written by Scott Chacon and Ben Straub and published by Apress, https://gitscm.com/book/en/v2
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094443347369984278 2_shared/overview

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

1. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013301347121774592119 26_shared/overview

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

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

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

CREDITS – 3

COURSE PREREQUISITES:
- Fundamentals of software Development activities, Management functions.

COURSE OBJECTIVES:
- Outline software engineering principles and activities involved in building large software programs.
- Identify ethical and professional issues and explain why they are of concern to Software Engineers.
- Describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.
- Infer the fundamentals of object-oriented concepts, differentiate system models, use UML diagrams and apply design patterns.
- Explain the 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, Evolutionary process models, Specialized process models. **Requirements Engineering**: Requirements Engineering Task, Initiating the Requirement Engineering process, Eliciting Requirements, developing use cases, Building the analysis model, Negotiating Requirements, Validating Requirements, Software Requirement Document (Sec 4.2).	**8 Hours**

MODULE - II	
Introduction, Modelling Concepts and Class Modelling: 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 **Building the Analysis Models**: Requirement Analysis, Analysis Model Approaches, Data modeling Concepts, Object Oriented Analysis, Scenario-Based Modeling, Flow-Oriented Modeling, class Based Modeling, Creating a Behavioral Model.	**8 Hours**
MODULE - III	
Software Testing: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging. **Agile Methodology**: Before Agile – Waterfall, Agile Development.	**8 Hours**
MODULE - IV	
Introduction to Project Management: Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.	**8 Hours**
MODULE - V	
Activity Planning: Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass– Backward Pass, identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks. **Software Quality**: Introduction, the place of software quality in project planning, Importance of software quality, software quality models, ISO 9126, quality management systems, process capability models, techniques to enhance software quality, quality plans.	**8 Hours**

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Understand the activities involved in software engineering and 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	Interpret various software testing methods and to understand the importance of agile methodology.	CL2
CO4	Apply the Concepts of project planning and quality management in software development	CL3
CO5	Illustrate the importance of activity planning and its models	CL2

CO-PO-PSO MAPPING															
CO No.	**Programme Outcomes (PO)**												**Programme Specific Outcome (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**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. Students learning will be assessed using Direct and Indirect methods:

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

ASSESSMENT DETAILS

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

SEE QUESTION PAPER PATTERN:

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

TEXT BOOKS:

1. 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. 4. https://nptel.ac.in/courses/128/106/128106012/ (DevOps)

NATURAL LANGUAGE PROCESSING

(Effective from the Academic Year 2023 - 2024)

VII SEMESTER

Course Code	**21AI62**	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:

- 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 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 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 Techniques.	**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,	**8**

Fuzzy model, LSTM model**, Major Issues in Information Retrieval.** **Lexical Resources**: World Net, Frame Net, Stemmers, POS Tagger- Research Corpora.	**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	CL3
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.	CL3
CO3	Apply the Naïve Bayes classifier and sentiment analysis for Natural language problems and text classifications.	CL3
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.	CL3
CO5	Develop the Machine Translation applications using Encoder and Decoder model.	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1	Consider the following Corpus of three sentences a) There is a big garden. b) Children play in a garden c) They play inside beautiful garden Calculate P for the sentence "They play in a big Garden" assuming a bi-gram language model.		CL3
2	Find the bigram count for the given corpus. Apply Laplace smoothing and find the bigram probabilities after add-one smoothing (up to 4 decimal places)		CL3
3	Implement rule-based tagger and stochastic tagger for the give corpus of sentences.		CL3
4	Implement top-down and bottom-up parsing using python NLTK.		CL3
5	Given the following short movie reviews, each labeled with a genre, either comedy or action: a) fun, couple, love, love : **comedy** b) fast, furious, shoot : **action** c) couple, fly, fast, fun, fun :**comedy** d) furious, shoot, shoot, fun :**action** e) fly, fast, shoot, love :**action** and a new document D: ***fast, couple, shoot, fly*** compute the most likely class for D. Assume a naive Bayes classifier and use add-1 smoothing for the likelihoods.		CL3
6	The dataset contains following 5 documents. D1: "Shipment of gold damaged in a fire" D2: "Delivery of silver arrived in a silver truck" D3: "Shipment of gold arrived in a truck" D4: "Purchased silver and gold arrived in a wooden truck"		CL3

	D5: "The arrival of gold and silver shipment is delayed." Find the top two relevant documents for the query document with the content "gold silver truck " using the vector space model. Use the following similarity measure and analyze the result. a) Euclidean distance b) Manhattan distance c) Cosine similarity		
7	The dataset contains following 4 documents. D1: " It is going to rain today " D2: " Today Rama is not going outside to watch rain" D3: "I am going to watch the movie tomorrow with Rama" D4: "Tomorrow Rama is going to watch the rain at sea shore " Find the top two relevant documents for the query document with the content "Rama watching the rain " using the latent semantic space model. Use the following similarity measure and show the result analysis using bar chart. a) Euclidean distance b) Cosine similarity c) Jaccard similarity d) Dice Similarity Coefficient.		
8	Extract Synonyms and Antonyms for a given word using WordNet.		CL3
9	Implement a machine translator for 10 words using encoder-decoder model for any two languages.		CL3

CO-PO-PSO MAPPING

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

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

		MV	MV	MV

NOTE:

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

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

SEE QUESTION PAPER PATTERN:

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

TEXT BOOKS:

1. 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://onlinecourses.nptel.ac.in/noc23_cs45/preview
2. https://www.coursera.org/specializations/natural-language-processing

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MACHINE LEARNING

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

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

CREDITS – 3

COURSE PREREQUISITES:

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

COURSE OBJECTIVES:

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

TEACHING - LEARNING STRATEGY:

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

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

COURSE CONTENTS

MODULE - I

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

MODULE - II

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

MODULE - III

Support Vector Machine, Decision Tree and Random Forest: Linear SVM classification, Nonlinear SVM classification, SVM Regression, Decision Tree representation, Appropriate problems for Decision Tree learning, Basic Decision Tree learning algorithm, Voting classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking.	**8 Hours**

MODULE - IV

Bayesian Learning: Bayes theorem, Bayes theorem and Concept learning, Maximum likelihood and Least squared error hypothesis, Minimum description length principle, Bayes Optimal classifier, Gibbs algorithm, Navie Bayes classifier, Text classification, Bayesian Belief Networks.	**8 Hours**

MODULE - V

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

COURSE OUTCOMES

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

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

CO-PO-PSO MAPPING

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

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

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

SEE QUESTION PAPER PATTERN:

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

TEXT BOOKS:

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

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

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

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COMPUTER NETWORKING CONCEPTS

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	21AI641	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 computer.

COURSE OBJECTIVES:

- Demonstration of application layer protocols
- Discuss transport layer services and understand UDP and TCP protocols
- Explain routers, IP and Routing Algorithms in network layer
- Illustrate concepts of Data link Layer, Physical layer and Multimedia Networking
- Describe the concepts of networking over machine learning

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 networks: Network hardware, Network software, Reference models **Principles of Network Applications:** Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. **The Web and HTTP:** Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, **File Transfer:** FTP Commands & Replies, **Electronic Mail in the Internet:** SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages.	**8 Hours**

MODULE - II

Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, **Principles of Reliable Data Transfer:** Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, **Connection-Oriented Transport TCP:** The TCP Connection, TCP Segment Structure, Round Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management.	**8 Hours**

MODULE - III	
The Network layer: Router Architecture, Input Processing, Switching, Output Processing, Occurrence of Queuing, IPv6, A Brief foray into IP Security, **Routing Algorithms:** The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, **Intra-AS Routing in the Internet:** RIP and OSPF. Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast. **Physical Layer:** Guided transmission media, Wireless transmission.	**8 Hours**
MODULE - IV	
The Data link layer: Design issues of Data Link Layer, Error detection and correction, Elementary data link protocols, Sliding window protocols**. The medium access control sublayer:** The channel allocation problem, Multiple access protocols. **Multimedia Networking:** Properties of video, properties of Audio, Types of multimedia Network Applications, **Streaming stored video:** UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks **Voice-over-IP:** Limitations of the Best-Effort IP Service, Removing Jitter at the Receiver for Audio, Recovering from Packet Loss Protocols for Real-Time Conversational Applications, RTP , SIP.	**8 Hours**
MODULE - V	
Deep Learning in Traffic Management: Introduction, Survey on DNS over HTTPS, DNS over Telnet and machine Learning Classification, Implementation, Results and Analysis. **Machine Learning–Based Approach for Detecting Beacon Forgeries in Wi-Fi Networks:** Introduction to the Models, Dataset Generation, Dataset Classification, Evaluation.	**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 principles of application layer and importance of its protocol	CL2
CO2	Discuss transport layer services and infer UDP and TCP protocol	CL2
CO3	Explain the architecture of Router and its algorithms in network layer and able to explain the transmission of data over medium in physical layer	CL2
CO4	Discuss the design issues and error control of data link layer	CL2
CO5	Explain the application of networking concepts in deep learning and machine learning	CL2

CO-PO-PSO MAPPING

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

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

ASSESSMENT STRATEGY

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

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	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%)			**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: 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:

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

TEXT BOOKS:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017
2. Sangita Roy, Rajat Subhra Chakraborty, Jimson Mathew, Arka Prokash Mazumdar, Sudeshna Chakraborty, Artificial Intelligence And Deep Learning For Computer Network Management And Analysis, 2023
3. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
4. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
5. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
6. Mayank Dave, Computer Networks, Second edition, Cengage Learning

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

PATTERN RECOGNITION

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21AI642**	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:

Linear algebra, probability and statistics, programming skills ,data and database knowledge

COURSE OBJECTIVES:

This course will enable students to:

- Identifies and predicts the hidden or untraceable data.
- Understand the automatic discovery of regularities in data through the use of computer algorithms .
- Explain the recognizable proof of verifiable items and relations.
- Choose the features that allow pattern vectors to belong to different categories.
- Analyze the use of complex algorithms to identify patterns in the input data.

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

Statistical Pattern Recognition: Introduction to Statistical Pattern Recognition, The Gaussian Case and Class Dependence, Discriminant Functions, Classifier Performance, Risk, and Errors.	**8 Hours**

MODULE – II

Supervised Learning Using Parametric and Nonparametric Approaches: Parametric Estimation and Supervised Learning, Maximum Likelihood Estimation, Bayesian Parameter Estimation Approach, Parzen Windows. **Linear Discriminant Functions:** Linear Discriminant Functions and Decision Surfaces, Generalized Linear Discriminant Functions, Linearly Separable Case, Minimizing the Perceptron Criterion Function, Relaxation Procedures, Minimum Square Error Procedures, Linear Programming Algorithms, Support Vector Machines.	**8 Hours**

MODULE – III	
Unsupervised Learning and Clustering: Formulation of Unsupervised Learning Problems, Hierarchical Clustering, Partitional Clustering, Density Based Clustering, Learning Vector Quantization. **Clustering:** Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k means, Isodata), clustering large data sets, examples, An application: Handwritten Digit recognition .	**8 Hours**

MODULE – IV	
Syntactic Pattern Recognition: Quantifying Structure in Pattern Description and Recognition, Grammar Based Approach and Applications, Elements of Formal Grammar, Recognition of Syntactic Descriptions, Parsing, Graph Based Structural Representations.	**8 Hours**

MODULE – V	
Neural Pattern Recognition: Neural Network Structures for Pattern Recognition Applications, Single Layer Perceptron, Multilayer Back-propagation Algorithm, Radial Basis Function Network, Hopfield Nets, Kohonen Network.	8 Hours

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Explain statistical pattern recognition principles .	CL2
CO2	Describe the different supervised learning approaches and linear discriminant function for PR.	CL3
CO3	Determine the unsupervised learning and clustering problems and applications.	CL3
CO4	Illustrate the syntactic pattern recognition.	CL3
CO5	Apply pattern recognition algorithms for neural network structures.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2				2				2		
CO2	3	3	2	2				2				2		
CO3	3	3	3	2				2				2		
CO4	3	3	3	2				2				2		
CO5	3	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**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

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

SEE QUESTION PAPER PATTERN:

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

TEXT BOOKS:

1. Pattern Recognition (An Introduction) V Susheela Devi, M Narsimha Murthy Universities Press.
2. Pattern Recognition & Image Analysis Earl Gose, Richard Johnsonbaugh, Steve Jost PH 1996.
3. R. Schalkoff, "Pattern Recognition Statistical, Structural and Neural Approaches".
4. Pattern Classification Duda R. O., P.E. Hart, D.G. Stork John Wiley and sons 2000.
5. E. Gose, R. Johnsonbaugh and S. Jost, "Pattern Recognition and Image Analysis", Prentice Hall, 1996
6. B. D. Ripley and N. L. Hjort, "Pattern Recognition and Neural Networks", Cambridge University Press.
7. C. H. Chen and P. S. Pwang, "Pattern Recognition and Computer Vision", World Scientific, 2005
8. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 2nd Edition, Academic Press

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

1. https://www.youtube.com/watch?v=U5xsX2ersHQ&list=PLbRMhDVUMngcx-ATexXZH_-u1wsIGIiyS
2. https://www.youtube.com/watch?v=8cZ-ljrSaEw
3. https://www.analyticsvidhya.com/blog/2020/12/patterns-recognition-the-basis-of-human-and-machine-learning/

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SOCIAL NETWORK ANALYSIS

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

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

CREDITS – 3

COURSE PREREQUISITES:

- Fundamental knowledge of Mathematics, Data Structures and algorithms.

COURSE OBJECTIVES:

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

TEACHING - LEARNING STRATEGY:

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

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

COURSE CONTENTS

MODULE - I

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

MODULE - II

Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector 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 network. Network visualization and graph layouts. Graph sampling. Low -dimensional projections.	**8 Hours**

MODULE - V	
Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets.	**8 Hours**

COURSE OUTCOMES

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

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

CO-PO-PSO MAPPING

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

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

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

SEE QUESTION PAPER PATTERN:

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

REFERENCE BOOKS:

1. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010.
2. Eric Kolaczyk, Gabor Csardi. Statistical Analysis of Network Data with R (Use R!). Springer, 2014
3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994.
4. Guandong Xu ,Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
5. Dion Goh and Schubert Foo, ―Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
6. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, ―Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling‖, IGI Global Snippet, 2009.
7. John G. Breslin, Alexander Passant and Stefan Decker, ―The Social Semantic Web‖, Springer, 2009.

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

1. https://onlinecourses.nptel.ac.in/noc22_cs117/preview

DATA MINING AND DATA WAREHOUSING

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21AI644**	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 Data Structures, Data Base Management System

COURSE OBJECTIVES:

- Define multi-dimensional data models.
- Explain rules related to association, classification and clustering analysis.
- Compare and contrast between different classification and clustering algorithms

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
- Virtual Lab
- Expert Talk/Webinar/Seminar
- Peer-to-Peer Activities
- Problem Based Learning
- MOOC/NPTEL Courses
- Any other innovative initiatives with respect to the Course contents

COURSE CONTENTS

MODULE - I	
Data Warehousing & modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations.	**8 Hours**
MODULE - II	
Data warehouse implementation & Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. **:** Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity.	**8 Hours**
MODULE - III	
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.	**8 Hours**
MODULE - IV	
Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers.	**8 Hours**
MODULE - V	
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph-Based Clustering, Scalable Clustering 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	Describe the data warehouse and OLAP technology for understanding the overall data mining and knowledge discovery process.	CL 2
CO2	Discuss the implementation aspects of the data warehouse and illustrate the importance of data for the mining process.	CL 3
CO3	Use the association rules for discovering important relationships hidden in large data sets.	CL 3
CO4	Solve many diverse applications using different classification techniques.	CL 3
CO5	Apply the concepts of clustering for understanding data and solving different practical problems.	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
CO1	3	3	2	2								2		
CO2	3	3	2	2								2		
CO3	3	3	2	2								2		
CO4	3	3	2	2								2		
CO5	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**
	Continuous Internal Evaluation (CIE)	60 %	30
	Assignments	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

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

SEE QUESTION PAPER PATTERN:

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

TEXT BOOKS:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.
3. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.
4. Michael.J.Berry, Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edtion,2012.

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

1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview

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 , Hashfucntions, financial markets and trading.	**8 Hours**
MODULE - III	
Bit Coin Introduction, Transactions: Structure, Transactions types, The structure of a block, The genesis block , The bitcoin network, Wallets and its types, Bitcoin payments, Bitcoin investment and buying and selling bitcoins, Bitcoin installation, Bitcoin programming and the command-line interface, Bitcoin improvement proposals (BIPs).	**8 Hours**
MODULE - IV	
Ethereum: Ethereum block chain, Etherium network, Components of the Ethereum ecosystem, Keys and Addresses, Accounts and its types, Transactions and Messages, Contract Creation transaction, Message call transaction, messages,Calls, Transaction Validation and execution, Transaction substrate, State storage in the Ethereum blockchain, Ether cryptocurrency / tokens (ETC and ETH), The Ethereum Virtual Machine (EVM), Execution environment, Native contracts.	**8 Hours**
MODULE - V	
Smart Contract and Hyper ledger: Ricardian contracts, Application developed on Etherium : The DAO. **Hyper ledger:** Hyper ledger projects, Hyperledger as a protocol, The reference architecture, Requirements and design goals of Hyperledger Fabric, Applications on blockchain on fabric, Consensus in Hyperledger Fabric, The transaction life cycle in Hyperledger Fabric, Sawtooth lake, Corda Architecture.	**8 Hours**

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Apply basic concepts of Blockchain and evaluate the benefits and limitation of Blockchain	CL3
CO2	Examine the decentralization concepts and apply 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
CO1	3	3	2						1		2	2		
CO2	3	3	2						1		2	2		
CO3	3	3	2		2				1		2	2		
CO4	3	3	2		2				1		2	2		
CO5	3	3	2		2				1		2	2		

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

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	05

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

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

SEE QUESTION PAPER PATTERN:

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

TEXT 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

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

CLOUD COMPUTING AND ITS APPLICATIONS

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21AI652**	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 computer networks.

COURSE OBJECTIVES:

- Provide students with the fundamentals and essentials of Cloud Computing.
- To provide students a sound foundation of Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real life scenarios.
- To enable students exploring some important cloud computing driven commercial systems and applications.
- To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

TEACHING - LEARNING STRATEGY:

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

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

COURSE CONTENTS

MODULE - I

Introduction: Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Historical Developments, Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies. **Virtualization**: Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples Xen: Paravirtualization, VMware: Full Virtualization, Microsoft Hyper-V.	**8 Hours**

MODULE - II

Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects **Aneka:** Cloud Application Platform, Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment	**8 Hours**

Mode, Public Cloud Deployment Mode. Case study: Netflix.	
MODULE - III	
Concurrent Computing: Introducing Parallelism for Single Machine Computation, Programming Applications with Threads, What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, Multithreading with Aneka, Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, Programming Applications with Aneka Threads, Aneka Threads Application Model, Domain Decomposition: Matrix Multiplication, Functional Decomposition: Sine, Cosine, and Tangent.	**8 Hours**
MODULE - IV	
Data-Intensive Computing: What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application Exploring Large-Data Issues in the Curriculum: A Case Study with MapReduce.	**8 Hours**
MODULE - V	
Cloud Platforms in Industry: Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure, Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. **Cloud Applications**: Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Geoscience: Satellite Image Processing, Business and Consumer Applications, CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming.	**8 Hours**

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Explain cloud computing, virtualization and classify services of cloud computing	CL3
CO2	Illustrate architecture and programming in cloud	CL3
CO3	Able to use concurrent programming methods	CL3
CO4	Able to use data intensive services like map reduce	CL3
CO5	Describe the platforms for development of cloud applications and List the application of cloud.	CL3

CO-PO-PSO MAPPING

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

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

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

SEE QUESTION PAPER PATTERN:

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

TEXT BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education.
2. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.

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

1. What is Cloud Computing? | Amazon Web Services - YouTube

NOSQL DATABASE

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code	**21AI653**	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 DBMS

COURSE OBJECTIVES:

- Recognize and describe the four types of NoSQL Databases, the Document-oriented, Key-Value Pairs, Column-oriented and Graph databases useful for diverse applications.
- Apply performance tuning on Column-oriented NoSQL databases and Document-oriented NoSQL Databases.
- Differentiate the detailed architecture of column-oriented NoSQL database, Document database and Graph Database and relate usage of processor, memory, storage and file system commands.
- Evaluate several applications for location-based service and recommendation services. Devise an application using the components of NoSQL.

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

Importance of NoSQL: The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, **Aggregate Data Models**; Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. **More Details on Data Models**; Relationships, Graph Databases, Schema less Databases, Materialized Views, Modeling for Data Access.	**8 Hours**

MODULE - II

Distribution Models; Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums. Version Stamps, Business and System Transactions, Version Stamps on Multiple Nodes. **Case Study:** Distribution models and Version stamps.	**8 Hours**

MODULE - III

Key-Value Databases, Introduction to Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, constraints of Key value store, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets. Case Study on Key Value Databases.	**8 Hours**

MODULE - IV

Document Databases, Introduction to Document Database, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E- Commerce Applications, constraints of Document database, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure. **Column Family data store**: Introduction to Column-Family Data Store? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage, constraints of Column family data store.	**8 Hours**

MODULE - V

Graph Databases: Introduction to Graph Database, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, constraints of Graph databases. Case study on Graph Database.	**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 basics of NoSQL with its various types, Aggregate orientation and Aggregate Data Access Models.	CL2
CO2	Summarize the detailed architecture of Distribution models and consistency using various version stamps.	CL2
CO3	Explain the Map-reduce concepts and perform various Key-Value based operations on NoSQL databases.	CL2
CO4	Explain the detailed aspects of Document Database and Column Family data store.	CL2
CO5	Summarize the detailed architecture, consistency and transactions of Graph Databases.	CL2

CO-PO-PSO MAPPING

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

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

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

40%	30%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

SEE QUESTION PAPER PATTERN:

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

TEXT BOOKS:

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012.
2. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
3. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
4. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694).
5. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
6. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
7. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

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

1. https://www.geeksforgeeks.org/introduction-to-nosql/ (and related links in the page)
2. https://www.youtube.com/watch?v=0buKQHokLK8 (How do NoSQL databases work? Simply explained)
3. https://www.techtarget.com/searchdatamanagement/definition/NoSQL-Not-Only-SQL (What is NoSQL and How do NoSQL databases work)
4. https://www.mongodb.com/nosql-explained (What is NoSQL)
5. https://onlinecourses.nptel.ac.in/noc20-cs92/preview (preview of Bigdata course contains NoSQL

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
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MANGALURU

IOT TECHNOLOGIES

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

Course Code:	**21AI654**	**CIA Marks**	**50**
Number of Contact Hours/Week (L:T:P:S)	**3:0:0:2**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 L + 20 S**	**Exam Hours**	**3 Hours**

CREDITS – 3

Prerequisites:

- Knowledge about computer networks
- Moderate knowledge on working of sensors and actuators

Course Objectives:

This course will enable students to:

- Interpret the impact and challenges posed by IoT networks leading to new architectural models.
- Compare and contrast the deployment of smart objects and the technologies to connect them to the network.
- Appraise the role of IoT protocols for efficient network communication.
- Elaborate the need for Data Analytics and Security in IoT.
- Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in the Industry

Teaching-Learning Strategy:

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

- 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

COURSE CONTENTS

MODULE - 1

Module Contents	Lecture Hours
Introduction to IoT, Genesis, Digitization and 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 - 2

Smart Objects: The "Things" in IoT, Sensors, Actuators, Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.	**8 Hours**

MODULE - 3

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 - 4

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.	**8 Hours**

MODULE - 5

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, Smart City Security Architecture, Smart City Use-Case Examples.	**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 IoT fundamentals, impact, architecture, and data management	**CL2**
CO2	Acquire proficiency in IoT smart objects, sensors, actuators, and connectivity, enhancing your ability to work with IoT devices	**CL2**
CO3	Explain IoT network layers, IP optimization, compliance, and application protocols for effective IoT implementation	**CL2**
CO4	Interpret IoT data analytics, machine learning, security, and risk analysis to effectively harness the power of IoT for data-driven insights and secure operations	**CL2**
CO5	Effectively work with IoT physical devices like Arduino and Raspberry Pi, enabling the development of IoT solutions for smart cities and beyond	**CL2**

CO-PO-PSO MAPPING

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

CO2	3	3	1								2			
CO3	3	3	1								2			
CO4	3	3	1								2			
CO5	3	3	3	3	3					2	2	2		

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

CO - Assessment Mapping:

Course Outcomes	**Continuous Internal Assessment (CIA) (50%)**				**Semester End Exam (SEE) (50%)**
	Continuous Internal Evaluation (CIE) (60%)			**Assignment/ Activities (40%)**	
	I	**II**	**III**		
	Syllabus Coverage				
	40%	**30%**	**30%**	**100%**	**100%**
CO1	X			X	X
CO2	X			X	X
CO3		X		X	X
CO4		X	X	X	X
CO4			X	X	X

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

Assignment Types:

Sl. No.	**Assignment Description**	**Max. Weightage (%)**	**Max. Marks**
1	Written Assignments	25 %	5
2	Quiz	25 %	5
3	Field Visits/Survey/Case Studies	50 %	10

4	Model / Prototype Development	100 %	20
5	Project Based Learning		
6	Seminar/Presentation	25 %	5
7	Peer-to-Peer Learning	25 %	5

SEE Question Paper Pattern:

- The question paper will have **TEN** full questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from all the FIVE modules.
- Each full question will have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text 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", 1 st edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017.
3. Vijay Madisetti and ArshdeepBahga, "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/noc23_cs83/preview

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MACHINE LEARNING LABORATORY

(Effective from the Academic Year 2023 - 2024)

VI SEMESTER

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

CREDITS – 1

COURSE PREREQUISITES:

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

COURSE OBJECTIVES:

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

TEACHING - LEARNING STRATEGY:

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

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

LIST OF EXPERIMENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Implement and demonstrate the Find-S algorithm for finding the most specific hypothesis.	CO1	CL3
2.	Implement and demonstrate the Candidate Elimination algorithm using a data set stored as a .CSV file.	CO1	CL3
3.	Demonstrate data Preprocessing (Data Cleaning, Integration and Transformation) operations on a suitable data.	CO2	CL3
4.	Demonstrate the working of SVM classifier for a suitable dataset.	CO3	CL3
5.	Implement and demonstrate the working of the Decision Tree algorithm.	CO3	CL3
6.	Implement Random Forest classifier using python programming.	CO3	CL3
7.	Demonstrate the text classifier using Naive Bayes classifier algorithm.	CO4	CL3
8.	Implement the Naive Bayesian classifier for a sample training data set stored as a .CSV file.	CO4	CL3
9.	Construct a Bayesian network to analyze the diagnosis of heart patients using heart diseases dataset.	CO4	CL4
10.	Implement KNN classification algorithm with an appropriate dataset and analyze the results.	CO5	CL4

COURSE OUTCOMES

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

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

CO-PO-PSO MAPPING

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

ASSESSMENT STRATEGY

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

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

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

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

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

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

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

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

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

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

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

SEE QUESTION PAPER PATTERN:

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

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

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

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

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DIGITAL IMAGE PROCESSING

(Effective from the Academic Year 2024 - 2025)

VII SEMESTER

Course Code	**21AI71**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

- Fundamental knowledge of Image concepts and applications, linear Algebra.

COURSE OBJECTIVES:

- Describe the fundamentals of image processing and computer vision
- Illustrate the image enhancement techniques
- Illustrate Image restoration and image compression technique
- Describe the image segmentation and morphological image processing
- Review computer vision techniques and its applications.

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

Digital Image Fundamentals: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.	**8 Hours**

MODULE – II

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, -Smoothing Spatial Filters, Sharpening Spatial Filters **Frequency Domain:** Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, and Selective Filtering.	**8 Hours**

MODULE – III

Restoration: Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, and Constrained Least Squares Filtering.	**8 Hours**

MODULE – IV

Wavelets: Background, Multiresolution Expansions. **Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, and Some Basic Morphological Algorithms.	**8 Hours**

MODULE – V

Computer vision and Image formation: Overview of computer vision and its application in real world **Image formation:** Geometric primitives and transformations like 2D, 3D and 3D rotations, 3D to 2D projections, lens distortion Photometric image formation with lighting, Reflectance and shading, optics The digital camera- Sampling and aliasing and compression.	**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, Establish and describe the basics of image processing concepts through mathematical interpretation	CL3
CO2	Apply image processing techniques in both the spatial and frequency (Fourier)domains.	CL3
CO3	Demonstrate image restoration process and its respective filters required.	CL3
CO4	Design image analysis techniques in the form of image segmentation and to evaluate the Morphological processing.	CL3
CO5	Identify and interpret principles of computer vision	CL3

LABORATORY COMPONENTS

Exp. No.	Experiment Description	CO No.	Bloom's Taxonomy Level
1.	Write a Program to read a digital image. Split and display image into 4 quadrants, up, down, right and left	CO1	CL3
2.	Read an image and extract and display low-level features such as edges, textures using filtering techniques.	CO2	CL3
3.	Demonstrate enhancing and segmenting low contrast 2D images.	CO2	CL3
4.	Demonstrate image restoration using spatial or frequency domain	CO3	CL3
5.	Read an image, first apply erosion to the image and then subtract the result from the original. Demonstrate the difference in the edge image if you use dilation instead of erosion.	CO4	CL3
6.	Implement image processing model using Computer Vision libraries (Tensor Flow, Keras)	CO5	CL3
7.	Write a program to show rotation, scaling, and translation of an image.	CO5	CL3
8.	Demonstrate enhancing and segmenting low contrast 2D images	CO5	CL3

CO-PO-PSO MAPPING

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

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

ASSESSMENT STRATEGY

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

Sl. No.	Assessment Description	Weightage (%)	Max. Marks
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	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
30%	40%	30%	100%	100%
MI			MI	MI
MII	MII		MII	MII
	MIII		MIII	MIII
		MIV	MIV	MIV
		MV	MV	MV

NOTE:

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

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

SEE QUESTION PAPER PATTERN:

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

TEXT BOOKS:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice Hall, 2008. (Chapter 1,2,3,4,5,7,
2. Computer Vision: Algorithms and Applications 2nd Edition Richard Szelisk (Chapter 1 & 2).
3. Digital Image Processing- S. Jayaraman, S. Esakkirajan, T. Veerakumar, TataMcGraw Hill 2014.
4. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.
5. S. Sridhar, Digital Image Processing, Oxford University Press, 2nd Edition, 2016.
6. Computer Vision, A Modern Approach David A Forsyth, Jean Ponce

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

1. https://onlinecourses.nptel.ac.in/noc23_ee118/course
2. https://onlinecourses.nptel.ac.in/noc23_cs77/announcements?force=true

NEURAL NETWORKS AND DEEP LEARNING

(Effective from the Academic Year 2024 - 2025)

VII SEMESTER

Course Code	**21AI72**	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

Strong foundation in Linear Algebra and Calculus, Understanding basic concepts in machine learning and statistics.

COURSE OBJECTIVES:

- Understanding of the fundamental concepts in deep learning
- To learn about different types of neural network architectures
- Analyze optimization and generalization in neural networks
- To apply deep learning models for suitable 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	
Linear models (SVMs and Perceptron's, logistic regression)- Intro to Neural Nets: Shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.	**8 Hours**
MODULE – II	
Deep Networks: History of Deep Learning- A Probabilistic Theory of Deep Learning Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semi Supervised Learning.	**8 Hours**
MODULE – III	
Dimensionality Reduction: Linear (PCA, LDA) and manifolds, metric learning - Autoencoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization.	**8 Hours**
MODULE – IV	
Optimization and Generalization: Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.	**8 Hours**
MODULE – V	
Case Study and Applications: Imagenet- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection Bioinformatics- Face Recognition- Scene Understanding Gathering Image Captions.	**8 Hours**

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Explain the basics of Linear models and Neural Networks.	CL2
CO2	Discuss various Deep Networks and their Probabilistic Theory.	CL2
CO3	Interpret high dimensional data using reduction techniques for the given problem	CL2
CO4	Describe optimization and generalization techniques of deep learning.	CL2
CO5	Illustrate the given deep learning application and enhance by applying latest 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
CO1	3	3	2		2							1		
CO2	3	3	2		2							1		
CO3	3	3	2		2							1		
CO4	3	3	2		2							1		
CO5	3	3	2		3							1		

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

ASSESSMENT STRATEGY

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

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

ASSESSMENT DETAILS

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

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

ASSIGNMENT TYPES WITH WEIGHTAGES

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

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

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

SEE QUESTION PAPER PATTERN:

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

TEXT BOOKS:

1. CosmaRohillaShalizi, Advanced Data Analysis from an Elementary Point of View,2015.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.
3. Francois Chollet, “Deep Learning with Python”, Second Edition, Manning Publications, 2021
4. Neural Networks and Deep Learning, Determination Press,2015.

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

- https://cs230.stanford.edu/

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Robotic Process Automation

(Effective from the Academic Year 2024 - 2025)

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	**40 L**	**Exam Hours**	**3 Hours**

CREDITS – 3

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:

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

- Chalk and Talk Method/Blended Mode Method
- Power Point Presentation
- Expert Talk/Webinar/Seminar
- Video Streaming/Self-Study/Simulations
- Peer-to-Peer Activities
- Activity/Problem Based Learning
- Case Studies
- MOOC/NPTEL Courses

COURSE CONTENTS

MODULE - 1

Module Contents	Lecture Hours
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-UIStack-Downloading and installing UIPath Studio-Learning UI Path Studio-Task Recorder-Step-by-Step Examples using the Recorder.	**8 Hours**

MODULE - 2

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	**8 Hours**

Activities - The Assign Activity - 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 - 3

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 - 4

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 - 5

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
CO1	3	3	2							1	1	1		
CO2	3	3	2		2					1	1	1		
CO3	3	3	3	1	2					1	1	1		
CO4	3	3	3	1	2					1	1	1		
CO5	3	3	3	1	2					1	1	1		
3: Substantial (High)					2: Moderate (Medium)					1: Poor (Low)				

CO - Assessment Mapping:

Course Outcomes	Continuous Internal Assessment (CIA) (50%)				Semester End Exam (SEE) (50%)
	Continuous Internal Evaluation (CIE) (60%)			Assignment/Activities (40%)	
	I	II	III		
	Syllabus Coverage				
	40%	30%	30%	100%	100%
CO1	x			x	x
CO2	x			x	x
CO3		x		x	x
CO4		x	x	x	x
CO4			x	x	x

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

Assignment Types:

Sl. No.	Assignment Description	Max. Weightage (%)	Max. Marks
1	Written Assignments	25 %	5
2	Quiz	25 %	5
3	Field Visits/Survey/Case Studies	50 %	10
4	Model / Prototype Development	100 %	20
5	Project Based Learning		
6	Seminar/Presentation	25 %	5
7	Peer - to -Peer Learning	25 %	5

SEE Question Paper Pattern:

- The question paper will have **TEN** full questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from all the FIVE modules.
- Each full question will have a maximum of four sub-questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text 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/

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AUGMENTED REALITY AND VIRTUAL REALITY

(Effective from the Academic Year 2024 - 2025)

VII SEMESTER

Course Code	**21AI732**	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 mobile development and deployment
- Knowledge of any programming languages such as C, Python or Java

COURSE OBJECTIVES:

- To understand geometric modeling and Virtual environment
- To study about Virtual Hardware and Software
- To develop Virtual Reality applications

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 three I's of virtual reality, commercial VR technology, and the five classic components of a VR system. **Virtual Reality and Virtual Environment:** Introduction, Computer graphics, Real-time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.	**8 Hours**

MODULE - II

Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces, and gesture interfaces. Output Devices: Graphics displays, sound displays & haptic feedback.	**8 Hours**

MODULE - III

Modeling: Geometric modeling, kinematics modeling, physical modeling, behavior modeling, model management.	**8 Hours**

MODULE - IV

Human Factors: Methodology and terminology, user performance studies, VR health and safety issues. Applications: Medical applications, military applications, robotics applications, Engineering, Entertainment, Science, and Training.	**8 Hours**

MODULE - V

Augmented reality: Augmented reality, relation with other technologies, Augmented reality concepts, working of AR, concepts related to augmented reality, Ingredients of an augmented reality Experience.	**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 concepts of virtual reality, including its history, components, and applications	CL2
CO2	Explain the different input and output devices used in virtual reality systems	CL2
CO3	Interpret the different types of modeling used in virtual reality, and how to create and manage them.	CL2
CO4	Explain the human factors considerations in the design and use of virtual reality systems and their applications in different domains.	CL2
CO5	Explain Augmented Reality's core concepts, integration with other technologies, and the essential elements for creating impactful AR experiences	CL2

CO-PO-PSO MAPPING

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

TEXT BOOKS:

1. Virtual Reality Technology, Gregory C. Burdea& Philippe Coiffet, John, 2nd Edition, 2013 Wiley & Sons, Inc., ISBN: 978-0-471-36089-6.
2. Alan B. Craig, "Understanding Augmented Reality", Concepts and Applications, Morgan Kaufmann,1st Edition, 2013 ISBN: 978024082408.
3. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Interscience, 2nd Edition, 2006. ISBN: 978-0-471-36089-6.
4. Oliver Bimber and Ramesh Raskar, Spatial Augmented Reality: Merging Real and Virtual Worlds, 2005.ISBN 1-56881-230-2.

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

1. https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-course-on-virtual-reality-and-augmented-reality/
2. https://archive.nptel.ac.in/courses/121/106/121106013/
3. http://lavalle.pl/vr/book.html
4. https://nptel.ac.in/courses/106106138
5. https://www.coursera.org/learn/introduction-virtual-reality.
6. https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf
7. https://learn.microsoft.com/en-us/windows/mixed-reality/
8. https://learn.microsoft.com/en-us/archive/msdn-magazine/2016/november/hololens-introduction-to-the-hololens

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BUSINESS INTELLIGENCE

(Effective from the Academic Year 2024 - 2025)

VII SEMESTER

Course Code	**21AI733**	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:
Database fundamentals, Statistical Concepts, Critical Thinking and Analytical Skills, Basic of Microsoft Excel.

COURSE OBJECTIVES:
This course will enable students to:

- Extract meaningful insights from diverse data sources.
- Contribute to strategic decision-making processes.
- Explore the responsible use of data, privacy concerns, and the ethical considerations associated with BI applications.

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	
Development Steps: BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation.	**8 Hours**
MODULE – II	
Managing The BI Project: Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process.	**8 Hours**
MODULE – III	
Differences in Database Design Philosophies: Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery.	**8 Hours**
MODULE – IV	
Growth Management: Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard.	**8 Hours**
MODULE – V	
Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics of enterprise reporting, BI road ahead.	**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 development steps of business intelligence.	CL2
CO2	Explain the BI project managing activities and requirements..	CL2
CO3	Differentiate different database design philosophies.	CL2
CO4	Explain the growth management and BI applications.	CL2
CO5	Determine the role of information technology for business 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
CO1	3	3	2	1				2				2		
CO2	3	3	2	1				2				2		
CO3	3	3	3	1				2				2		
CO4	3	3	3	1				2				2		
CO5	3	3	3	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.

TEXT BOOKS:

1. 'Business Intelligence Roadmap: The Complete Project Lifecycle for Decision Support Applications', Larissa T Moss and Shaku Atre, Addison Wesley Information Technology Series, 2003.
2. 'Fundamentals of Business Analytics', R N Prasad, Seema Acharya, Wiley India, 2011.
3. 'Business Intelligence: The Savvy Manager's Guide', David Loshin, Publisher: Morgan Kaufmann, ISBN 1-55860- 196-4.
4. 'Delivering Business Intelligence with Microsoft SQL Server 2005', Brian Larson, McGraw Hill, 2006.
5. 'Foundations of SQL Server 2008', Lynn Langit, Business Intelligence –Apress, ISBN13: 978- 14302-3324-4, 2011.

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

1. Business Analytics & Business Intelligence Full Course 2022 | Business Analysis | Simplilearn - YouTube

DATA SCIENCE AND BIG DATA ANALYTICS

(Effective from the Academic Year 2024 - 2025)

VII SEMESTER

Course Code	**21AI734**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40L + 20P	Exam Hours	03

CREDITS – 4

COURSE PREREQUISITES:

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

COURSE OBJECTIVES:

- Demonstrate the proficiency with statistical analysis of data to derive insight from results and interpret the data findings visually
- Utilize the skills in data management by obtaining, cleaning and transforming the data
- Understand fundamentals and applications of Big Data analytics and various machine learning algorithms for Big Data Analytics
- Explore the Hadoop framework, Hadoop Distributed File system and employ MapReduce programming model to process the big data
- Explore the SPARK data model and SPARK Programming Model

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

Data Science Fundamentals: Introduction to Data science. **Visualizing Data**: matplotlib, Bar Charts, Line Charts, Scatterplots, **Linear Algebra**: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, **Probability**: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.	**8 Hours**

MODULE - II

Hypothesis and Inference: Statistical Hypothesis Testing, Example: Flipping a Coin, p-Values, Confidence Intervals, p-Hacking, Example: Running an A/B Test, Bayesian Inference, Getting Data, stdin and stdout, Reading Files, Scraping the Web, Using APIs, Example: Using the Twitter APIs, **Working with Data**: Exploring the Data, Using Named Tuples, Data classes, Cleaning and Munging, Manipulating Data, Rescaling, tqdm library, Dimensionality Reduction.	**8 Hours**

MODULE - III

Introduction to Big Data Analytics: 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	**8 Hours**

Analytics Applications and Case Studies. **Machine Learning Algorithms for Big Data Analytics**: introduction, Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlation, Clustering Analysis: Overview of Clustering, K-Means, Hierarchical Clustering	
MODULE - IV	
Introduction to Hadoop (T1): Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. **Hadoop Distributed File System Basics (T2):** HDFS Design Features, Components, HDFS User Commands. **MapReduce, Hive and Pig:** Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms.	**8 Hours**
MODULE - V	
Spark: Data Model: Resilient Distributed Datasets and Data Frames, Other data structures, Programming Model: Data Ingestion, Basic Actions—Count, Take, and Collect, Other Operations—flatMap and Reduce, Architecture, Spark 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	Explain the Data science Concepts and demonstrate the data representations using visualization tools.	CL3
CO2	Make use of Statistical hypothesis tests to choose the properties of data, curate and manipulate Data.	CL3
CO3	Discuss the fundamentals of Big Data analytics and apply Machine Learning algorithms for analyzing real world big data.	CL3
CO4	Illustrate Hadoop Distributed File system using MapReduce programming model to process big data.	CL3
CO5	Discuss the SPARK data model and demonstrate SPARK Programming Model.	CL3

CO-PO-PSO MAPPING

CO No.	Programme Outcomes (PO)												Programme Specific Outcome (PSO)	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	2	2			2						
CO2	3	3	3	2	2			2						
CO3	3	3	3	2	2			2						
CO4	3	3	3	2	2			2						
CO5	3	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**
	Continuous Internal Evaluation (CIE)	60 %	30

	Practical Session (Laboratory Component)	40 %	20
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT DETAILS

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

NOTE:

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

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

SEE QUESTION PAPER PATTERN:

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

TEXT BOOKS:

1. Joel Grus, "Data Science from Scratch", 2nd Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13: 978-9352138326.
2. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
3. Douglas Eadline, "Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1stEdition, Pearson Education, 2016. ISBN13: 978-9332570351
4. Wiktorski, Tomasz. Data-intensive systems: Principles and fundamentals using Hadoop and spark. Springer International Publishing, 2019.
5. Emily Robinson and Jacqueline Nolis, "Build a Career in Data Science", 1st Edition, Manning Publications, 2020. ISBN: 978-1617296246.
6. AurélienGéron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", 2nd Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13: 978-1492032649.
7. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O"Reilly Media, 2015.ISBN-13: 978-9352130672.
8. ArshdeepBahga, 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://onlinecourses.nptel.ac.in/noc21_cs69/preview
2. https://nptel.ac.in/courses/106104189

NEURAL NETWORKS AND DEEP LEARNING LABORATORY WITH MINI PROJECT

(Effective from the Academic Year 2022 - 2023)

VII SEMESTER

Course Code	**21AIL75**	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:

- Introductory knowledge on mathematic, linear algebra
- Proficiency on programming language like Python and R

COURSE OBJECTIVES:

- Support the computers make intelligent decisions with limited human assistance.
- Assist software agents learn how to reach their goals.

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
Pre-requisite:	
	Part-A
1	Write a program to demonstrate the working of different activation functions like Sigmoid, Tanh, RELU and softmax to train neural network.
2	a. Design a single unit perceptron for classification of a linearly separable binary dataset without using pre-defined models. Use the Perceptron () from sklearn. b. Identify the problem with single unit Perceptron. Classify using Or, And and Xor data and analyze the result
3	Build a Deep Feed Forward ANN by implementing the Backpropagation algorithm and test the same using appropriate data sets. Use the number of hidden layers >=4.
4	Design and implement a CNN model (with 4+ layers of convolutions) to classify multi category image datasets. Use the concept of regularization and dropout while designing the CNN model. Use the Fashion MNIST datasets. Record the Training accuracy and Test accuracy corresponding to the following architectures: a. Base Model b. Model with L1 Regularization c. Model with L2 Regularization d. Model with Dropout
5	Design and implement an Image classification model to classify a dataset of images using Deep Feed Forward Neural Network. Record the accuracy corresponding to the number of epochs. Use the MNIST datasets.
6	Implement Bidirectional Long Short-Term Memory(LSTM) for sentiment analysis on movie reviews.

Part-B: Mini Project

Develop mini project must be demonstrated on desktop/laptop as a stand-alone or web based Application. Installation procedure of the required software must be demonstrated, carried out in groups and documented in the journal.

Indicative areas include: health care, education, agriculture, banking, library, agent based systems, registration systems, industry, reservation systems, facility management, super market etc.,

Similar to but not limited to:

- Handwritten Digit Recognition
- Prediction of Cardiac Arrhythmia type using Clustering and Regression Approach
- Hybrid Regression Technique for House Prices Prediction
- An Iris Recognition Algorithm for Identity Authentication
- An Approach to Maintain Attendance using Image Processing Techniques
- Unconstrained Face Recognition
- Vehicle Number Plate Detection System
- Detection of Fake News
- Stock Prediction using Linear Regression
- Prediction of Weather Report
- Analyzing Bike Sharing Trends
- Sentiment Analysis for Movie Reviews
- Analyzing and Recommendations of Music Trends
- Forecasting Stock and Commodity Prices
- Diabetes Prediction
- Speech Recognition
- Spam Detection using neural Networks in Python
- Combining satellite imagery and to predict poverty

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 working of different activation functions in a neural network and to identify the problem with single unit Perceptron	CL3
CO2	Illustrate Deep Feed Forward Neural Network for different datasets.	CL3
CO3	Experiment a CNN model using regularization concepts for multi category image datasets.	CL3
CO4	Use Bidirectional Long Short-Term Memory(LSTM) for rating a movie	CL3
CO5	Design, implement and demonstrate stand-alone or web based mini project using appropriate algorithm and data sets	CL3

CO-PO-PSO MAPPING

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

No.			
1	**Continuous Internal Assessment (CIA)**	**100 %**	**50**
	Laboratory Work (A)	50 %	25
	Laboratory Test (B)	30 %	15
	Open Ended Experiments /Mini Projects (C)	20 %	10
2	**Semester End Examination (SEE)**	**100 %**	**50**

ASSESSMENT STRATEGY:

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

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

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

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

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

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

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

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

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

SEE QUESTION PAPER PATTERN:

1. All laboratory experiments should be included for practical examination, from which students are allowed to pick one experiment from the lot.
2. SEE shall be conducted for 100 Marks and the marks will be scaled down to 50.
3. General Marks Distribution: Procedure + Conduction + Viva = 20% + 50% + 30%.
4. Change of experiment is allowed only once and 20% of the marks allotted to the Procedure will be made ZERO (if a question carries two experiments, both should be changed). The evaluation will be done for 80% of the total maximum marks.

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

1. https://www.youtube.com/watch?v=CS4cs9xVecg&list=PLkDaE6sCZn6Ec-XTbcX1uRg2_u4xOEky0
2. https://www.youtube.com/watch?v=n1l-9lIMW7E&list=PLkDaE6sCZn6Ec-XTbcX1uRg2_u4xOEky0&index=3

SAHYADRI
COLLEGE OF ENGINEERING & MANAGEMENT
An Autonomous Institution
MANGALURU

PYTHON DATA STRUCTURES AND ALGORITHMS

(Effective from the Academic Year 2024 - 2025)

VII SEMESTER

Course Code	**21AI744**	CIA Marks	50
Number of Contact Hours/Week (L: T: P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	20P	Exam Hours	03

CREDITS – 1

COURSE PREREQUISITES:

- Basic Knowledge of Python and concepts of Data Structures.

COURSE OBJECTIVES:

- To use different types of data structures, operations and algorithms
- Apply searching operations on files
- To use stack, Queue, Lists, Trees and Graphs in problem solving
- Apply sorting algorithms on files
- Implement all data structures in a high-level language for problem solving.

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	Develop a Python program to Implement the following searching techniques a. Linear Search b. Binary Search.
2	Develop a Python program to implement the following sorting algorithms using user defined functions: a. Bubble sort (Ascending order) b. Selection sort (Descending order).
3	Develop a Python Program implement STACK with the following operations a. Push an Element onto Stack b. Pop an Element from Stack
4	Implement a Program in Python for converting an Infix Expression to Postfix Expression
5	Implement a Program in Python for evaluating a Postfix Expression.
6	Develop a Python program to simulate the working of a singly linked list providing the following operations: a. Display & Insert b. Delete from the beginning/end c. Delete a given element
7	Obtain the Topological ordering of vertices in a given graph with the help of Python programming.

8	Check whether a given graph is connected or not using the DFS method using Python programming.
9	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm
10	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm

COURSE OUTCOMES

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

CO No.	Course Outcome Description	Bloom's Taxonomy Level
CO1	Design a system by using different types of data structures, operations and algorithms	CL3
CO2	Apply different types of searching operations	CL3
CO3	Apply stack, Queue, Lists, Trees and Graphs in problem solving	CL3
CO4	Apply different types of sorting algorithms	CL3
CO5	Implement all data structures in a high-level language for problem solving	CL3

CO-PO-PSO MAPPING

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

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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.

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

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

1. https://jovian.com/learn/data-structures-and-algorithms-in-python
2. https://onlinecourses.nptel.ac.in/noc20_cs70/preview
3. https://online.vtu.ac.in/course-details/Programming-Data-Structures-And-Algorithms-Using-Python
4. https://www.edureka.co/blog/data-structures-in-python/