NAGARJUNA
COLLEGE OF ENGINEERING & TECHNOLOGY

An Autonomous College under VTU

DEPARTMENT OF CSE (AI&ML)

III Semester
Scheme and Syllabus

With effect from Academic Year 2025-26

VISION :
To be at the frontier of Artificial Intelligence and Machine learning with a focus on innovation, industry needs and to produce global professionals contributing to society.

MISSION :

1. Provide a state-of-the-art curriculum and infrastructure to deliver high- quality education in Artificial Intelligence and Machine Learning.

2. Promote high-quality research and higher education through strong collaborations between industry and academia.

3. Inculcate professional ethics and encourage sustainable solutions for addressing societal challenges.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Program Educational Objectives (PEOs) of the UG program in CSE (AI & ML) are as follows.

PEO1: Graduates of the program will pursue successful careers in the IT, Artificial Intelligence, and Machine Learning industries.

PEO2: Graduates will be equipped with the knowledge and skills required to excel in postgraduate education.

PEO3: Graduates of the program will design and implement computing solutions that address real-world challenges and societal demands.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Apply the the principles of cognitive computing, artificial intelligence, and machine learning to design and develop intelligent systems in the domain of AI & ML engineering.

PSO2: Exhibit strong computational knowledge, hands-on proficiency, and innovative thinking in the field of Artificial Intelligence and Machine Learning.

PSO3: Utilize modern technologies and approaches to effectively solve real-world problems in Machine Learning, Deep Learning, Computer Vision, and NLP.

List of POs as Defined by NBA in Annexure II.

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6).

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9).

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8).

Nagarjuna College of Engineering and Technology
Department of CSE (AI&ML)
Scheme of Teaching and Examinations 2025-2026
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2025-26)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	L	T	P	S	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	MAT	24MATS31	Mathematics for Computer Science	Maths Dept.	2	2	0	0	03	50	50	100	**3**
2	IPCC	24CII32	Data Structures and Applications	CSE Board	3	0	2	0	05	50	50	100	**4**
3	IPCC	24CII33	Database Management Systems	CSE Board	3	0	2	0	05	50	50	100	**4**
4	PCC	24CIT34	Artificial Intelligence	CSE Board	3	0	0	0	03	50	50	100	**3**
5	PCCL	24CIL35	Artificial Intelligence Laboratory	CSE Board	0	0	2	0	02	50	50	100	**1**
6	ESC	24CIT361	Operating System	CSE Board	3	0	0	0	03	50	50	100	**3**
		24CIT362	Software Engineering										
		24CIT363	Business Process Fundamentals										
		24CIT364	Analog and Digital Systems										
7	UHV	24UHV37	Social Connect and Responsibility	Any Department	0	0	2	0	02	100	0	100	**1**
8	AEC	24CIL381	Technical Writing using Latex	CSE Board	0	0	2	0	02	50	50	100	**1**
		24CIL382	Data analytics with Excel										
		24CIL383	Full Stack Web Development										
9	NCMC	24NS39	NSS	NSS Coordinator	0	0	2	0	0	100	0	100	**0**
		24PE39	YOGA	Yoga Coordinator									
		24YO39	Physical Edu. (Sports and Athletics)	PE Coordinator									
			Total		25					550	350	900	**20**

Mathematics for Computer Science					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23MATS31	2:2:0:0	3	CIE:50 SEE:50	3 Hours	PCC

Pre-Requisites:
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Objectives :

The goal of the course **Mathematics for Computer Science** is to,

1. Introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Computer Science Engineering and sociallife situations.
2. Provide the principles of statistical inferences and the basics of hypothesis testing with emphasison some commonly encountered hypotheses.
3. Determine whether an input has a statistically significant effect on the system's response throughANOVA testing.

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the variouscourse outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods maybe adopted so that the delivered lessons shall develop students theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, anddocumenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   ● As an introduction to new topics (pre-lecture activity).
   ● As a revision of topics (post-lecture activity).
   ● As additional examples (post-lecture activity).
   ● As an additional material of challenging topics (pre-and post-lecture activity).
   As a model solution of some exercises (post-lecture activity).

Module I

Probability Distributions:
Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only).   .   **8 Hours.**
 [Text 1: 26.1, 26.2, 26.7, 26.8, 26.9, 26.10, 26.13, 26.14, 26.15, 26.16]
[RBT Levels: L1, L2 and L3]
Self-Study: Exponential distribution.
 Applications: Used for Modeling and prediction, analyzing data, algorithm design, cryptography, error detection, machine learning, computer vision, computer graphics, random number generation and natural language processing.

Module II
Joint probability distribution & Markov Chain:
Joint probability distribution: Joint Probability distribution for two discrete random variables,expectation, covariance and correlation.
Markov Chain: Introduction to Stochastic Process, Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of RegularMarkov chains and absorbing states. **8 Hours.**
[Text 3: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 5.6, 5.7]
[RBT Levels: L1, L2 and L3]
Self-Study: Joint Probability distribution for two continuous random variables.
Applications: Joint distribution for system design and maintenance decisions. Markov chain for algorithmic design and networking.

Module III
Statistical Inference 1:
Introduction, sampling distribution, standard error, testing of hypothesis, levels of significance, test ofsignificances, confidence limits, simple sampling of attributes, test of significance for large samples, comparison of large samples. Sampling variables, central limit theorem and confidence limit for unknown mean. Test of Significance for means of two large samples. **8 Hours.**
[Text 1: 27.1, 27.2, 27.3, 27.4 27.5, 27.6, 27.7, 27.8, 27.9, 27.10, 27.11, 27.12]
[RBT Levels: L1, L2 and L3]
Applications: Decision making and problem solving, software testing and quality control

Module IV
Statistical Inference 2:
Sampling of variables-small samples, students 't' distribution, Chi-square distribution as a test ofgoodness of fit. F-Distribution. **8 Hours.**
[Text 1: 27.13, 27.14, 27.15, 27.16, 27.17, 27.18, 27. 19]
[RBT Levels: L1, L2 and L3]
Self-Study: Fisher's Z-Distribution.
Applications: Algorithm performance evaluation, Software testing, Hardware testing, Quality assurance, Biometric systems, Network security, database management, Biomedical informatics,
Information retrieval, signal processing and image processing.

Module V
Design of Experiments and ANOVA:
Principles of experimentation in design, Analysis of completely randomized design, randomized block design. The ANOVA Technique, Basic Principle of ANOVA, One-way ANOVA, Two-way ANOVA,Latin-square Design, and Analysis of Co-Variance. **8 Hours.**
[Text 2:]
[RBT Levels: L1, L2 and L3]
Applications: Algorithm Optimization, Network performance, Database management, User experiencedesign and Hardware design..
08 Hours

Assessment Details (both IAT and SEE)

Theory Component	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	**25 Marks**
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	**25 Marks**
Grand Total of IAT Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
IAT + SEE (min marks 40)		**100 Marks**

Course Outcomes (Course Skill Set):

After successfully completing the course, the students will be able to:
1. Understand the basic concepts of probability, random variables, probability distribution and apply suitable probability distribution models for the given scenario.
2. Learn the concept of joint distribution and make use of the notion of a discrete-time Markov chain and n-step transition probabilities to solve the engineering application problem
3. Use statistical methodology and tools in the sampling analysis.
4. Compute the confidence intervals for the mean of the population by using different tests. Apply the ANOVA test related to engineering problems.

Suggested Learning Resources:

Text Books:
1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2021.
2. **Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye** "Probability & Statistics for Engineers & Scientists", Pearson Education, 9th edition, 2017.
3. **Seymour Lipschutz and Marc Lars Lipson:** "Probability", (Chapters: 5 and 8), McGraw Hill Education (India) Private Limited, Chennai, Special Indian Edition, 2010.

Reference Books:
1. **Erwin Kreyszig**, "Advanced Engineering Mathematics", John Wiley &Sons,9th Edition, 2006.
2. **Peter Bruce, Andrew Bruce & Peter Gedeck** "Practical Statistics for DataScientists" O'Reilly Media, Inc., 2nd edition **2020**.
3. **G Haribaskaran** "Probability, Queuing Theory & Reliability Engineering",LaxmiPublication, Latest Edition, 2006.
4. **Irwin Miller & Marylees Miller,** John E. Freund's "Mathematical Statistics withApplications" Pearson. Dorling Kindersley Pvt. Ltd. India, 8th edition, 2014.
   S C Gupta and V K Kapoor, "Fundamentals of Mathematical Statistics", S Chand andCompany, Latest edition.
6. **Robert V. Hogg, Joseph W. McKean & Allen T. Craig**. "Introduction to Mathematical Statistics", Pearson Education 7th edition, 2013.
7. **Jim Pitman**. Probability, Springer-Verlag, 1993.

8. **Sheldon M. Ross,** "Introduction to Probability Models" 11th edition. Elsevier,2014.
9. **A. M. Yaglom and I. M. Yaglom**, "Probability and Information". D. Reidel PublishingCompany. Distributed by Hindustan Publishing Corporation (India)Delhi, 1983.
10. **P. G. Hoel, S. C. Port and C. J. Stone**, "Introduction to Probability Theory", UniversalBook Stall, (Reprint), 2003.
11. **S. Ross**, "A First Course in Probability", Pearson Education India, 6th Ed., 2002.
12. **W. Feller**, "An Introduction to Probability Theory and its Applications", Vol. 1,Wiley, 3rd Ed., 1968.
13. **N.P. Bali and Manish Goyal**, A Textbook of Engineering Mathematics,LaxmiPublications, Reprint, 2010.
14. **Veerarajan T**, Engineering Mathematics (for semester III), Tata McGraw-Hill,NewDelhi, 2010.

E-Resources:
1. http://.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU e-Shikshana Program
5. VTU EDUSAT Program

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
6. Quizzes
7. Assignments
8. Seminars

CO-PO-PSO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
23MATS31.1	3	3	1									
23MATS31.2	3	3	2									
23MATS31.3	3	3										
23MATS31.4	3	3										
23MATS31.5	2	3	1									
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped												

DATA STRUCTURES AND APPLICATIONS

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
24CII32	3:0:2:0	04	IAT:50 SEE:50	03 Hours	IPCC

Prerequisite:
- Basic knowledge of common programming concepts, including loops, arrays, stacks, and recursion.
- Basic knowledge of mathematics, including proof by induction and contradiction.

Course Objectives:
  This course will enable students to:
- Understand the basics of pointers and dynamic memory allocation.
- Learn concepts of structure and its application in programming.
- Gain knowledge to choose the specific linked lists for implementing real world problems.
- Grasp the use of stacks and queues in solving complex problems.

Acquire knowledge of non-linear data structure like trees.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module - I

Introduction: Data Structures, Classifications (Primitive & Non Primitive), Data Structures operations, Functions, Review of Pointers and Dynamic Memory Allocation, Arrays, Structures and Unions, Case study on Dynamic allocated arrays**.**

Stacks: Stack, Array Representation of Stacks along with Stack Operations, Stack Applications: Reverse Polish notation, Infix to Postfix conversion, Evaluation of postfix expression, Stacks using Dynamic Arrays.

08 HOURS

Module - II

Recursion: Introduction to Recursion, Examples of Recursion: Factorial, Fibonacci Sequence, Tower of Hanoi.
Queues: Queues, ADT- Queue, Array Representation, Queue Operations, Circular Queues, Programming Examples.
Priority Queues: Single and double ended Priority Queues.

08 HOURS

Module - III

Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Stacks and Queues implementation using Linked Lists, Doubly Linked lists, Programming Examples.

08 HOURS

Module - IV

Circular lists: Circular Singly and Doubly linked lists; Basic operations: Insert, Delete and Display with programming examples. Application: Adding Polynomials.

Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, Postorder, Preorder

08 HOURS

Module - V
Trees: Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application: Evaluation of Expression.   **Graphs:** The Graph Abstract Data Types, Elementary Graph Operations.   **Hashing:** Introduction, Static Hashing, Dynamic Hashing   **08 HOURS**

SL NO	Experiments
1	Design, develop and execute a program in C based on the following requirements: An EMPLOYEE structure is to contain the following members: Employee_Number (an integer), Employee_Name (a string of characters), Basic_Salary (an integer), All_Allowances (an integer), IT (an integer), Net_Salary (an integer). Write a function to read the data of an employee, to calculate Net_Salary and to print the values of all the structure members. (All_Allowances = 123% of Basic, Income Tax (IT) = 30% of the gross salary (Gross salary = Basic_Salary + All_Allowance), Net_Salary = Basic_Salary + All_Allowances –IT). Display the above data for at least 5 employees.
2	Write a program to Store Roll number of N students. Perform Insert and delete Roll_No at a given valid position (POS) using pointers. Display the status of array elements at any given point of time. Support the program with functions for each operation.
3	Develop an array implementation on stack and perform Push and Pop operations. Check for overflow and underflow conditions. Demonstrate stack implementation to check palindrome. Display the status of the stack for all the operations performed. Support the program with appropriate functions for each of the above operations.
4	Write a Program in C to evaluate the Suffix (Postfix) expression with single digit operands and operators.
5	Implement Circular QUEUE program in C for rainbow colors (VIBGYOR) and perform Insert and Delete operations. Check for overflow and underflow conditions. Display the status of the Circular QUEUE for all the operations performed. Use pointers and functions.
6	Implement a Menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Avg_Marks a. Create N number of Students Data by inserting at end of the list. b. Insert and Delete at front of the list c. Delete at the end of list d. Display the status of SLL d. Demonstration stack and queue e. Exit
7	Design and Develop following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept etc. a. Create a Node of N Employees Data by inserting in front. b. Insert a new node to the right of key value. c. Perform Insertion and Deletion at End of DLL d. Display the status of DLL and count the number of nodes e. Exit
8	Design and Develop a program in C for the following operations on Binary Search Tree (BST) of Integers. a. Create a BST of N Integers b. Traverse the BST using Inorder, Preorder and Post Order techniques c. Search a KEY element in BST and display the appropriate message

Assessment Details (Both CIE / IAT and SEE):

Theory Component	IAT-1 after completion 45 to 50% Syllabus		25 Marks
	IAT-2 after completion 95 to 100% Syllabus		25 Marks
	Average of two IATs		**25 Marks**
	Total 25 Marks : Reduced to 15 Marks		
	CCE-1		25 Marks
	CCE-2		25 Marks
	Average of two CCEs		**25 Marks**
	Total 25 Marks : Reduced to 10 Marks		
Lab Component	Lab Record and execution of programs		**15 Marks**
	Lab Test at the end of 15ᵗʰ week		**10 Marks**
	Total		**25 Marks**
Grand Total of CIE Marks (min marks 20 / 50)			**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**			**50 Marks**
CIE + SEE (min marks 40)			**100 Marks**

Course Outcomes

On completion of this course, the students are able to:

CO1: Define and explain the concepts of Data Structures

CO2: Apply the knowledge of Data Structures and its applications in solving real time problems

CO3: Analyze and identify the output for the given code snippet.

CO4: Develop different methods of organizing the data using either linear or non-linear data structures.

CO5: Study independently as a member of the team and present effectively on the applications of data structures.

Text Books:

1. Ellis Horowitz and Sartaj Sahani, Fundamentals of Data Structures in C, 2ⁿᵈ Ed, Universities Press, 2014. (Chapter 1: 1.1, 1.2; Chapter 2: 2.2; Chapter 3: 3.2 & 3.4; Chapter 4: 4.3 & 4.8 ;

Chapter 5: 5.1 – 5.3, 5.7)

2. Reema Thareja, Data Structures using C, 3ʳᵈ Ed, Oxford press, 2012, (Chapter 2: 2.1 – 2.7; Chapter 3: 3.1 – 3.8, Chapter 5: 5.1 to 5.10 & 5.14 to 5.16; Chapter 7: 7.1 to 7.5; Chapter 8: 8.5 – 8.8; Chapter 9: 9.1 to 9.3, 9.7 & 9.8, 9.11 - 9.13).

Reference Books:

1. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2ⁿᵈ Ed, Cengage Learning, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1ˢᵗ Ed, McGraw Hill, 2014. Chapters 5.1 – 5.8, 6.6 – 6.7, 8.3.

CO-PO Mapping:

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	2	-	-	2
CO3	-	3	-	-	-	-	-	-	-	-	2	-	-	2
CO4	-	-	2	-	-	-	-	-	-	-	2	-	-	1
CO5	-	-	-	-	-	1	-	-	-	1	1	-	-	-

DATABASE MANAGEMENT SYSTEMS

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
24CII33	3:0:2:0	04	IAT:50 SEE:50	03 Hours	IPCC

Course Objectives :
  The Student will be able to:

1. Understand the basics of database concepts, technology, and practice.

2. Gain Knowledge of the relational database design principles.

3. Practice SQL programming through a variety of database.

4. Learn the use of concurrency and transactions in database.

Gain knowledge of building database applications for real world problems.

Module - I

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach.

Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets and structural constraints, Weak entity types, ER diagrams

08 HOURS

Module - II

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

SQL: SQL data definition and data types, Schema change statements in SQL, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.

08 HOURS

Module - III

SQL: Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Implementation of different types of Joins in SQL, Views in SQL

Functional Dependencies and Normalization: Informal design guidelines for relation schemas, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form.

08 HOURS

Module - IV

Transaction Processing-I: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions.

Transaction Processing-II: Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

08 HOURS

Module - V

NOSQL Databases: Introduction to NoSQL - CAP Theorem – Data Models - Key-Value Databases - Document Databases- Column Family Stores – Graph Databases – Working of NoSQL Using MONGODB/CASSANDR

08 HOURS

Sl.no	EXPERIMENTS

1	The storage of digital data is increasing day by day. Every big/small organization has started storing their employee details such as name, salary, address, and department under which they are working in their own database. Design a company database that stores the details of Departments, Projects, Employees, and their Dependents in a particular organization using the following relational schema:
	 Relational Schema
	   Employee (ssn, name, salary, sex, super_ssn, address, dno)
	   Department (dname, dnumber, mgr_ssn)
	   Dept_Loc (dnumber, dloc)
	   Project (pname, pnumber, plocation, dnum)
	   Works_On (essn, pno, hours)
	   Dependent (essn, depen_name, address, relationship, sex)
	 Where:
	   ssn: Primary key of Employee
	   dnumber: Primary key of Department and foreign key in Employee, Dept_Loc, and Project
	   pnumber: Primary key of Project
	   essn: Foreign key in Works_On and Dependent referencing Employee(ssn)
	   super_ssn: Foreign key referencing Employee(ssn)
	 Write SQL Queries for the Following:
	   1. Insert sample records into each table.
	   2. Retrieve the names of employees who work on all the projects controlled by department number 3.
	   3. Retrieve the names of employees who get the second highest salary.
	   4. List the names of employees who have no dependents, in alphabetical order.
	   5. Retrieve the number of employees and their average salary working in each department.
	   6. Retrieve the SSN of all employees who work on at least one of the project numbers 1, 2, or 3.
	   7. Retrieve the number of dependents for an employee named RAM.
	   8. List the employees who do not work on any project.
	   9. Retrieve the names of employees who live in the same address as their dependents.
	   10. List the department names that have more than one location.
	   11. Retrieve the names and addresses of all employees who work on more than two projects.
	   12. Find the names of employees who earn more than their managers.
	   13. Retrieve the highest salary paid in each department in descending order.
	   14. Retrieve the names of employees who are paid the same salary as Anil.
	   15. Retrieve the total number of hours worked by each employee on all projects.
	   16. Find the average salary of male and female employees separately.

2	In recent years, most of the grocery items are available online, and people are increasingly using online platforms for purchasing. These platforms offer various discounts and benefits and help customers save time.
	 To support such an application, a robust database system is needed to store and manage transaction data. The system must keep track of customers, agents, products, and all order transactions across various cities.
	 Relational Schema
	   Customer (cid, cname, city, phone)
	   Agent (aid, aname, city, phone)
	   Product (pid, pname, price, stock)
	   Orders (oid, cid, aid, odate, mode, status)
	   Order_Details (oid, pid, qty)
	 Where:
	   cid: Primary key of Customer and foreign key in Orders
	   aid: Primary key of Agent and foreign key in Orders
	   pid: Primary key of Product and foreign key in Order_Details
	   oid: Primary key of Orders and foreign key in Order_Details

	Perform the Following Operations and Write SQL Queries for the Following 1. Add a column email with domain VARCHAR(50) to the Customer table. 2. Insert some sample records into the each table. 3. Update the phone number of the customer with cid = 3. 4. Rename the column phone to mobile in the Agent table. 5. Delete the customer whose cid is 5. 6. Retrieve the names of customers who ordered more than 3 different products. 7. List the names of agents who have delivered orders to customers in "Bangalore". 8. Display the total amount spent by each customer. 9. Retrieve the names of products that are out of stock. 10. List the agents who haven't delivered any orders. 11. Retrieve order IDs and product names for orders placed on '2025-08-01'. 12. Display the number of orders delivered by each agent. 13. Retrieve the highest priced product in each order. 14. Find customers who haven't placed any orders. **15.** List the most frequently ordered product.

3	The need for maintaining digital academic records is growing rapidly. Educational institutions such as schools, colleges, and universities have started storing students' details such as name, age, marks, and enrolled courses in a structured database. This helps in tracking academic performance, course enrollment, and individual student progress efficiently. Design a Student Performance Management System database that stores the details of Students, their enrolled Courses, and the Marks they obtain using the following relational schema:
	Relational Schema
	  Student (sid, sname, age, gender, course)
	  Course (course_id, course_name, instructor)
	  Marks (sid, course_id, marks)
	Where:
	  sid: Primary key of Student and foreign key in Marks
	  course_id: Primary key of Course and foreign key in Marks
	 Perform the following operations and write SQL Queries for the Following:
	1. Create the Student, Course, and Marks tables.
	2. Insert some sample records into the each table .
	3. Update the age of the student with sid = 3.
	4. Rename the column sname to student_name in the Student table.
	5. Delete the student whose sid = 5.
	6. Count the number of students from the Student table.
	7. Find the maximum marks obtained in any course.
	8. Find the minimum marks obtained in any course.
	9. Retrieve the average marks grouped by each course.
	10. Display the total number of students enrolled in each course.
	11. List the student names and marks in descending order of marks.
	12. Retrieve the sum of marks scored by students in each course.
	13. Display the minimum and maximum marks for each course.
	14. Find the average age of students.
	15. List all courses in alphabetical order along with the number of enrolled students.

4	Modern databases must ensure that concurrent access to data by multiple users does not lead to inconsistencies. Transaction processing plays a crucial role in maintaining data integrity and supporting operations like recovery and concurrency control. The system must handle multiple transactions while ensuring desirable properties like atomicity, consistency, isolation, and durability (ACID). Relational Schema ● Accounts

	Fields: acc_no, cust_name, balance
	● Transactions
	Fields: trans_id, acc_no, trans_type, amount, trans_date

Where Section

acc_no: Foreign key in the Transactions table referencing Accounts

trans_type: Can be 'deposit' or 'withdrawal'

Each transaction must be processed atomically without leaving the database in an inconsistent state

Multiple transactions can affect the same account and must be scheduled serializably

Perform the Following Operations and Write Queries for the Following

1. Create Accounts and Transactions tables using SQL.

2. Insert sample records into both tables with a minimum of five transactions.

3. Write a query to simulate a transaction: withdraw ₹500 from account acc_no = 101 and update balance accordingly.

4. Show a schedule of two transactions accessing the same account and identify if the schedule is recoverable.

5. Write a serial schedule and a non-serial schedule, and explain which one is conflict serializable.

6. Identify a situation that causes cascading rollback and how recoverable schedules can avoid it.

7. Implement COMMIT and ROLLBACK statements in SQL with proper examples.

8. Explain with an example how a dirty read could happen if isolation is not enforced.

9. Use SQL SET TRANSACTION command to assign different isolation levels and test behavior.

Write an SQL query to check for concurrent updates on the same account and prevent them.

5	In recent years, most organizations maintain structured databases to manage customer information efficiently. To track changes in sensitive information such as salary, database systems often employ triggers for automatic auditing or monitoring.

Relational Schema:

  CUSTOMERS (ID, NAME, AGE, ADDRESS, SALARY)

Where:

  ID: Primary key of the CUSTOMERS table.

  SALARY: Numerical field representing the income of a customer.

  NAME, ADDRESS: Character fields storing customer information.

  AGE: Integer value representing the age of the customer.

Perform the Following Operations and Write SQL Queries for the Following:

1. Create the CUSTOMERS table with appropriate data types and constraints.

2. Create a row-level trigger on the CUSTOMERS table that fires on INSERT, UPDATE, or DELETE operations:

    a) On UPDATE, the trigger should display the salary difference between the old and new salary.

    b) On INSERT, the trigger should display the inserted customer's name and salary.

    c) On DELETE, the trigger should display the deleted customer's name and salary.

3. Insert five sample records into the CUSTOMERS table.

4. Update the SALARY of the customer whose ID = 2.

5. Delete the record of the customer whose ID = 4.

6	In today's data-driven world, NoSQL databases like MongoDB offer flexible, schema-less storage suitable for handling large-scale and unstructured data. MongoDB is a widely used open-source NoSQL database that stores data in JSON-like documents with dynamic schemas, making it ideal for agile development and scalability.

To manage educational data efficiently, an institution has decided to store student records, including their ID, name, age, and enrolled course, in a NoSQL database system.

Relational Schema (Logical Document Structure)

  Students

  Fields: sid, sname, age, course, email, status

Where Section

sid: Primary key, uniquely identifies each student.

course: Stores the name of the enrolled course.

email: Optional field, can be added dynamically.

status: Indicates student status (e.g., "active").

All operations are to be performed on the students collection inside the mydb database.

Perform the Following Operations and Write Queries for the Following

Install MongoDB Community Edition on your system.

Create a database named mydb.

Create a collection named students.

1. Insert five documents into the students collection with the fields:
2. sid (student ID)
3. sname (student name)
4. age (student age)
5. course (enrolled course)
6. Display all the documents in the students collection.
7. Find a student document with sid = 3.
8. Update the course of the student whose sid = 2.
9. Delete a student document whose sid = 5.
10. Display all student names who are enrolled in the course "Data Science".
11. Sort the student documents by age in ascending order.
12. Count the number of students enrolled in "Full Stack Development".
13. Insert a new document with an additional field email into the students collection.
14. Update all documents to include a default status: "active" field.
15. Delete all students who are older than 25.
16. Drop the students collection from the database.

Assessment Details (Both CIE / IAT and SEE):

<table>
<tr><td rowspan="7">Theory Component</td><td>IAT-1 after completion 45 to 50% Syllabus</td><td>25 Marks</td></tr>
<tr><td>IAT-2 after completion 95 to 100% Syllabus</td><td>25 Marks</td></tr>
<tr><td>Average of two IATs</td><td>25 Marks</td></tr>
<tr><td colspan="2">Total 25 Marks : Reduced to 15 Marks</td></tr>
<tr><td>CCE-1</td><td>25 Marks</td></tr>
<tr><td>CCE-2</td><td>25 Marks</td></tr>
<tr><td>Average of two CCEs</td><td>25 Marks</td></tr>
<tr><td colspan="3">Total 25 Marks : Reduced to 10 Marks</td></tr>
<tr><td rowspan="3">Lab Component</td><td>Lab Record and execution of programs</td><td>15 Marks</td></tr>
<tr><td>Lab Test at the end of 15th week</td><td>10 Marks</td></tr>
<tr><td>Total</td><td>25 Marks</td></tr>
<tr><td colspan="2">Grand Total of CIE Marks (min marks 20 / 50)</td><td>50 Marks</td></tr>
<tr><td colspan="2">SEE conducted for 100 and scaled down to 50 (min marks 18/50)</td><td>50 Marks</td></tr>
<tr><td colspan="2">CIE + SEE (min marks 40)</td><td>100 Marks</td></tr>
</table>

Text 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. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2013.

Reference Books:
1) An Introduction to Database Systems, C. J. Date, A. Kannan and S. Swamynathan, Pearson Education, Eighth Edition, 2009.
2) Database SystemConcepts, Abraham Silberschatz, Henry F. Korth and S. Sudarshan, McGraw-Hill Education (Asia), Fifth Edition, 2006.
3) Database Systems Concepts, Designs and Application, Shio Kumar Singh, Pearson Education, Second Edition, 2011.

E – Resources:
1. https://www.javatpoint.com/dbms-tutorial
2. https://www.javatpoint.com/dbms-tutorial
3. Introduction to Database Management Systems (youtube.com) by Neso Academy

Course outcomes:

The Student will be able to:

CO1: Describe the basic elements of a database management system.

CO2: Apply the concepts of database management system for various applications.

CO3: Analyse database concepts for a given problem.

CO4 :Design SQL/NoSQL queries and conceptual models for database applications.

CO5: Demonstrate SQL and NoSQL queries to manipulate the data in the database.

CO-PO Mapping:

PO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	1	-	3	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	-	-	3	-	3	-	-	-	-	-	-	-	-	3	-
CO	3	3	2.5	-	3	-	-	-	-	-	-	1	-	3	-

ARTIFICIAL INTELLIGENCE					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
24CIT34	3:0:0:0	3	IAT:50 SEE:50	3	PCC

Pre- Requisites:

i)   Mathematics and Statistics

ii)   Data structures

Objectives:

- Understand the basic concepts of intelligent agents.

- Develop general purpose problem solving agents, logical reasoning agents

- The reason under uncertainty

- Employ AI techniques to solve some of today's real world problems.

Teaching - Learning Process:

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer methods (L) need not to be only traditional lecture method, but alternative effectiveteaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with theirown creative ways to solve them.
8. Discuss how every concept can be applied to the real world-and when that's possible, it helps improve the students' understanding.

Module - I

Introduction to AI: History, What is AI?, Intelligent Systems, The foundations and sub area of AI, Applications of AI, Current Trends and Development of AI, Intelligent Agents: Agents and Environments, The concept of Rationality, The nature of environment, Specifying the Task Environments, Properties Of Task Environment, The Structure of Agents, Agent problems, Simple reflex agents, Model base reflex agents.

08 HOURS

Module – II

Problem Solving: Problems solving agents, Well defined problems and solutions, Formulating problems, Real world problems, 8 Queens problem, Problems on AI, Travelling salesman problem, Means-Ends analysis.

08 HOURS

Module – III
Advanced Search Techniques: Uniformed search strategies: Breadth first search (BFS), Depth first search (DFS), Avoiding Repeated states.
Informed search strategies: Heuristic search strategies, Heuristic search techniques, Search Algorithms, General and Test search, Best first search, Bounded best first search, A* search , Hill Climbing: Features of hill climbing, Types of Hill Climbing.
08 HOURS
Module – IV
Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving,Learning from Examples, Winston's Learning Program, Decision Trees.
08 HOURS
Module – V
Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition. Knowledge representations, Representations and mappings, Framework of knowledge representations, Mapping between facts and representations, Knowledge representation schemes on relational knowledge, inheritable knowledge, procedural knowledge.
08 HOURS

Assessment Details (Both CIE / IAT and SEE):

Theory Component	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	**25 Marks**
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	**25 Marks**
Grand Total of CIE Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
CIE + SEE (min marks 40)		**100 Marks**

Course Outcomes :
At the end of the course the student will be able to :

- Explain autonomous agents that make effective decisions in fully informed, partially observable, and adversarial settings.

- Choose appropriate algorithms for solving given AI problems.

- Design and implement logical reasoning agents.

- Design and implement agents that can reason under uncertainty

Text Books:
1. Artificial Intelligence A modern Approach, second edition, Stuart Russell, Peter Noring.
2. Nils J. Nilsson, Artificial Intelligence:, Third Edition,Prentice-Hall,2010.

Reference Books:
1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B.Nair,The McGraw Hill publications, Third Edition,2009.
2. Eugene Charniak and Drew McDermott, second edition, Introduction to Artificial Intelligence:

E – Resources:

https://www.google.co.in/books/edition/Fundamentals_of_Artificial_Intelligence/8SfbDwAAQBAJ?hl=en
&gbpv=1&dq=fundamentals+of+AI&printsec=frontcover.

CO-PO Mapping:

CO/PO	Program Outcomes (PO)											PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	3	-	3	-	-	-	-	-	1	1	1
CO2	3	3	3	-	3	-	-	-	-	-	1	3	3
CO3	3	3	3	2	3	-	-	-	-	-	1	2	3
CO4	3	3	3	2	3	-	-	-	-	-	1	2	3
Avg	3	3	3	2	3	-	-	-	-	-	1	2	2.5

ARTIFICIAL INTELLIGENCE LABORATORY

Course Code	L : T : P : S	Credits	Exam Marks	Exam Duration	Course Type
24CIL35	0 : 0 : 2 : 0	1	IAT:50 SEE:50	3 Hours	PCCL

Course objectives:

This laboratory course enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of

- AI Search strategies
- Formulating and solving AI problems
- Expert Systems

	PROGRAMS
1	Implementation and analysis of a) Breadth First Search b)Depth First Search for an application
2	Given a graph where each node represents a state and each edge has an associated cost, implement the best first search algorithm to find the path from the starting node to the goal node.
3	Implement A* algorithm to find the shortest path between two nodes in a graph.
4	Implement 4-Queens problem using hill-climbing algorithm, where the goal is to place 4 queens on a 4*4 chessboard so that no queens threaten each other.
5	You are given two jugs, a 4-litre one and a 3-litre one. Neither have any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 liters of water in to a 4-litre jug? Implement.
6	Implement Travelling Salesman Problem to determine the shortest possible route that allows the salesperson to visit each city once and return to the same city.
7	There is a monkey at the door into a room. In the middle of the room, a banana is hanging from the ceiling. The monkey is hungry and wants to get the banana, but he cannot stretch high enough from the floor. At the window of the room, there is a box the monkey may use. Implement the monkey banana problem.
8	Implement 8-Puzzle problem using search algorithms to find the solution to the puzzle.
9	Implement Recursive / Iterative solutions for the Tower of Hanoi Problem
10	Implement Tic-Tac-Toe game using search algorithms and heuristics to make optimal moves.

Laboratory Outcomes:
The student should be able to:
1. Analyze and implement uninformed search strategies.
2. Analyze and implement different types of informed or heuristic search strategies.
3. Formulate different real world problems.
4. Design and implement expert systems.

Assessment Details(both CIE and SEE)

Continuous Internal Assessment of Laboratory/Practical Courses		
Lab Test 1	Lab Test 2	Lab Records
15 marks	15 marks	20 marks
Semester End Examination(SEE)		50 marks

Conduct of Practical Examination:

Experiment distribution :

For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.

For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.

● Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.

● Marks Distribution (Need to change in accordance with university regulations)

a) For laboratories having only one part → Procedure + Execution + Viva-Voce:15+70+15 = 100 Marks

b) For laboratories having PART A and PART B

i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks

ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

CO-PO-PSO Mapping :

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	3														
CO 2		3													
CO 3			3												
CO 4				2	2										
Avg	3	3	3	2	2										

OPERATING SYSTEMS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
24CIT361	3:0:0:0	03	CIE:50 SEE:50	3 Hours	ESC

Pre-Requisites:

1. Computer systems organization: You should have a basic understanding of the hardware and software aspects of computer systems organization.

2. Programming: You should be proficient in at least one low-level programming language, like C or Assembly, and one high-level language, like Python or Java.

3. Binary and hexadecimal notation: You should be familiar with hexadecimal and binary notation.

Objectives :

This course will enable students to:
1. To Demonstrate the need for OS and different types of OS
2. To discuss suitable techniques for management of different resources
3. To demonstrate different APIs/Commands related processor, memory, storage and file system management.

Teaching-Learning Process

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters student's, Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps to improve the students' understanding.

Module I

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments.

Operating System Services: User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System debugging, Operating System generation; System boot.

Textbook 1: Chapter — 1 (1.1-1.12), 2 (2.2-2.11)   **08 Hours**

Module II

Process Management: Process concept; Process scheduling; Operations on processes; Inter process communication
Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues.
Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling; Multiple-processor scheduling,

Textbook 1: Chapter — 3 (**3.1-3.4**), 4 (**4.1-4.4**), 5 (5.1 -5.5)

08 Hours

Module III

Process Synchronization: Synchronization: The critical section problem; Peterson' solution; Synchronization hardware; Semaphores; Classical problems of synchronization;
Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

Textbook 1: Chapter — 6 (6.1-6.6), 7 (7.1 -7.7)

08 Hours

Module IV

Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.
Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

Textbook 1: Chapter -8 (**8.1-8.6**), 9 (**9.1-9.6**)

08 Hours

Module V

File System, Implementation of File System: File system: File concept; Access methods; Directory and Disk structure; File system mounting; File sharing; **Implementing File** system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.
Secondary Storage Structure, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; **Protection:** Goals of protection, Principles of protection, Domain of protection, Access matrix.

Textbook 1: Chapter — 10 (10.1-10.5) ,11 (11.1-11.5),12 (12.1-12.5), 14 (14.1-14.4)

08 Hours

Assessment Details :

	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	**25 Marks**
Theory Component	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	**25 Marks**
Grand Total of CIE Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
CIE + SEE (min marks 40)		**100 Marks**

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:
CO 1. Explain the structure and functionality of operating system
CO 2. Apply appropriate CPU scheduling algorithms for the given problem.
CO 3. Analyze the various techniques for process synchronization and deadlock handling.
CO 4. Apply the various techniques for memory management
CO 5. Demonstrate storage management strategies and need of protection mechanisms.

Textbooks:

Sl. No.	Title of Book	Authors details	Publisher details	Edition and Year
1	Operating system principles	Abraham Silberschatz, Peter Baer Galvin, Greg gagne	Wiley India	8th Edition, 2015

Reference Books:

12014	Understanding operating system	Ann McHoes Ida M Fylnn	Cengage Learning	6th Edition
2	Operating Systems: A Concept Based Approach	D.M Dhamdhere	McGraw-Hill	3rd Edition 2013
3	An Introduction to Operating Systems Concepts and Practice	P.C.P. Bhatt	PHI(EEE),	4TH edition 2014
4	Operating Systems: Internals and Design Principles	William Stallings	Pearson	6th edition

E-Resources:

1. https://youtu.be/mXw9ruZaxzQ
2. https://youtu.be/vBURTt97EkA
3. https://www.youtube.com/watch?v=783KAB-tuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE_f
4. https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQf HjPnsWzkeRn6mkO

CO-PO-PSO Mapping

PO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	-	-	2	-	-	-	-	-	-	-	-	-	2	-	-
CO4	-	-	3	-	3	-	-	-	-	-	-	-	2	-	-
CO5	3	3	2.5	-	3	-	-	-	-	-	-	-	2	-	-

SOFTWARE ENGINEERING					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
24CIT362	3:0:0:0	3	IAT:50 SEE:50	3	ESC

Pre- Requisites:

Software Development Life Cycle (SDLC), Scripting Language, Version Control Tool, Database

Objectives:

This course will enable students to,

- Recollect Software process models and compare their applicability
- Acquire Software Requirement Analysis and Specification
- Acquire Systematic software design procedure for Object Oriented and Real Time software
- Interpret how to develop and test a software application/product
- Cognize software cost estimation techniques and to know project management

Teaching - Learning Process:

Module - I

Introduction to Software Engineering & Software Process Model: what is Software Engineering (SE), Difference between SE and System Engineering. The evolving role of software – the changing nature of software- Life cycle models [Text Book-1]

Software Process Model: - Water fall, Incremental, Spiral, Evolutionary, Prototyping Concurrent development – Specialized Process Models: Component-Based Development, The Formal Methods Model, and Aspect-Oriented Software Development [Text Book-2]

08 HOURS

Module – II

Software Requirement Analysis and Specifications: Functional and Non-Functional, User, System – Requirement, Interface specification, software requirement documents.[Text Book-1]

Requirement Engineering Process: Feasibility Studies, Requirements Elicitation and analysis, Requirement Validation and Requirement management. [Text Book-1]

System Model: Context Model, Behavioral model, Data Model, Object Model, Structured Model [TextBook-1]

08 HOURS

Module – III

Software Design: Architectural design, Architectural Design Document, Client Server Architecture Distributed Object Architecture. [Text Book-1]

Object Oriented Design: Object Oriented Design Process, Design Evolution, [Text Book-1]

Real time Software Design: System Design, Real time Operating System, Monitoring and ControlSystem and Data Acquisition System [Text Book-1]

08 HOURS

Module – IV

Software Development and Testing: Rapid Software Development-Agile Methods, Extreme Programming, Rapid Application Development, [Text Book-1]

Software Reuse: Reuse landscape, Design Pattern, Application system Reuse [Text Book-1]

Verification and Validation; Planning Verification & Validation, Software Inspection, Verification and formal Methods. [Text Book-1]

Software Testing: Approaches of Software Testing, Software Testing Strategies, Test Strategies for Object Oriented Software-Unit Testing, Integration Testing [Text Book-2]

08 HOURS

Module – V

Software Cost Estimation and Project Management: Software cost estimation - COCOMO model – Estimation Techniques, Project Duration and Staffing, [Text Book-1]

Quality management: Quality Assurance and Standard, Quality Planning and Quality Control [TextBook-1]

Configuration Management: Configuration Management Planning, Change Management, Version and Release Management [Text Book-1]

Emerging Technology: Security Concepts, Security Risk Management. [Text Book-1]

08 HOURS

Assessment details :

Theory Component	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	**25 Marks**
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	**25 Marks**
Grand Total of CIE Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
CIE + SEE (min marks 40)		**100 Marks**

Course Outcomes :
On completion of this course, the students will be able to,

- Identify and apply Software life cycle and process models to compare their applicability
- Analyze the types of requirements and summarize Requirement Engineering for various System models
- Design data, functional and behavioral model for any given software requirement
- Apply appropriate techniques and Test the software application/product for a given problem
- Comprehend concepts of software quality assurance and software configuration management

Text Books:
1. Ian Sommerville, ‖Software Engineering‖, 8th Edition,ISBN-10- 9332582696,ISBN-13- 978-9332582699,Pearson Education (24 May2017).

2. Rogar Pressman, ‒Software Engineering and Application‖, 7th Edition, McGraw Hill Education Publication, 2009,ISBN-13:9789339212087.

Reference Books:

1. Pankaj Jalote, ‑Software Engineering, A Precise Approach‖, Wiley India, 2010,ISBN: 9788126523115
2. Pfleeger and Lawrance, ‑Software Engineering: Theory and Practice‖ Pearson Education, 2 nd Edition, 200.1
3. Stephan Schach, ‑Software Engineering‖, Tata McGraw Hill, 2007.
4. Rajib Mall, ‑Fundamentals of Software Engineering‖, 3 rd Edition, PHI Learning Private Limited, 2009,ISBN-10-9788120338197,ISBN-13-978-8120338197.
5. Kelkar S.A., ‑Software Engineering‖, ISBN 10: 8120332725, ISBN 13: 9788120332720, Publisher: Prentice-Hall of India Pvt.Ltd, 2007.

E – Resources:

1. https://www.pearson.com/us/higher-education/product/Sommerville-Software-
Engineering- 9th- Edition/9780137035151.html.
2. https://www.abebooks.com/9788120332720/Software-Engineering-Kelkar-S-A- 8120332725/plp

CO-PO Mapping:

CO/PO	Program Outcomes (PO)											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	-	3	-	-	-	-	-	1	1	1
CO2	3	3	3	-	3	-	-	-	-	-	1	3	3
CO3	3	3	3	2	3	-	-	-	-	-	1	2	3
CO4	3	3	3	2	3	-	-	-	-	-	1	2	3
Avg	3	3	3	2	3	-	-	-	-	-	1	2	2.5

BUSINESS PROCESS FUNDAMENTALS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
24CIT363	3:0:0:0	3	IAT:50 SEE:50	3	ESC

Pre- Requisites:

  Basic Probability concepts

Objectives:

 This course will enable students to:

  CLO 1: Understand the basics of business and economy
  CLO 2: Learn the basics ethics of entrepreneurship and how to start a business.
  CLO 3: Understand the roles of ownership, management and leadership.
  CLO 4: Learn how to design an organization and its operations.
  CLO 5: Understand the roles and management of human resource in an organization.

Teaching - Learning Process:

 These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at-least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world-and when that's possible, it helps to improve the students' understanding.

Module - I

Teamwork & Economics
Teamwork in Business, The Foundation of Business – Introduction, Getting Down to Business, Functional Areas of Business, External Forces that Influence Business Activities
Economics and Business - What is Economics? Perfect Competition and Supply and Demand, Monopolistic Competition, Oligopoly, and Monopoly, Measuring the Health of the Economy, Government's Role in Managing the Economy

08 HOURS

Module – II

Ethics and Entrepreneurship
Ethics – Introduction, What is Business Ethics? Identifying Ethical Issues and Dilemmas, Corporate Social Responsibility, Ethical Organizations, The Individual Approach to Ethics
Entrepreneurship - The Nature of Entrepreneurship, The Importance of Small Business to the U.S. Economy, What Industries Are Small Businesses In? Advantages and Disadvantages of Business Ownership, Starting a Business, Why Some Businesses Fail and Where to Get Help

08 HOURS

Module – III
Ownership, Management and Leadership
Ownership - The Ice Cream Men , Factors to Consider, Mergers and Acquisitions
Management and Leadership - Noteworthy Management, What Do Managers Do?, Planning, Leading, Controlling, Managerial Skills, Applying Your Skills at Notes-4-You
08 HOURS

Module – IV
Organizational structures and Operation Management
Organizational structure – Organizing, Organizational Structure: How companies do the job done **Operation Management** - The Challenge: Producing Quality Jetboards, Operations Management in Manufacturing, Managing the Production Process in a Manufacturing Company, Graphical Tools: Gantt and PERT Charts, The Technology of Goods Production, Operations Management for Service Providers, Producing for Quality
08 HOURS

Module – V
Human resources and Motivating employees
Motivating Employees – Motivation, Hierarchy of Needs Theory, Two-Factor Theory, Expectancy Theory, Equity Theory **Managing Human Resources** - Human Resource Management, Developing Employees, What Makes a Great Place to Work? Compensation and Benefits, Performance Appraisal
08 HOURS

Assessment Details (Both CIE / IAT and SEE):

Theory Component	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	**25 Marks**
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	**25 Marks**
Grand Total of CIE Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
CIE + SEE (min marks 40)		**100 Marks**

Course Outcomes :
On completion of this course, the students will be able to:
- Design the basics of any business
- Design the rules and social responsibility of an organization.
- Develop the roles of the interrelated functions of management.
- Construct and manage an organization.
- Utilize the human resources effectively by motivating the employees.

Text Books:
1. Stephen J. Skripak, Fundamentals of Business, Pamplin college of Business and Virginia Tech Libraries, 2016.

Reference Books:
1. S.S. Kanaka, Entrepreneurial Development, S-Chand Fourth Edition.
2. Robert D. Hisrish and Michael P. Peters, Entrepreneurship, McGraw – Hill Publication.
3. Poornima M. Charantimath, Entrepreneurship Development Small Business Enterprises,

	Pearson Education.
	Thomas. W. Zimmerer & Norman. M. Scarboraugh, Essentials of Entrepreneurship and Small Business Management, PHI.

E – Resources:

- Lee Angelelli (1994). "Steve Paul Jobs." Retrieved from: http://ei.cs.vt.edu/~history/Jobs.html
- Warren E. Buffet and Carol Loomis (2003). "America's Growing Trade Deficit Is Selling The Nation Out From Under Us. Here's A Way To Fix The Problem--And We Need To Do It Now." Fortune. November 10, 2003. Retrieved June 9, 2016 from: http://archive.fortune.com/magazines/fortune/fortune_archive/2003/11/10/352872/index.htm
- Coca Cola Company (2016). "Our Company: Vision, Mission, and Values." Cocacola.com.Retrieved from: http://www.coca-colacompany.com/our-company/mission-vision-values
- Johnson and Johnson (2016). "Company Structure." Retrieved from: http://www.jnj.com/about-jnj/company-structure
- Burger King (2016). "About Us." Burger King Website: bk.com. Retrieved from: http://www.bk.com/about-bk
- Starbucks (2016). "Working at Starbucks." Starbucks.com. Retrieved from: http://www.starbucks.com/careers/working-at-starbucks
- Fortune (2007). "100 Top MBA Employers." Fortune. Retrieved from: http://archive.fortune.com/magazines/fortune/mba100/2007/full_list/index.html

CO-PO Mapping:

CO/PO	Program Outcomes (PO)											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1								2	3		2		
CO2							3	3			2		
CO3								3	3		3		
CO4		2							3		3		
CO5								3	3		3		

ANALOG AND DIGITAL SYSTEMS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
24CIT364	3:0:0:0	3	IAT:50 SEE:50	3	ESC

Pre- Requisites:

Basic Electrical Engineering, Digital Logic Design Concepts, Fundamentals of Electronics.

Objectives:

CLO1. Explain the use of PN junction Diode, special purpose Diodes
CLO2. Understand the operation of transistor under different biasing conditions.
CLO3. Illustrate combinational circuits and Karnaugh map simplification of Boolean expressions
CLO4. Study the working of sequential circuit and VHDL implementation of digital circuit.
CLO5. Study of digital logic families and circuit implementation of programmable devices.

Teaching - Learning Process:

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes criticalthinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information ratherthan simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes.

Give Programming Assignments.

Module - I

Diodes and Applications: Semiconductors: Charge carriers, Hall effects. Diode: P-N Junction, Current Equation, Equilibrium condition, Forward & Reverse biased junction, Junction-capacitance breakdown characteristic, I-V Characteristics of a diode, Review of half-wave and Full-wave rectifiers, Zener diodes, Clamping and Clipping circuit.
Special Diodes: LED, Photo-diode, Schottky diode, Tunnel diode, their characteristics and application

08 HOURS

Module – II

Bipolar junction transistors Transistor construction, operation, amplification action, common base, common emitter, common collector configuration, dc biasing of BJTs: operating point, fixed-bias, emitter bias, voltage-divider bias configuration.
Field effect transistor (MOSFET): Device structure and its operation in equilibrium, V-I characteristics. Circuits at DC, MOSFET as Amplifier and switch, Biasing in MOS amplifier circuits.

08 HOURS

Module – III

Combinational Logic and Karnaugh Maps:
Combinational Logic: MSI devices like Magnitude comparator, Multiplexers, De-multiplexers, Decoders, and Encoders. Multiplexed display, half and full adders, subtractors, serial and parallel adders, BCD adder. **Karnaugh maps:** minimum forms of switching functions, two and three variable Karnaugh maps, four variable karnaugh maps, determination of minimum expressions using essential prime implicants, Quine-McClusky Method: determination of prime implicants. **08 HOURS**

Module – IV

Sequential Logic and VHDL:
Sequential Logic and Its Applications: Storage elements: latches & flip flops, Characteristic Equations of Flip Flops, Flip Flop Conversion, Shift Registers, Ripple Counters, Synchronous Counters, Other Counters: Johnson & Ring Counter. VHDL description of combinational circuits, VHDL Models for multiplexers, VHDL Modules. **08 HOURS**

Module – V

Memory & Programmable Logic Devices
Digital Logic Families: DTL, DCTL, TTL, ECL & CMOS., Fan Out, Fan in, Noise Margin; RAM, ROM, PLA, PAL; Circuits of Logic Families, Interfacing of Digital Logic Families, Circuit Implementation using ROM, PLA and PAL **08 HOURS**

Assessment Details (Both CIE / IAT and SEE):

Theory Component	IAT-1 after completion 45 to 50% Syllabus	25 Marks
	IAT-2 after completion 95 to 100% Syllabus	25 Marks
	Average of two IATs	**25 Marks**
	CCE-1	25 Marks
	CCE-2	25 Marks
	Average of two CCEs	**25 Marks**
Grand Total of CIE Marks (min marks 20 / 50)		**50 Marks**
SEE conducted for 100 and scaled down to 50 **(min marks 18/50)**		**50 Marks**
CIE + SEE (min marks 40)		**100 Marks**

Course Outcomes :

On completion of this course, the students will be able to:
At the end of the course the student will be able to:
- CO 1. Identify different data structures and their applications.
- CO 2. Apply stack and queues in solving problems.
- CO 3. Demonstrate applications of linked list.
- CO 4. Explore the applications of trees and graphs to model and solve the real-world problem.
- CO 5. Make use of Hashing techniques and resolve collisions during mapping of key value pairs

Text Books:

1. S. Salivahanan and S. Arivazhagan , Analog and Digital Electronics, First Edition McGraw-Hill, 2019.
2. RP Jain and Kishor Sarawadekar, Modern Digital Electronics, Fifth Edition, McGraw Hill, 2022.
3. U. A. Bakshi A. P. Godse, Analog and Digital Electronics, Technical Publications, First edition, 2019

Reference Books:

1. Anil K Maini, Varsha Agarwal, Electronic Devices and Circuits, Wiley, 2012.
2. Donald P Leach, Albert Paul Malvino & GoutamSaha, Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015.
3. M. Morris Mani, Digital Design, 4th Edition, Pearson Prentice Hall, 2008.
4. David A. Bell, Electronic Devices and Circuits, 5th Edition, Oxford University Press, 2008

E – Resources:

1. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
2. https://github.com/reds-heig/logisim-evolution

CO-PO Mapping:

CO/PO	Program Outcomes (PO)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3						1			2	1
CO2	3	2	2									2	
CO3	3	2	3							2	3		
CO4	3	2	2							2	1	2	
CO5	3	2	3						1		3		1

SOCIAL CONNECT & RESPONSIBILITY					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
24UHV37	0:0:2:0	01	IAT:100	03 Hours	UHV

Course Objectives:
1. Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & the government and build solutions to alleviate these complex social problems through immersion, design & technology.
2. Provide a formal platform for students to communicate and connect with their surroundings.
3. Enable to create a responsible connection with society.

Module - I

Plantation and adoption of a tree

Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

06 HOURS

Module - II

Heritage walk and crafts corner

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photoblog and documentary on evolution and practice of various craft forms.

06 HOURS

Module - III

Organic farming and waste management

usefulness of organic farming, wet waste management in neighboring villages and implementation in the campus

06 HOURS

Module - IV

Water Conservation

knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.

06 HOURS

Module - V

Food Walk/ Food Festival

City's culinary practices, food lore and indigenous materials of the region used in cooking/ Food festivals.

06 HOURS

Course Outcomes :

The students are expected to have the ability to :

1. Understand social responsibility
2. Practice sustainability and creativity
3. Showcase planning and organizational skills

Reference:
Faculty mentor has to design the Course.

E – Resources:
https://ffreedom.com/english/about-app?gad_source=1&gclid=CjwKCAjw74e1BhBnEiwAbqOAjBOnuaO-a6CMVTjwubTiz2e13DWkkZ7ZpwX8PELXz5NRhe2a5cG2dBoCjwQQAvD_BwE
https://prasarbharati.gov.in/dd-kisan-homepage/

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2					2		2		2	3
CO2	2				3	3		2		1	2
CO3	2				1			2		3	3

TECHNICAL WRITING USING LATEX					
Course Code	**L : T : P : S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
24CIL381	0 : 0 : 2 : 0	1	IAT:50 SEE:50	3 Hours	AEC

Course objectives:

This laboratory course enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of Latex documents

➢ Introduce Document Preparation Using LaTeX

➢ Develop Skills in Structuring and Formatting Documents

➢ Equip Students with Mathematical Typesetting Capabilities

➢ Introduce the Use of Figures, Tables, and Graphics in LaTeX

➢ Prepare Students for Independent Document Creation

	PROGRAMS
1	Getting Started with LaTeX Basics.
2	Develop a LaTeX script to create a simple document that consists of 2 sections [Section1, Section2], and a paragraph with dummy text in each section. And also include header [title of document] and footer [institute name, page number] in the document
3	Develop a LaTeX script to create a document that displays the sample Abstract/Summary of your semester and include subjects with itemized format and insert an image in the document
4	Develop a LaTeX script to create Document Structuring with Sections and Table of Contents, typesetting Mathematical Equations and Symbols
5	Develop a LaTeX script to Construct and Format Tables
6	D Develop a LaTeX script to Create a Presentation in LaTeX Using Beamer
7	Develop a LaTeX script to Create a Presentation in LaTeX Using Beamer consisting of figures, tables.
8	Develop a LaTeX script to Manage Citations and Bibliography with BibTeX
9	Develop a LaTeX script Cross-Referencing Figures, Tables, and Equations
Part B	

	Student has to Develop a document consisting all the programs as an assignment and submit to the Lab incharge

Laboratory Outcomes:
The student should be able to:

1. CO1:Develop Proficiency in Basic LaTeX Syntax and Structure
2. CO2:Create Professionally Formatted Documents
3. CO3:Implement Mathematical Notation and Equations
4. CO4:Create Referencing and Citations in LaTeX

Assessment Details(both CIE and SEE)

Continuous Internal Assessment of Laboratory/Practical Courses		
Lab Test 1	Lab Test 2	Lab Records
15 marks	15 marks	20 marks
Semester End Examination(SEE)		50 marks

Conduct of Practical Examination:

Experiment distribution :

For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.

- Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
- Marks Distribution (Need to change in accordance with university regulations)
  a) For laboratories having only one part → Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks

CO-PO-PSO Mapping :

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	3														
CO 2		3													
CO 3			3												
CO 4				2	2										

DATA ANALYTICS WITH EXCEL

Course Code	L : T : P : S	Credits	Exam Marks	Exam Duration	Course Type
24CIL382	0 : 0 : 1 : 0	1	IAT:50 SEE:50	3 Hours	AEC

Course objectives:

1. To apply analytics techniques to datasets in Excel
2. Learn how to Pivot tables and Pivot charts to streamline your work in Excel
3. Understand and identify the principles of data analytics
4. Enhancement of data analysis skills using Excel function and core techniques.

	PROGRAMS
1.	**Getting Started with Excel**: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions.
2.	**Working with Data** : Importing data, Data Entry & Manipulation, Sorting & Filtering.
3.	**Working with Data:** Data Validation, Pivot Tables & Pivot Charts.
4.	**Data Analysis Process**: Conditional Formatting, What-If Analysis, Data Tables, Charts and Graphs.
5.	**Cleaning Data with Text Functions**: use of UPPER and LOWER, TRIM function, Concatenate
6.	**Cleaning Data Containing Date and Time Values:** use of DATEVALUE function, DATEADD an DATEDIF, TIMEVALUE functions.
7.	**Conditional Formatting**: formatting, parsing, and highlighting data in spreadsheets during data analysis.
8.	**Working with Multiple Sheets**: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.
9	Create worksheet with following fields: Empno, Ename, Basic Pay(BP), Travelling Allowance(TA), Dearness Allowance(DA), House Rent Allowance(HRA), Income Tax(IT) Provident Fund(PF), Net Pay(NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
10	Create worksheet on Inventory Management: Sheet should contain Product code, Product name, Product type, MRP, Cost after % of discount, Date of purchase. Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.

Laboratory Outcomes

The student should be able to:
1. Use advanced functions and productivity tools to assist in developing worksheets.
2. Manipulate data lists using Outline and Pivot tables.
3. Use consolidation to summarize and report results from multiple worksheets.
4. Apply techniques for data analysis through dashboard for real time scenarios.

Reference Books:

1. Berk & Carey - Data Analysis with Microsoft® Excel: Updated for Offi ce 2007®, Third Edition, © 2010 Brooks/Cole, Cengage Learning, ISBN-13: 978-0-495-39178-4

2. Wayne L. Winston - Microsoft Excel 2019: Data Analysis And Business Modeling, PHI, ISBN: 9789389347180

3. Aryan Gupta - DataAnalysis in Excel: The Best Guide. (https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel)

Assessment Details(both CIE and SEE)

Continuous Internal Assessment of Laboratory/Practical Courses		
Lab Test 1	Lab Test 2	Lab Records
15 marks	15 marks	20 marks
Semester End Examination(SEE)		50 marks

Conduct of Practical Examination:

Experiment distribution :

For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.

For laboratories having PART A and PART B: Students are allowed to pick one experiment from PART A and one experiment from PART B, with equal opportunity.

● Change of experiment is allowed only once and marks allotted for procedure to be made zero of the changed part only.
● Marks Distribution (Need to change in accordance with university regulations)
   a) For laboratories having only one part → Procedure + Execution + Viva-Voce:15+70+15 = 100 Marks
   b) For laboratories having PART A and PART B
      i. Part A – Procedure + Execution + Viva = 6 + 28 + 6 = 40 Marks
      ii. Part B – Procedure + Execution + Viva = 9 + 42 + 9 = 60 Marks

CO-PO-PSO Mapping :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3		2	3							3		2
CO2	1	2		3	3							2	2	
CO3	3	2	2	2	2					1		3		
CO4	2	3		3	3					1		2	2	2

Full Stack Web Development					
Course Code	**L : T : P : S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
24CIL382	0 : 0 : 2 : 0	1	IAT:50 SEE:50	3 Hours	AEC

Pre- Requisites:

1. This course focuses on developing comprehensive skills in Full Stack Web Application Development. Students will learn to develop both front-end and back-end components of web applications, integrate with databases and external services, and apply best practices in web development.
2. Under this project work, student should develop Advanced Web based Application using technologies such as PHP, Python, Node JS, React, Angular.
3. Students can form a group with minimum of two and maximum of four.
4. Teacher allotted for project work to students should teach full stack technologies like Node JS, React, etc., during Class/Lab hours as per the allotment. Teacher allotted for project work should guide the students in choosing the topic and towards carrying out project work and complete the evaluation of assigned students.

Course Objectives:

• Learn core full-stack web development tools and technologies.

• Identify and solve real-world social and environmental issues using web applications.

• Build integrated front-end and back-end systems with databases and APIs.

• Develop teamwork and problem-solving skills through collaborative projects.

Teaching - Learning Process:

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.

2. Show Video/animation films to explain functioning of various concepts.

3. Encourage collaborative (Group Learning) Learning in the class.

4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.

6. Topics will be introduced in a multiple representation.

7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.

8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understandin

	PROGRAMS
1	Introduction to Full Stack Technologies & Issue Identification
2	Conceptualizing a Web Application
3	Basic Front-end and Back-end Development
4	Data Management and Integration
5	Advanced Frontend & Back-end Technologies Project Development and Mid-term Review
6	Integrating Feedback & Refining Applications
7	Final Project Review
8	Final Project Presentation
9	Final Project Submission

Laboratory Outcomes:

The student should be able to:

CO1. Apply full-stack web development technologies to solve real-world problems.

CO2. Design and develop user-centric web applications focused on social and environmental issues.

CO3. Integrate front-end and back-end components effectively with databases and external services.

CO4. Demonstrate teamwork and problem-solving skills in project development.

Assessment Details(both CIE and SEE)

Continuous Internal Assessment of Laboratory/Practical Courses		
Lab Test 1	Lab Test 2	Lab Records
15 marks	15 marks	20 marks
Semester End Examination(SEE)		50 marks

Conduct of Practical Examination:

Experiment distribution :

For laboratories having only one part: Students are allowed to pick one experiment from the lot with equal opportunity.

● Change of experiment is allowed only once and marks allotted for procedure to be made   zero of the changed part only.

● Marks Distribution (Need to change in accordance with university regulations)

a) For laboratories having only one part → Procedure + Execution + Viva-Voce: 15+70+15 = 100 Marks

CO-PO-PSO Mapping :

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	3				3									
CO 2			3		3	3	3							
CO 3			3		3									
CO 4								3	3	3				