



BMS COLLEGE OF ENGINEERING, BENGALURU-19
(Autonomous Institute, Affiliated to VTU)

BACHELOR OF ENGINEERING

**DEPARTMENT
OF
COMPUTER SCIENCE AND ENGINEERING
(DATA SCIENCE)**

**SCHEME & SYLLABUS
III - IV SEMESTERS
(Academic Year: 2023-24)**



B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

INSTITUTE VISION

Promoting Prosperity of mankind by augmenting Human Resource Capital through Quality Technical Education & Training.

INSTITUTE MISSION

Accomplish Excellence in the field of Technical Education through Education, Research and Service needs of society.

DEPARTMENT VISION

To be recognized as Centre for Quality Education in Computer Science and Engineering with emphasis on Data Science

DEPARTMENT MISSION

- Enable quality Computer Science education through continually evolving curriculum and pedagogical techniques.
- Conduct research collaboratively with established research labs and industries contributing to the futuristic field of Data Science.
- Nurture ethical and skilled professionals by promoting multi-disciplinary thinking in solving problems of the data-driven world.



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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- PEO1:** Excel in professional career as a Data Science Professional thereby contributing to the public/private sector or as an entrepreneur.
- PEO2:** Graduates to pursue higher education and research to upgrade themselves to serve the global market.
- PEO3:** Contribute to humankind by solving societal problems and exhibiting professionalism, team work & ethics.

PROGRAMME OUTCOMES (POs)

- PO1: Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2: Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3: Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4: Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5: Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO6: The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.



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PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Apply computing theory, algorithms, mathematical and statistical models, optimization principles using programming languages and tools to effectively formulate and solve data analysis problems.

PSO2: Apply principles of databases and organize big data sets to derive meaningful insights and make informed decisions for business processes.

PSO3: Exhibit expertise in teamwork, professional ethics, communication, and documentation skills during the development of software products, while adhering to established software engineering methodologies.



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Scheme of Instructions

Semester – III

(With effect from the Academic Year 2023-24)

Course Type	Course Code	Course Title	Credits			Total Credits	Marks		
			L	T	P		CIE	SEE	Total
BS-1	23MA3BSEM4	Engineering Mathematics for CSE - III	2	1	0	3	50	50	100
ES-1	23DC3ESCOA	Computer Organization & Architecture	3	0	0	3	50	50	100
PC-1	23DC3PCDSC	Data Structures	3	0	1	4	50	50	100
PC-2	23DC3PCDM	Database Management Systems	3	0	1	4	50	50	100
PC-3	23DS3PCOOJ	Object Oriented Programming with Java	3	0	1	4	50	50	100
PC-4	23DS3PCFDS	Foundations of Data Science	3	0	0	3	50	50	100
AE-1	23DS3AEFWD	Full Stack Web Development	0	0	1	1	50	50	100
NCMC		NSS	Non-credit mandatory Course						
		YOGA							
		PHYSICAL EDUCATION							
TOTAL			17	1	4	22	350	350	700
<p>Note: BS: Basic Science Course, ES: Engineering Science Course, PC: Professional Core Course, AE: Ability Enhancement Course, NCMC: Non-credit mandatory course</p>									



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Scheme of Instructions

Semester – IV

(With effect from the Academic Year 2023-24)

Course Type	Course Code	Course Title	Credits			Total Credits	Marks		
			L	T	P		CIE	SEE	Total
BS-2	23MA4BSEM4	Engineering Mathematics for CSE – IV	2	1	0	3	50	50	100
ES-2	23DC4ESTOC	Theory of Computation	3	0	0	3	50	50	100
PC-5	23DC4PCOPS	Operating Systems	3	0	0	3	50	50	100
PC-6	23DS4PCCON	Computer Networks	3	0	0	3	50	50	100
PC-7	23DS4PCMLG	Machine Learning	3	0	1	4	50	50	100
PC-8	23DC4PCDAA	Design and Analysis of Algorithms	3	0	1	4	50	50	100
AE-2	23DS4AEDVZ	Data Visualization using Tools	0	0	1	1	50	50	100
UHV	23MA4AEUHV	Universal Human Values	0	1	0	1	50	50	100
NCCM		NSS	Non-credit mandatory Course						
		YOGA							
		PHYSICAL EDUCATION							
TOTAL			17	2	3	22	400	400	800
<p>Note: BS: Basic Science Course, ES: Engineering Science Course, PC: Professional Core Course, AE: Ability Enhancement Course, NCCM: Non-credit mandatory course</p>									



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Computer Organization and Architecture

Sem	III		
Course Code:	23DC3ESCOA	Total Contact Hours: 40 hours	
L-T-P:	3-0-0	Total Credits:	3

Unit No.	Topics	Hours
1	Basic Structure of Computers and Instruction Set Architecture: Functional Units, Basic Operational Concepts, Number Representation and Arithmetic Operations, Memory Locations and Addresses, Memory Operations, Instructions, and Instruction Sequencing, Addressing Modes, Stored program concept.	8
2	Introduction to Assembly Language Concepts, Stacks, Subroutines, Additional Instructions, Basic Input/Output: Accessing I/O Devices, Interrupts, Bus Structure, Bus Operation, Arbitration	8
3	Memory System: Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories: Mapping Functions, Virtual Memory	8
4	Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Unsigned Numbers, Multiplication of Signed Numbers Fast Multiplication: Bit-Pair Recoding of Multipliers, Carry-Save Addition of Summands, Summand Addition Tree using 3-2 Reducers, Integer Division, Floating-Point Numbers and Operations: Arithmetic Operations on Floating-Point Numbers, Guard Bits and Truncation, Implementing Floating-Point Operations	8
5	Basic Processing Unit: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Hardwired Control Parallel Computer Architecture: Processor Architecture and Technology Trends, Flynn's Taxonomy of Parallel Architectures, Memory Organization of Parallel Computers: Computers with Distributed Memory Organization, Computers with Shared Memory Organization, Thread-Level Parallelism: Simultaneous Multithreading, Multicore Processors	8



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Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Computer Organization and Embedded Systems	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian	6th Edition	McGraw-Hill	12
2.	Parallel Programming for Multicore and Cluster Systems	Thomas Rauber, Gudula Runger	2nd Edition	Springer	13
Reference Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Computer Organization and Design - The Hardware /Software Interface	David A. Patterson, John L. Hennessy	5th Edition	Elsevier	2014
2.	Computer Organization & Architecture	William Stallings	11th Edition	Pearson	2018

MOOC Course				
Sl. No.	Course name	Course Offered By	Year	URL
1.	Computer Architecture and Organization	NPTEL	2022	https://onlinecourses.nptel.ac.in/noc22_cs88/preview

Course Outcomes

At the end of the course the student will be able to

CO1	To apply the concepts of basic functional units to demonstrate the working of computational system.
CO2	To analyze the issues of the processor architecture to improve the efficiency in computer design.
CO3	To design Memory modules and Arithmetic Logic unit for a given specification by analysing performance issues.



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CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Tool	Remarks	Marks
Internals	---	40
QUIZ	---	10
Total		50

SEE Exam Question paper format

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Mandatory	One Question to be asked for 20 Marks
Unit-3	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-4	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-5	Mandatory	One Question to be asked for 20 Marks



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Data Structures

Semester	III		
Course Code:	23DC3PCDSC	Total Contact Hours: 40 hours	
L-T-P:	3-0-1	Total Credits:	4

Unit No.	Topics	Hours
1	Introduction To Data Structure: Data Management concepts, Data types – primitive and non-primitive, Types of Data Structures- Linear & Non-Linear Data Structures. Structures and pointers Dynamic memory allocation: allocating a block of memory: Malloc, allocating multiple blocks of memory: Calloc, Releasing the used space: Free Altering the size of memory: Realloc.	8
2	Linear list: Singly linked list implementation, insertion, deletion and searching operations on linear list, circularly linked lists- insertion, deletion and searching operations for circularly linked lists, doubly linked list implementation, insertion, deletion and searching operations, maintaining directory of names, Manipulation of polynomials (addition), representing sparse matrices.	8
3	Stacks: Operations, array representations of stacks, stack applications - infix to postfix conversion, postfix expression evaluation, and function call tracing, recursion. Queues: Introduction, Basic concept, linear queue operations, circular queue, priority queues, double ended queues. Applications of Queues. Stack and queue implementation using linked lists	8
4	Trees: Definitions, tree representation, properties of trees, Binary tree, Binary tree representation, binary tree properties, binary tree traversals, binary tree implementation, Binary Search Tree operations and its implementation, applications of trees.	8
5	Balanced Trees: AVL Trees, Splay trees, Red- Black Trees – Definitions, Rotation and other basic operations.	8



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Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Fundamentals of Data Structures in C	Horowitz, Sahni, Anderson Freed	Second	Universities Press	008
2.	Data Structures using C	Reema Thareja	Second	Oxford University press	014
Reference Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Data Structures using C	Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein	Fifth	Pearson Education	2007
2	Data Structures - A Pseudocode Approach with C	Richard F. Gilberg Behrouz A. Forouzan	First	Cengage Learning	2005

E-Book						
Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	Data Structures using C	E. Balaguruswamy		McGraw Hill	2013	https://dokumen.pub/data-structures-using-c-9781259029547-1259029549.html
2.	Data structures and program design in C	Robert L. Kruse, Clovis L. Tondo, Bruce P. Leung	Second	Prentice Hal	1997	https://cdn.preterhuman.net/texts/math/Data_Structure_And_Algorithms/Data%20Structures%20and%20Program%20Design%20in%20C++%20-%20Robert%20L.%20Kruse.pdf



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MOOC Courses				
Sl. No.	Course name	Course Offered By	Year	URL
1	Data Structures	Coursera	2023	https://www.coursera.org/learn/data-structures
2	Data Structures and Algorithms	NPTEL	2023	https://nptel.ac.in/courses/106102064/

Course Outcomes

At the end of the course the student will be able to

CO1	Apply the concept of linear and nonlinear data structures for computing problems.
CO2	Analyse the appropriate data structure operations for a given problem
CO3	Design and develop solutions using the linear and nonlinear data structure for a given specification.
CO4	Conduct experiments for demonstrating the operations of different data structures.

CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Assessment Tool	No. of Assessments	Marks
Internals	2	20
QUIZ/AAT	1	5
Lab Component	CIE+ Two Lab Tests	25
Total		50



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Laboratory Plan

Instructions to Students to be followed in each lab:

1. Each Student should write down the program in the observation book and get it evaluated by the respective lab faculty in-charge and then execute the program.
2. Each Student should bring the lab record with the programs and output written for the programs completed in their respective previous week and get it evaluated by the lab faculty in-charge. In the record book students should - Handwrite the Program - Pasting of the printout of the Output or Handwriting of the Output (Output should be written for all the cases).
3. Students have to practice following list of programs and additional programming exercises will also be given in lab. Students will be made to solve coding challenges on programming platforms like LeetCode and HackerRank.

	Unit#	Program Details
1	2	Write a program to implement Singly Linked List with following operations a) Create a linked list. b) Insertion of a node at first position, at any position and at end of list. c) Display the contents of the linked list.
2	2	Write a program to Implement Singly Linked List with following operations a) Create a linked list. b) Deletion of first element, specified element and last element in the list. c) Display the contents of the linked list.
3	2	Write a program to Implement Singly Linked List with following operations a) Sort the linked list. b) Reverse the linked list. c) Concatenation of two linked lists
4	2	Write a program to Implement doubly linked list with primitive operations a) Create a doubly linked list. b) Insert a new node to the left of the node. c) Delete the node based on a specific value d) Display the contents of the list
5	3	Write a program to simulate the working of stack using an array with the following: a) Push b) Pop c) Display The program should print appropriate messages for stack overflow, stack underflow
6	3	Write a program to convert a given valid parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide)



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7	3	Write a program to simulate the working of a queue of integers using an array. Provide the following operations a) Insert b) Delete c) Display The program should print appropriate messages for queue empty and queue overflow conditions
8	3	Write a program to simulate the working of a circular queue of integers using an array. Provide the following operations. a) Insert b) Delete c) Display The program should print appropriate messages for queue empty and queue overflow conditions
9	3	Write a program to implement Stack & Queues using Linked Representation
10	4	Write a program a) To construct a binary Search tree. b) To traverse the tree using all the methods i.e., in-order, preorder and post order c) To display the elements in the tree.
11	4	Write a program a. To construct a binary search tree b. To implement iterative in order traversal c. To delete a given element
12	5	Write a program to construct an AVL tree of integers

SEE Question paper format

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-3	Mandatory	One Question to be asked for 20 Marks
Unit-4	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-5	Mandatory	One Question to be asked for 20 Marks



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Database Management Systems

Semester	III		
Course Code:	23DC3PCDBM	Total Contact Hours: 40 hours	
L-T-P:	3-0-1	Total Credits:	4

Unit No.	Topics	Hours
1	<p>Introduction to Database Systems: Introduction, An Example, Characteristics of Database approach, Advantages of using DBMS approach, when not to use a DBMS.</p> <p>Database System Concepts and Architecture: Data models, Schemas and instances, Three schema architecture.</p> <p>SQL: SQL Data Definition and Data Types specifying basic constraints in SQL, Basic retrieval queries in SQL, Insert, Delete and Update statements in SQL, Additional features of SQL, more complex SQL Queries, Specifying Constraints as Assertions and Triggers, Views (Virtual Tables) in SQL, Schema Change Statement in SQL.</p>	8
2	<p>Entity Relation Model: Using High-Level Conceptual Data Models for Database Design, a sample Database Application, Entity types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity types, Refining the ER Design, ER Diagrams, Relationship Types of Degree Higher than two, Relational Database Design using ER to Relational Mapping.</p> <p>Relational Databases: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations, Functional Dependencies</p>	8
3	<p>Relation Algebra: Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations, Examples of Queries in Relational Algebra.</p> <p>Normalization: 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, Multi-valued Dependencies and a Fourth Normal Form, Join Dependencies, Fifth Normal Form.</p>	8



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4	<p>Transaction Processing Concepts: 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, Two-Phase Locking Techniques for Concurrency Control.</p>	8
5	<p>Storage Systems: Overview of Physical Storage Media, Storage Interfaces, Magnetic Disks, Flash Memory, RAID, Disk-Block Access, Database Backup and Recovery from Catastrophic Failures</p> <p>Indexing: Basic Concepts, Ordered Indices, B+-Tree Index Files, B+-Tree Extensions, Hash Indices, Multiple-Key Access, Creation of Indices, Write-Optimized Index Structures, Bitmap Indices, Indexing of Spatial and Temporal Data</p> <p>Query processing & operations</p>	8

Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Fundamentals of Database Systems	Elmasri and Navathe	7th Edition	Pearson	2016
2.	Database System Concepts	Silberschatz, H Korth and S Sudarshan	7th Edition	McGrawHill	2019
Reference Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Database Management Systems	Ramakrishnan and Gehrke	3 rd Edition	McGrawHill	2014
2.	Database Systems: Design, Implementation, and Management	Peter Rob and Carlos Coronel	8 th Edition	CENGAGE Learning	2009



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E-Book						
Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	An Introduction to Relational Database Theory	Hugh Darwen	Third Edition	Ventus Publishing ApS	2012	https://www.e-booksdirectory.com/details.php?ebook=3093
2.	Database System The Complete Book	Hector GarciaMolina, Jeffrey D. Ullman, Jennifer Widom	Second Edition	Pearson Education	2009	https://people.inf.elte.hu/miiqaa/i/elektroModulatorDva.pdf

MOOC Course				
Sl. No.	Course name	Course offered by	Year	URL
1.	Database Management Systems	SWAYAM	2023	https://onlinecourses.swayam2.ac.in/cec23_cs10/preview
2.	Database Management Essentials	Coursera	2023	https://www.coursera.org/learn/database-management

Course Outcome

At the end of the course the student will be able to

CO1	Apply the concepts of database management systems for various applications.
CO2	Analyse the given database concepts to its correctness.
CO3	Design and demonstrate conceptual models, query and optimization.
CO4	Ability to conduct experiments to demonstrate the various SQL query processing



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CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Tool	Remarks	Marks
Internals	2	25
QUIZ	1	5
Lab Component	CIE + Lab Test	25
Total		50

Laboratory Plan

1. Each Student should write down the work carried out and the outputs in the observation book and get it evaluated by the respective lab faculty in-charge.
2. Students have to practice following SQL queries and additional exercises will also be given in the lab.

Sl.No.	Program Details
1	Sailor Database
2	Supplier Database
3	Salesman Database
4	Movie Database
5	Employee Database



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PROGRAM 1: SAILOR DATABASE

Create tables for the following schema:

SAILOR (sid: integer, sname: string, rating: integer, age: real)

BOAT (bid: integer, bname: string, color: string)

RESERVES (sid: integer, bid: integer, day: date)

Queries:

- 1) Add the required constraints on the created tables.
- 2) Populate the relations with at least 5 tuples each.
- 3) Select names and ages of all sailors. Rename same as 'Sailor Name'
- 4) Find all sailors with a rating above 7
- 5) Find the sid of sailors who have reserved a red boat
- 6) Find the colors of boats reserved by 'Shyam'
- 7) Delete all boats which have never been reserved.

PROGRAM 2: SUPPLIER DATABASE

Create tables for the following schema:

SUPPLIER (sid: integer, name: string, address: string)

PART (pid: integer, name: string, color: string)

CATALOG (sid: integer, pid: integer, cost: real)

Queries:

- 1) Add the required constraints on the created tables.
- 2) Populate the relations with at least 5 tuples each.
- 3) Select the ID and names of all the suppliers.
- 4) Select the most costly part available in the catalog.
- 5) Find the name's of parts for which there is some supplier.
- 6) Find the sids of suppliers who supply a red part and a green part.
- 7) Delete all parts of a given ID.

PROGRAM 3: SALESMAN DATABASE

Create tables for the following schema:

SALESMAN (Salesman_id: integer, Name: string, City: string, Commission: integer)

CUSTOMER (Customer_id: integer, Cust_Name: string, City: string)

ORDERS (Ord_No: integer, Purchase_Amt: real, Ord_Date: date, Customer_id: integer, Salesman_id: integer)



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Queries:

- 1) Add the required constraints on the created tables.
- 2) Populate the relations with at least 5 tuples each.
- 3) Select the ID and names of all the customers.
- 4) Select the salesman with the highest commission.
- 5) List all the orders placed in descending order of their purchase amount.
- 6) Select customers who have salesmen in their cities.
- 7) Delete all orders placed before Jan 2018.

PROGRAM 4: MOVIE DATABASE

Consider the schema for Movie Database:

ACTOR(Act_id, Act_Name, Act_Gender)
DIRECTOR(Dir_id, Dir_Name, Dir_Phone)
MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)
MOVIE_CAST(Act_id, Mov_id, Role)
RATING(Mov_id, Rev_Stars)

Queries:

- i. List the titles of all movies directed by 'Hitchcock'.
- ii. Find the movie names where one or more actors acted in two or more movies.
- iii. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation).
- v. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.
- vi. Update rating of all movies directed by 'Steven Spielberg' to 5.

PROGRAM 5: EMPLOYEE DATABASE

Create the following Tables:

LOCATION	
Location_ID	Regional_Group
122	NEW YORK
123	DALLAS
124	CHICAGO
167	BOSTON



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DEPARTMENT		
Department_ID	Name	Location_ID
10	ACCOUNTING	122
20	RESEARCH	124
30	SALES	123
40	OPERATIONS	167

JOB	
Job_ID	Function
667	CLERK
668	STAFF
669	ANALYST
670	SALESPERSON
671	MANAGER
672	PRESIDENT

EMPLOYEE									
EMPLOYEE_ID	LAST_NAME	FIRST_NAME	MIDDLE_NAME	JOB_ID	MANAGER_ID	HIRE_DATE	SALARY	COMM	DEPARTMENT_ID
7839	MEGAN	JOHN	S	672	NULL	12-DEC-14	5500	NUL L	30
7369	SMITH	JOHN	Q	667	7521	17-DEC-18	800	NUL L	20
7499	ALLEN	KEVIN	J	670	7507	20-FEB-17	1600	300	30
7505	DOYLE	JEAN	K	671	7839	04-APR-15	2850	NUL L	30
7506	DENNIS	LYNN	S	671	7839	15-MAY-15	2750	NUL L	30
7507	BAKER	LESLIE	D	671	7839	10-JUN-15	2200	NUL L	40
7521	WARK	CYNTHIA	D	670	7505	22-FEB-15	1250	500	30



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Queries based on the above tables:

Order By Clause:

1. List out the employee id, last name in ascending order based on the employee id.
2. List out the employee id, name in descending order based on salary column

Group By & Having Clause:

3. How many employees who are working in different departments wise in the organization
4. List out the department wise maximum salary, minimum salary, average salary of the employees
5. List out the job wise maximum salary, minimum salary, average salaries of the employees.
6. List out the no.of employees joined in every month in ascending order.
7. How many employees joined in 1985?
8. How many employees joined in March 1985.
9. Which is the department id, having greater than or equal to 3 employees joined in April1985.

Sub-Queries

10. Display the employee who got the maximum salary.
11. Display the employees who are working in Sales department
12. Display the employees who are working as “Clerk”.
13. Display the employees who are working in “New York”
14. Find out the number of employees working in the “Sales” department.
15. Delete the employees who are working in the accounting department.
16. Display the second highest salary drawing employee details.

Subquery operators: (ALL, ANY, SOME, EXISTS)

17. List out the employees who earn more than every employee in department 30.
18. List out the employees who earn more than the lowest salary in department 30.
19. Find out which department does not have any employees.

Simple join

20. List our employees with their department names
21. Display employees with their designations (jobs)
22. How many employees are working in the sales department?

Non – Equi Join:

23. Display employee details with salary grades.
24. List out the no. of employees on grade wise.

Self-Join:

25. Display the employee details with their manager names.
26. Display the employee details who earn more than their manager’s salaries.

Outer Join:

27. Display employee details with all departments.
28. Display all employees in sales or operation departments.

Set Operators:

29. List out the distinct jobs in Sales and Accounting Departments.
30. List out the ALL jobs in Sales and Accounting Departments.
31. List out the common jobs in Research and Accounting Departments in ascending order.



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SEE Exam Question paper format

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-3	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-4	Mandatory	One Question to be asked for 20 Marks
Unit-5	Mandatory	One Question to be asked for 20 Marks



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Object Oriented Programming with Java

Semester	III		
Course Code:	23DS3PCOOJ	Total Contact Hours: 40 hours	
L-T-P:	3-0-0	Total Credits:	3

Unit No.	Topics	Hours
1	<p>Introduction to Java: Java's Lineage, The Bytecode, The Java Buzzwords. An overview of Java: Object oriented programming, Structure of a Java Program, Datatypes and Arrays.</p> <p>Introducing classes: Class fundamentals, Declaring objects, Assigning object reference variables, Introducing methods, Constructors, this keyword, Garbage Collection, A Stack class.</p> <p>Methods and classes: Overloading methods, Objects as parameters, argument passing, Returning objects.</p>	8
2	<p>Inheritance: Basics, Using super, Multilevel hierarchy, When constructors are executed, Method overriding, Dynamic method dispatch, Abstract classes, Using final with inheritance.</p> <p>Packages and Interfaces: Packages, Access Protection, Importing packages, Interfaces, Default interface methods.</p>	8
3	<p>Exception Handling: Fundamentals, types, Uncaught exceptions, Try and catch blocks, multiple catch, nested try, throw, throws, finally, Creating own exceptions.</p> <p>Multithreaded programming: Java thread model, The main thread, Creating a thread and multiple threads, Using isAlive() and join(), Thread Priorities, Synchronization.</p>	8
4	<p>File I/O Basics, Reading console input, Writing console output, Print writer class, Reading and writing files, Closing a file.</p> <p>String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Changing the Case of Characters Within a String, Joining Strings, StringBuffer.</p>	8



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5	<p>Generics: Type Wrappers, Auto boxing, A simple generic example, Generic Class with two type parameters, The General Form of a Generic Class.</p> <p>Collections Framework: Overview, Collection classes - ArrayList Class, LinkedList Class, HashSet Class, TreeSet Class, ArrayDeque Class.</p>	8
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Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Java : The Complete Reference	Herbert Schildt	11 th Edition	McGraw-Hill Education	2018
2.	Programming with Java A Primer	E.BalaGuru Swamy	6 th Edition	McGraw-Hill Education	2014
Reference Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Introduction to Java Programming	Y. Daniel Liang	11 th Edition	Pearson	2017
2.	Object Oriented Programming with Java: Essentials and Applications	Rajkumar Buyya, Thamarai Selvi, Xing	1 st Edition	Tata McGraw Hill Education	2009

E-Book						
Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	The Art and science of Java	Eric S. Roberts	-	Greg Tobin	2007	http://people.reed.edu/~jerry/121/materials/artsciencejava.pdf
2.	Java Programming	Wikibooks Contributors	7th Edition	wikibooks.org	2016	https://upload.wikimedia.org/wikipedia/commons/e/e7/Java_Programming.pdf



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MOOC Course				
Sl. No.	Course name	Course Offered By	Year	URL
1.	Object Oriented Programming in Java	Udacity	2022	https://www.udacity.com/course/java-programming-basics--ud282
2.	Java	Swayam NPTEL	2023	https://onlinecourses.swayam2.ac.in/aic20_sp13/previe w

Course Outcomes

At the end of the course the student will be able to

CO1	Apply the knowledge of Java concepts to find the solution for a given problem.
CO2	Analyse the given Java application for correctness/functionalities.
CO3	Develop Java programs / applications for a given requirement.
CO4	Conduct practical experiments for demonstrating features of Java.

CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Assessment Tool	No. of Assessments	Marks
Internals	2	20
QUIZ	1	5
Lab Component	CIE + 2 Lab tests	25
Total		50

Laboratory Plan

Instructions to Students to be followed in each lab:

1. Each Student should write down the work carried out and the outputs in the observation book and get it evaluated by the respective lab faculty in-charge.



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- Each Student should bring the lab record with the programs and output written for the programs completed in their respective previous week and get it evaluated by the lab faculty in-charge.
- Students have to practice following list of programs and additional programming exercises will also be given in lab. Students will be made to solve coding challenges on programming platforms like LeetCode and HackerRank.

	Program Details
1	Create a class to represent a bank account with data members : Account no, Account holder name, Address and Balance amount. Create member methods to assign initial value to the account, deposit an amount, withdraw an amount after checking balance and display account holders name and balance. Write a main method for the above class that reads the initial values from the keyboard and invokes the appropriate methods.
2	Create a class named RetailItem that holds data about an item in a retail store. The class should have the following fields: <ul style="list-style-type: none">Description - The description field references a String object that holds a brief description of the item.Units - The units field is an int variable that holds the number of units currently in inventory.Price - The price field is a double that holds the item's retail price. Write a constructor that accepts arguments for each field, appropriate mutator methods that store values in these fields, and accessor methods that return the values in these fields. Write the main method which creates three RetailItem objects and invokes appropriate methods.
3	Write a program in java to define a class Shape which has data members and a member function showArea(). Derive two classes Circle and Rectangle from Shape class. Add appropriate data members and member functions to calculate and display the area of Circle and Rectangle.
4	Write a program that has an Interface I which is extended by I1 and I2. Interface I12 inherits from both I1 and I2. Each interface declares one constant and one method. Class DemoI implements I12. Instantiate DemoI and invoke each of its methods. Each method displays one of the constants.
5	Define Create a package named mypack, containing a class AreaTriangle in which a method Area() finds area of a triangle and returns area. Import this package in another class Triangle which is in package mypack1. The Triangle



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	class invokes the Area() method from mypack and displays the area of triangle. Member variables can be considered as per the program requirement.
6	Create a base class called “Father” and derived class called “Son” which extends the base class. In Father class, implement a constructor which takes the age and throws the exception WrongAge() when the input age<0. In Son class, implement a constructor that checks both father and son’s age and throws an exception if son’s age is >=father’s age.
7	Consider a bank offering online access to its customers to perform transactions. Suppose there are two transactions of deposit and withdrawal for a particular account simultaneously which leads to race condition. Develop a solution to avoid unpredictable situations with a program.
8	Implement a class that checks whether a given number is a prime using both the Thread class and Runnable interface.
9	Write a program to copy the content of File1.txt to another file File2.txt. by reading the file name as command line arguments.
10	Illustrate the following string operations using String object. i) Difference of equals() method and == operator ii) Check whether the string is palindrome or not iii) To convert the string into character array
11	Create a Class Gen which implements a stack using generics. Ensure that the stack never overflows and the main method would invoke the stack methods in class Gen by passing integer and floating-point numbers.
12	Write a program to create a new array list, add some colors (string) and perform the following operations: i. Add elements of List to ArrayList ii. Copy ArrayList to Array iii. Reverse ArrayList content iv. Get Sub list from an ArrayList. v. To sort a given ArrayList



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SEE Exam Question paper format

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-3	Mandatory	One Question to be asked for 20 Marks
Unit-4	Mandatory	One Question to be asked for 20 Marks
Unit-5	Internal Choice	Two Questions to be asked for 20 Marks each



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Foundations of Data Science

Semester	III		
Course Code:	23DS3PCFDS	Total Contact Hours: 40 hours	
L-T-P:	3-0-0	Total Credits:	3

Unit No.	Topics	Hours
1	<p>Introduction to Data Science: Describing Data science, The data science Venn diagram, Python for Data Science, Data science case studies</p> <p>Types of Data: structured versus unstructured data, quantitative versus qualitative data, the four levels of data: nominal, ordinal, interval and ratio</p> <p>Total information awareness, Bonferroni's Principle, Rhine's paradox.</p> <p>The Data Science Process: Overview, defining research goals, retrieving data, Cleansing, integrating and transforming data, exploratory data analysis, Build the models, Presenting findings. Data Analytics Lifecycle.</p>	8
2	<p>Statistics & Probability: Statistics, Obtaining data, Sampling Data, Statistical measures, empirical rule. Points estimates, Sampling distributions, Confidence intervals, Hypothesis Tests: Conducting a hypothesis test, one sample t-tests, Type I and type II errors, Hypothesis testing for categorical variables</p> <p>Information Gain & Entropy, Probability Theory, Probability Types, Probability Distribution Functions, Bayes' Theorem, Inferential Statistics</p>	8
3	<p>Correlation Analysis: Types of correlation, correlation coefficient.</p> <p>Regression Analysis: Linear Regression: Simple Linear Regression, Multilinear Regression, p-values, Logistic Regression, Multinomial logistic regression, Time-Series Model, Receiver Operating Characteristic</p>	8
4	<p>Dealing with missing data: single and multiple data imputation, Entropy based techniques, Monte Carlo and MCMC simulations;</p> <p>Correcting inconsistent data: Deduplication, Entity resolution, Pairwise Matching; Fellegi-Sunter Model</p> <p>Dimensionality Reduction: Eigenvalues and Eigenvectors of Symmetric Matrices: Definitions, Computing Eigenvalues and Eigenvectors, Finding Eigenpairs by Power Iteration, Eigenvector matrix</p> <p>Principal-Component Analysis: Example, Using Eigenvectors for Dimensionality Reduction, The matrix of distances</p> <p>Singular-Value Decomposition: Definition, interpretation, Dimensionality Reduction Using SVD, Why Zeroing Low Singular Values Works, Querying Using Concepts, Computing the SVD of a Matrix</p>	8



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5	Data Analytics on Text: Major Text Mining Areas – Information Retrieval – Data Mining – Natural Language Processing NLP) – Text analytics tasks: Cleaning and Parsing, Searching, Retrieval, Text Mining, Part-of-Speech Tagging, Stemming, Text Analytics Pipeline. NLP: Major components of NLP, stages of NLP, and NLP applications.	8
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Prescribed Text Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Principles of Data Science	Sinan Qzdemir, Sunil Kakade & Macro Tibaldeschi	Second Edition	Packt	2018
2.	Fundamentals of Data Science	Sanjeev Wagh, Manisha Bhende, Anuradha Thakare,	First Edition	CRC Press	2022
3.	Introducing Data Science: Big Data, Machine Learning, and More	Davy Cielen, Arno D.B. Meysman, Mohamed Ali	-	Manning	2016

Reference Text Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Doing Data Science	Rachel Schutt, Cathy O’Neil	-	O’Reilly	2014
2.	Mining Massive Datasets	Jure Leskovec, Anand Rajaraman, Jeffrey D Ullman	2 nd	Dreamtech Press	2016



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E-Book						
Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	Data Science & Machine Learning	DirkP.Kroese, ZdravkoI Botev, ThomasTaimre, RadislavVaisman	-	University of Queensland	2023	https://people.smp.uq.edu.au/DirkKroese/DSML/DSML.pdf
2.	Becoming a Data Head	Alex J. Gutman Jordan Goldmeier	-	Wiley	2021	https://32net.id/bukaheula/share/QP2cf2JLdeOPn00y3Nyu8aXHp1Slq1bc6P4YcuI4.pdf

MOOC Course				
Sl. No.	Course name	Course Offered By	Year	URL
1.	Data Science	Coursera	2023	https://www.coursera.org/professional-certificates/ibm-data-science
2.	Foundations of Data Science	SWAYAM	2023	https://onlinecourses.swayam2.ac.in/imb23_mg64/preview

Course Outcomes

At the end of the course the student will be able to

CO1	Gain fundamental knowledge on data science
CO2	Analyse and visualize data for knowledge representation.
CO3	Demonstrate proficiency in data analysis.
CO4	Conduct experiments to demonstrate the use of various data science tools



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CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Assessment Tool	No. of Assessments	Marks
Internals	2	40
QUIZ/AAT	2	10
Total		50

SEE Exam Question paper format

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-3	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-4	Mandatory	One Question to be asked for 20 Marks
Unit-5	Mandatory	One Question to be asked for 20 Marks



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Full Stack Web Development

Semester	III		
Course Code:	23DS3AEFWD	Total Contact Hours: 20 hours	
L-T-P:	0-0-1	Total Credits:	1

Introduction:

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 Outcomes

At the end of the course the student will 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.



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CO-PO mapping

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

Rubrics for Project Evaluation:

Criteria	Excellent	Good (3 Marks)	Satisfactory (2 Marks)	Needs Improvement (0-1 Marks)
Problem Identification & Relevance (10)	(10 Marks) Clearly articulates a significant social/environmental issue with insightful, innovative solutions.	(7 Marks) Recognizes a pertinent issue and offers practical solutions.	(5 Marks) Identifies a basic issue with standard solutions.	(0-2 Marks) Fails to identify a relevant issue or solution.
Technical Implementation (10)	(10 Marks) Exemplary implementation of full-stack technologies, showcasing efficiency, scalability, and technical excellence.	(7 Marks) Reliable and proficient technical performance, meeting key objectives.	(5 Marks) Basic implementation incorporating essential features and functionalities.	(0-4 Marks) Inadequate or incomplete technical implementation.
User Experience & Interface (10)	(10 Marks) Exceptional UI/UX design, prioritizing intuitiveness and user-friendliness, with a professional standard of execution.	(7 Marks) Competent UI design focused on usability and functionality.	(5 Marks) Basic UI design encompassing essential functions and user needs.	(0-4 Marks) Poor or non-functional user interface, lacking in user-centricity.
Group Participation (5)	(5 marks) Exhibits active engagement, exceptional collaboration, and effective teamwork throughout the project lifecycle.	(4 marks) Consistent participation and constructive collaboration within the group.	(2 marks) Minimal but noticeable participation and occasional contributions.	(0 marks) Lack of active participation and collaboration in the group.
Presentation (5)	(5 marks) Professional, engaging presentation with outstanding visuals and comprehensive content, demonstrating exceptional delivery skills.	(4 marks) Well-structured presentation with clear content and effective delivery.	(2 marks) Basic presentation with some structure and varying delivery quality.	(1 marks) Disorganized presentation lacking in coherence and adequate content.



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Report & Documentation (10)	(10 marks) Comprehensive report covering all project aspects with meticulous documentation, including methodology, design, and future scope.	(7 marks) Well-structured report with detailed coverage of project implementation.	(5 marks) Basic report with limited content, covering essential project details.	(2-4 marks) Poorly structured and incomplete report, lacking essential details.
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Laboratory Plan *(if applicable)*

Sl. No	Week	Activity	Content deliverables by the assigned teacher	Technologies/Skills to be Covered
1	1st	Formation of groups. Note: Student groups of size 2 or 3 or 4	Introduction to Full Stack Technologies & Issue Identification	<ul style="list-style-type: none"> • Overview of full stack development tools and frameworks. • Overview of web development (HTML, CSS, JavaScript), • Introduction to full stack frameworks (MEAN, MERN), Identifying social/environmental issues for web solutions.
2	2nd	Project topic selection by each Group. Presentation: Student and Project topic introduction by each group	Conceptualizing a Web Application	<ul style="list-style-type: none"> • Identifying problem and understanding social and environmental issues. • Brainstorming and planning a web application focused on a chosen social/environmental issue. • Tools for wireframing and prototyping (Figma, Sketch),
3	3rd	Design Layout of the Web Pages	Basic Front-end and Back-end Development	<ul style="list-style-type: none"> • Define layouts based on project scope and objectives. • Learning the basics of front-end (HTML, CSS, JavaScript) and back-end (Node.js, Python) development. • Front-end: HTML5, CSS3, JavaScript basics. • Back-end: Introduction to Node.js, Express.js, RESTful API development
4	4th ,5th , and 6th	Front end and back-end implementation	Data Management and Integration	<ul style="list-style-type: none"> • Techniques for managing and integrating data in web applications. • Database technologies (MongoDB, SQL), Integrating databases with back-end



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				(Mongoose for MongoDB), Basic CRUD operations.
5	7th 8th and 9th	Design and Development of connecting among different web pages	Advanced Front-end & Back-end Technologies Project Development and Mid-term Review	<ul style="list-style-type: none"> Delving into advanced front-end technologies (React, Angular) and back-end technologies (databases, server management). Front-end: React.js/Angular for dynamic UI development. Back-end: Advanced Node.js, Authentication (JWT, OAuth), Server-side rendering.
6				Development of the project with guidance and a mid-term review to assess progress.
7	10th	Presentation by each group	Integrating Feedback & Refining Applications	<ul style="list-style-type: none"> Applying feedback from the mid-term review and refining the application for better performance and impact. Implementing feedback, Optimization for performance, Security best practices (HTTPS, data validation), User testing and UX improvements.
8	11th	Complete Project Work Demonstration by each group	Final Project Presentations and Submissions	Students present their completed projects and submit their final work for assessment.
	12th	Project Report Preparation		

Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Modern Full-Stack Development: Using Type Script, React, Node.js	Frank Zammetti	1st Edition	Apress	2020
2.	Beginning MERN Stack, Build and Deploy a Full Stack MongoDB, Express, React, Node.js App	Greg Lim			2021



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Tutorial Link:

Sl. No.	Links
1	https://www.springboard.com/resources/learning-paths/web-development-python-django/
2	https://www.coursera.org/learn/introduction-to-web-development-with-html-css-javascript
3	https://www.boardinfinity.com/micro-learning/full-stack-development-course-with-certification
4	https://www.udemy.com/course/next-js-the-complete-developers-guide/
5	https://www.udemy.com/course/nextjs-build-full-stack-apps-with-nextjs-using-redux/
6	https://www.udemy.com/course/beginning-javascript/



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Theory of Computation

Sem	IV		
Course Code:	23DC4ESTOC	Total Contact Hours: 40 hours	
L-T-P:	3-0-0	Total Credits:	3

Unit No.	Topics	Hours
1	Introduction to Finite Automata: Central Concepts of Automata Theory, Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA), Finite Automata with Epsilon Transition, An Application Text Search. NP Problems solvable in Polynomial Time, Satisfiability Problem	8
2	Regular Expressions and Languages: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Proving Languages Not to Be Regular, Closure Properties of Regular Languages, Equivalence and Minimization of Automata	8
3	Context Free Grammars and Languages Parse Trees: Context Free Grammars, Parse trees, Applications of Context Free Grammars, Ambiguity in Grammars and Languages, Eliminating Useless Symbols, Computing the Generating and Reachable Symbols, Eliminating Epsilon Productions, Eliminating Unit Productions, Chomsky Normal Form, Greibach Normal form	8
4	Pushdown Automata: Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata, The Pumping Lemma for Context Free Languages, Closure Properties of Context Free Languages	8
5	Introduction to Turing Machine: Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Restricted Turing Machines, Turing Machines and Computers, Definition of Post Correspondence Problem, A Language That Is Not Recursively Enumerable, An Undecidable Problem That is RE, Other Undecidable Problems	8



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Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Introduction to Automata Theory, Languages and Computation	John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman: education	3 rd Edition	Pearson	2007

Reference Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Introduction to Languages and Automata Theory	John C Martin	3 rd Edition	Tata McGraw- Hill	2007
2.	An Introduction to formal Languages and Automata	Peter Linz	5 th Edition	Narosa Publishing House	2012

E-Book						
Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	Introduction to Theory of Computation	Anil Maheshwari, Michiel Smid	-	Carleton University	2019	https://cglab.ca/~michiel/TheoryOfComputation/TheoryOfComputation.pdf

MOOC Course					
Sl. No.	Course name	Course Offered By	Year	URL	
1.	Automata Theory	edX	2022	https://www.edx.org/course/automata-theory	
2.	Introduction to Automata, Languages and Computation	IITB	2022	https://onlinecourses.nptel.ac.in/noc21_cs19/preview	
3.	Automata Theory	Stanford University	2022	https://online.stanford.edu/courses/soe-ycsautomata-automata-theory	



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Course Outcomes

At the end of the course the student will be able to

CO1	Apply the knowledge of Automata Theory, Grammars & Regular Expressions for the given requirement of the formal language.
CO2	Analyze the given Automata to identify the formal language it represents.
CO3	Design Automata and Grammar for pattern recognition and syntax checking of the given formal language.

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	3											
CO2		2										
CO3			2									

Proposed Assessment Plan (for 50 marks of CIE)

Assessment Tool	No. of Assessments	Marks
Internals	2	40
QUIZ/AAT	2	10
Total		50

SEE Exam Question paper format

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-3	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-4	Mandatory	One Question to be asked for 20 Marks
Unit-5	Mandatory	One Question to be asked for 20 Marks



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Operating Systems

Semester	IV		
Course Code:	23DC4PCOPS	Total Contact Hours: 40 hours	
L-T-P:	3-0-0	Total Credits:	3

Unit No.	Topics	Hours
1	<p>Introduction to Operating Systems: What operating systems do, Operating System operations, Process management, Memory management, Storage management, Protection and security</p> <p>System Structures: Operating System Services, System calls, Operating System design and implementation, Operating System structure, System Boot.</p>	8
2	<p>Processes: Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication.</p> <p>Threads: Overview, Multi-core Programming, Multithreading Models, Implicit Threading, Threading Issues.</p> <p>Process Synchronization-Background, The Critical section problem, Synchronization hardware, Mutex Locks, Semaphores, Classical problems of synchronization.</p>	8
3	<p>CPU Scheduling- Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple-Processor scheduling.</p> <p>Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock.</p>	8
4	<p>Memory Management Strategies: Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation.</p> <p>Virtual Memory Management- Background, Demand paging, Page replacement, Thrashing.</p>	8
5	<p>Virtual Machines: Overview, Benefits and features, Building Blocks, Types of Virtual Machines and their implementations, Virtualization and Operating System Components, Protection Rings</p> <p>Case Study: VMWare</p>	8



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Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Operating System Concepts	Abraham Silberschatz, Peter Baer Galvin , Greg Gagne	9th Edition	John Wiley & Sons	2018
2.	Modern operating systems	Andrew Tanenbaum	4th Edition	Pearson Education	2009
Reference Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Operating System: Internals and Design Principles	William Stallings	8th Edition	Prentice Hall	2014
2.	Schaum's Outline of Operating Systems	J. Archer Harris	Kindle Edition	McGraw-Hill	2001

E-Book						
Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	Operating Systems Course Notes	Dr. John T.Bell	-	University of Illinois Chicago	2013	https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/index.html
2.	Operating System Concepts	Abraham Silberschatz, Peter Baer Galvin , Greg Gagne	Ninth Edition	John Wiley & Sons	2018	https://drive.uqu.edu.sa/_/mskhayat/files/MySubjects/2017SS%20Operating%20Systems/Abraham%20Silberschatz-Operating%20System%20Concepts%20(9th,2012_12).pdf



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MOOC Course				
Sl. No.	Course name	Course Offered By	Year	URL
1.	Operating Systems	SWAYAM	2023	https://onlinecourses.nptel.ac.in/noc20_cs04/preview
2.	Introduction to Operating Systems	Coursera	2023	https://www.coursera.org/specializations/codio-introduction-operating-systems

Course Outcomes

At the end of the course the student will be able to

CO1	Apply the different concepts and functionalities of Operating System
CO2	Analyse various Operating system strategies and techniques
CO3	Demonstrate the different functionalities of Operating Systems.

CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Assessment Tool	No. of Assessments	Marks
Internals	2	40
QUIZ/AAT	2	10
Total		50

SEE Exam Question paper format

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-3	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-4	Mandatory	One Question to be asked for 20 Marks
Unit-5	Mandatory	One Question to be asked for 20 Marks



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Computer Networks

Semester	IV		
Course Code:	23DS4PCCON	Total Contact Hours: 40 hours	
L-T-P:	3-0-0	Total Credits:	3

Unit No.	Topics	Hours
1	Introduction: Data Communications, Networks, Network Types, Network Models, Protocol Layering, Reference Models: The OSI Reference Model, The TCP/IP Reference Model, Physical Layer: Data and signals Digital Transmission, (D-D Conversion) Bandwidth Utilization, Multiplexing, Switching, Circuit Switched Networks, Packet Switching.	8
2	Data Link Layer: Link Layer Addressing, Error Detection and Correction, Block Coding, Cyclic Codes, Checksum. Data Link Control: DLC Services, Data-Link Layer Protocols, Media Access Control, Wired LANs, Ethernet protocol.	8
3	Network Layer: Network Layer Services, Packet Switching, Network Layer Performance, IPV4 Addresses. Network Layer Protocols: Internet Protocol, ICMPV4, Unicast Routing, Routing algorithms, Unicast routing protocols, Internet Structure, Routing Information Protocol (RIP), Next Generation IP: IPV6 Addressing, IPV6 Protocol, ICMPv6 Protocol, Transition from IPV4 to IPV6, Congestion Control Algorithms, QoS	8
4	Transport Layer: Transport Layer Protocols, User Datagram Protocol, Transmission Control Protocol.	8
5	Application Layer: Introduction, Standard Client Server Protocols, DNS—The Internet's Directory Service, SMTP, SNMP, FTP	8



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Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Data Communications and Networking	Behrouz A Forouzan	5 th Edition	McGraw Hill	2013
2.	Computer Networks	Andrew S. Tanenbaum, David J. Wetherall	5 th Edition	Pearson	2011
Reference Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Data and Computer Communication	William Stallings	8 th Edition	Pearson Education	2008
2.	Computer Networks – A Systems Approach	Larry L. Peterson and Bruce S. Davie	4 th Edition	Elsevier	2007

E-books:						
Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	An Introduction to Computer Networks	Peter L Dordal	1 st Edition	-	2020	https://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf
2.	A Top-Down Approach: Computer Networking	James F Kurose & Keith W Ross	8 th Edition	Pearson	2021	https://gaia.cs.umass.edu/kurose_ross/online_lectures.htm



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MOOC Course				
Sl. No.	Course name	Course Offered By	Year	URL
1.	Computer Networking	Coursera	2023	https://www.coursera.org/learn/illinois-tech-computer-networking
2.	NOC: Computer Networks and Internet Protocol	NPTEL		https://nptel.ac.in/courses/106105183

Course Outcomes

At the end of the course, the student will be able to

CO1	Apply the fundamental concepts of communication in networking.
CO2	Analyze the various protocols, and techniques in TCP/IP network architecture
CO3	Develop applications that demonstrate the functionalities of physical, Data Link, Network, Transport or Application layer

CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Assessment Tool	No. of Assessments	Marks
Internals	2	40
QUIZ/AAT	2	10
Total		50



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SEE Exam Question paper format

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Internal Choice	Two Question to be asked for 20 Marks each
Unit-3	Internal Choice	Two Question to be asked for 20 Marks each
Unit-4	Mandatory	One Question to be asked for 20 Marks
Unit-5	Mandatory	One Question to be asked for 20 Marks



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Machine Learning

Sem	IV		
Course Code:	23DS4PCMLG	Total Contact Hours: 40 hours	
L-T-P:	3-0-1	Total Credits:	4

Unit No.	Topics	Hours
1	<p>Machine Learning Landscape: Introduction, Types of Machine Learning, Challenges of Machine Learning, Testing and Validating.</p> <p>Supervised Learning</p> <p>Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, Issues in Decision tree learning, CART Training algorithm</p>	8
2	<p>Support Vector Machines: Linear SVM, Non Linear SVM, SVM Regression, Under the Hood.</p> <p>Instance Based Learning: Introduction, k-Nearest Neighbor learning</p>	8
3	<p>Probabilistic Learning</p> <p>Bayesian Learning: Bayes Theorem and Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, Bayesian Belief Network, EM Algorithm.</p>	8
4	<p>Ensemble Learning and Random Forests: Voting Classifiers, Bagging and Pasting, Random Patches and Random Subspaces, Random Forests, Boosting, Stacking</p>	8
5	<p>Unsupervised Learning Techniques</p> <p>Clustering – Kmeans, DBSCAN, Other Clustering Algorithms, Gaussian Mixtures – Anomaly Detection, Selecting Clustering, Bayesian Gaussian Mixture Models, Other algorithms for anomaly and novelty detection</p> <p>Reinforcement Learning: Markov Decision Process, Introduction, Learning Task, Q Learning</p>	8

Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Machine Learning	Tom M. Mitchell	First	McGraw Hill Education	2013
2	Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow	Aurelien Geron	Second	O'Reilly	2020



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Reference Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Introduction to Machine Learning with Python	Andreas C Muller & Sarah Guido	First	Shroff Publishers	2019
2.	Thoughtful Machine learning	Mathew Kirk	First	Shroff Publishers	2019

E-Book						
Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome H. Friedman	Second	-	2009	https://web.stanford.edu/~hastie/Papers/ESLII.pdf
2.	Machine Learning in Action	Peter Harrington	First	Manning	2017	http://www2.ift.ulaval.ca/~chaib/IFT-4102-7025/public_html/Fichiers/Machine_Learning_in_Action.pdf

MOOC Course				
Sl. No.	Course name	Course Offered By	Year	URL
1.	Machine Learning	Coursera	--	https://www.coursera.org/learn/machine-learning
2.	Introduction to Machine learning	NPTEL	2016	https://swayam.gov.in/nd_noc20_cs29/preview

Course Outcomes

At the end of the course the student will be able to

CO1	Apply different learning algorithms for various complex problems
CO2	Analyze the learning techniques for given dataset
CO3	Design a model using machine learning to solve a problem.
CO4	Ability to conduct practical experiments to solve problems using appropriate machine learning techniques.



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CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Tool	Remarks	Marks
Internals	2	25
QUIZ	1	5
Lab Component	CIE + 2 Lab Tests	25
Total		50

Laboratory plan

Sl. No	Unit#	Program Details
1	1	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
2	2	Develop a program to construct Support Vector Machine considering a Sample Dataset
3	2	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions
4	3	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets
5	3	Write a program to construct a Bayesian network considering training data. Use this model to make predictions.
6	3	Apply EM algorithm to cluster a set of data stored in a .CSV file. Compare the results of k-Means algorithm and EM algorithm.
7	4	Implement Boosting ensemble method on a given dataset.
8	4	Write a program to construct random forest for a sample training data. Display model accuracy using various metrics
9	5	Implement tic tac toe using reinforcement learning



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10	5	Consider a sample application. Deploy machine learning model as a web service and make them available for the users to predict a given instance.
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SEE Exam Question paper format

Unit-1	Mandatory	One Question to be asked for 20Marks
Unit-2	Mandatory	One Question to be asked for 20Marks
Unit-3	Internal Choice	Two Questions to be asked for 20Marks each
Unit-4	Internal Choice	Two Questions to be asked for 20Marks each
Unit-5	Mandatory	One Question to be asked for 20Marks



Design and Analysis of Algorithms

Semester	IV		
Course Code:	23DC4PCDAA	Total Contact Hours: 40 hours	
L-T-P:	3-0-1	Total Credits:	4

Unit No.	Topics	Hours
1	Introduction to Algorithm, Fundamentals of Algorithmic Problem Solving. Analysis of Algorithm Efficiency: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non Recursive Algorithm, Mathematical Analysis of Recursive Algorithms.	8
2	Brute-Force: String Matching, Exhaustive Search: TSP, Knapsack Problem, Assignment Problem, Depth-First Search and Breadth-FirstSearch. Decrease-and-Conquer: Topological Sorting, Algorithms for Generating Combinatorial Objects: Generating Permutations, Decrease by-a-Constant-Factor Algorithms: Binary Search, Russian Peasant Multiplication, Variable Size-Decrease Algorithms: Computing Median and the Selection Problem	8
3	Divide-and-Conquer: Merge sort, Quicksort, Multiplication of Large Integers and Strassen's Matrix Multiplication. Transform-and-Conquer: Presorting, Heaps and Heap sort, Horner's Rule. Space and Time Tradeoffs: Horspool Algorithm, Boyer-Moore Algorithm.	8
4	Dynamic Programming: Coin Problem, The Knapsack Problem, Warshall's and Floyd's Algorithms. Greedy Technique: Prim's Algorithm, Kruskal's Algorithm-Without disjoint subsets and Union Find algorithms, Dijkstra's Algorithm, Huffman Trees.	8
5	Backtracking: n -Queens Problem, Subset-Sum Problem. Branch-and-Bound: Knapsack Problem, Traveling Salesman Problem. NP-Completeness: Polynomial time, Polynomial-time verification, NP-completeness and reducibility. NP-Complete Problems: The Clique problem, The Vertex Cover problem, Approximation Algorithms: The Vertex-Cover problem.	8



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Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Introduction to the Design and Analysis of Algorithms	Anany Levitin	Third Edition	Pearson	2014
2.	Introduction to Algorithms	Charles E Leiserson, Ronald L Rivest, Clifford Stein	Third Edition	The MIT Press	2009

Reference Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Fundamentals of Computer Algorithms	Ellis Horowitz, Satraj Sahnii and Rajasekhara m	2nd Edition	University Press Pvt. Ltd,	2009
2.	Analysis and design of Algorithms	Padma Reddy		Sri Nandi Publications	2009

E-Books						
Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	Introduction to Design & Analysis of Algorithms	K. Raghava Rao	-	Smash words	2013	https://www.smashwords.com/books/view/365630
2.	Data structures and Algorithm Analysis in C++	Allen Weiss	Fourth edition	Pearson education	2014	http://www.uoitc.edu.iq/images/documents/informatiCS-institute/Competitive_exam/DataStructures.pdf



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MOOC Courses				
Sl. No.	Course name	Course Offered By	Year	URL
1	Algorithms	Coursera	2023	https://www.coursera.org/course/algs4partI
2	Design and Analysis of Algorithms	NPTEL	2023	https://onlinecourses.nptel.ac.in/noc19_cs47/preview

Course Outcomes

At the end of the course the student will be able to

CO1	Apply algorithmic design paradigms to basic computing problems.
CO2	Analyze the time complexity of different algorithms.
CO3	Design efficient algorithms using appropriate algorithm design techniques.
CO4	Conduct experiments to implement algorithms and provide valid conclusions.

CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Assessment Tool	No. of Assessments	Marks
Internals	2	20
QUIZ/AAT	1	5
Lab Component	CIE+ Two Lab Tests	25
	Total	50

Laboratory Plan

Instructions to Students to be followed in each lab:

1. Each Student should write down the program in the observation book and get it evaluated by the respective lab faculty in-charge and then execute the program.



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2. Each Student should bring the lab record with the programs and output written for the programs completed in their respective previous week and get it evaluated by the lab faculty in-charge. In the record book students should - Handwrite the Program - Pasting of the printout of the Output or Handwriting of the Output (Output should be written for all the cases).

3. Students have to practice following list of programs and additional programming exercises will also be given in lab. Students will be made to solve coding challenges on platforms like LeetCode and HackerRank.

Lab Program	Unit#	Program Details
1	2	Write program to do the following: a. Print all the nodes reachable from a given starting node in a digraph using BFS method. b. Check whether a given graph is connected or not using DFS method.
2	2	Write program to obtain the Topological ordering of vertices in a given digraph.
3	2	Implement Johnson Trotter algorithm to generate permutations
4	3	Sort a given set of N integer elements using Merge Sort technique and compute its time taken. Run the program for different values of N and analyze its time complexity.
5	3	Sort a given set of N integer elements using Quick Sort technique and compute its time complexity.
6	3	Sort a given set of N integer elements using Heap Sort technique and analyze its time complexity.
7	4	Implement 0/1 Knapsack problem using dynamic programming.
8	4	Implement All Pair Shortest paths problem using Floyd's algorithm.
9	4	Find Minimum Cost Spanning Tree of a given undirected graph using Prim/Kruskal's algorithm.
10	4	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
11	5	Implement "N-Queens Problem" using Backtracking.



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SEE Question paper format

Unit-1	Mandatory	One Question to be asked for 20 Marks
Unit-2	Mandatory	One Question to be asked for 20 Marks
Unit-3	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-4	Internal Choice	Two Questions to be asked for 20 Marks each
Unit-5	Mandatory	One Question to be asked for 20 Marks



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Data Visualization using Tools

Semester	IV		
Course Code:	23DS4AEDVZ	Total Contact Hours: 20 hours	
L-T-P:	0-0-1	Total Credits:	1

About the course: The course is designed to enhance programming and computation skills of students by exploring various features and extensive libraries of python programming language that are necessary for data science applications.

The students should work with a given dataset and create effective visualizations. The course will be executed in two cycles.

During Cycle 1, the students would be able to implement the key visualization techniques using Python tools like Matplotlib, Seaborn etc.

In Cycle 2, students will be exposed to industry-standard software tools like Tableau, Google Data Studio etc. to create compelling and interactive visualization of various types of data.

Prescribed Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Python Data Science Handbook	Jake Vander Plas	2nd Edition	O'Reilly	2017
2.	Pro Tableau: A Step by Step Guide	Seema Acharya , Subhashini Chellappan	2nd Edition	Apress	2016

Reference Text Book					
Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems	Sossama Embarak	-	Apress	2018
2.	Python Data Visualization Cookbook	Igor Milovanović , Dimitry Foures , Giuseppe Vettigl	Second Edition	O'Reilly	2015



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E-Book						
Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	Data Visualization with Python and JavaScript	Kyran Dale	-	O'Reilly	2016	https://github.com/jllovet/dataviz-with-py-and-js
2.	Jumpstart Tableau: A Step-by-Step Guide to Better Data Visualization	Arshad Khan	-	Apress	2016	https://link.springer.com/book/10.1007/978-1-4842-1934-8

MOOC Course				
Sl. No.	Course name	Course Offered By	Year	URL
1.	IBM Data Science	Coursera	2023	https://www.coursera.org/professional-certificates/ibm-data-science
2.	Data Visualization with Tableau	Coursera	2023	https://www.coursera.org/specializations/data-visualization



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Laboratory Plan

Lab-cycle-1

Sl. No.	Experiment
1	<p>Using the sales_data.csv, create the visualization report for the following using Matplotlib:</p> <p>a. Get total profit of all months and show line plot with the following Style properties.</p> <p style="padding-left: 40px;">Generated line plot must include following Style properties:</p> <ol style="list-style-type: none">1. Line Style dotted and Line-colour should be green2. Show annotation3. Add a square marker.4. Add ticks for both X and Y axis <p>b. Read Bathing soap facewash of all months and display it using the Subplot</p>
2	<p>Using the sales_data.csv, create the visualization report for the following using Matplotlib:</p> <p>a. Get total profit of all months and show line plot with the following Style properties</p> <p style="padding-left: 40px;">Generated line plot must include following Style properties: –</p> <ol style="list-style-type: none">1. Line Style dashed and Line-colour should be green2. Show legend at the lower right location.3. Add ticks for both X and Y axis4. Line width should be 2 <p>b. Read toothpaste sales data of each month and show it using a bar plot</p>



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3	<p>Using the sales_data.csv, create the visualization report for the following using Matplotlib:</p> <ul style="list-style-type: none">a. Calculate total sale data for last year for each product and show it using a Pie chart<ul style="list-style-type: none">1. Print the total sale inside each part2. Explode the highest sale3. Set the start angle=60b. Read face cream and facewash product sales data and show it using the horizontal bar chart
4	<p>Write a Python programming for the following:</p> <ul style="list-style-type: none">a. to display a horizontal bar chart of the sale of book. Use different color for each bar. Sample data: Programming languages: Fict, Tech, Moti, Business, Nutri, Dev Sale: 5.2,19.6, 8.7, 8, 7.7, 3.7<ul style="list-style-type: none">1. Add ticks for both axes2. Show legend at the upper right cornerb. Write a Python program to create a stacked bar plot. Note: Use bottom to stack the women bars on top of the men bars. Sample Data: Means (men) = (22, 30, 35, 35, 26) Means (women) = (25, 32, 30, 35, 29)<ul style="list-style-type: none">1. Add labels and ticks2. Use annotation



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5	<p>Write a Python programming for the following:</p> <p>a. To create a pie chart with a title of the pass percentage of subjects.</p> <p style="padding-left: 40px;">Sample data: Subjects: DSC, OOP, OPS, COA, MAT, Java Pass percentage (%): 40, 25.6, 8.8, 30, 7.7, 60.7</p> <ol style="list-style-type: none">1. Print percentage inside the chart2. Use explode property <p>b. Using the sales_data.csv, read the total profit of each month and show it using the histogram to see the most common profit ranges</p>
6	<p>Using the dataset planets.csv, create the visualization report for the following using Seaborn:</p> <p>a. Get the distance covered year-wise and show scatter plot with the following properties</p> <ol style="list-style-type: none">1. Add “mass” as additional features2. Use different markers3. Control the range of marker areas with sizes <p>b. Read the orbital_period of each year and show it using the histogram.</p>
7	<p>Using the dataset planets.csv, create the visualization report for the following using Seaborn:</p> <p>a. Get the distance covered year-wise and show scatter plot with the following properties</p> <ol style="list-style-type: none">1. Add “mass” and “method” as additional features2. Change the default colour palette3. Display the complete legend <p>b. Read the distance for each method and show it using the bar chart.</p>



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8	<p>Using the dataset titanic.csv, create the visualization report for the following using Seaborn:</p> <ol style="list-style-type: none">a. Demonstrate the use of “displot”b. Plot the distribution using Kernel density estimation.c. Use lineplot for any two suitable featuresd. Generate scatter plot with different color palette
9	<p>Using the dataset titanic.csv, create the visualization report for the following using Seaborn:</p> <ol style="list-style-type: none">a. Demonstrate the subplots (2x1) on scatter plotsb. Demonstrate the use of violin plotc. Get different line plots for survival of passengers’ class wise.d. Create visualization for strip plot without jitter
10	<p>Using the dataset titanic.csv, create the visualization report for the following using Seaborn:</p> <ol style="list-style-type: none">a. Create a visualization using categorical plot and re-order the axis contentsb. Demonstrate the use of violin plotc. Demonstrate the subplots (1x3) on line plotsd. Generate scatter plot with different color palette



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Lab-cycle-2

Sl. No.	Experiment
1	Create the visualization using Tableau for the “Corriander_seed_2021.csv” dataset. <ol style="list-style-type: none">a. Demonstrate the use of filters (General, wildcard, condition and limits)b. Demonstrate the group creation, removing and renaming a group.c. Demonstrate the creation of constant setd. Create the visualization by using quick table calculatione. Customize the data using any three number functions
2	Create the visualization using Tableau for the “Corriander_seed_2021.csv” dataset. <ol style="list-style-type: none">a. Demonstrate the use of cascading filter, calculation filter and data source filter.b. Demonstrate creating Hierarchiesc. Demonstrate the creation of computed setsd. Create a visualization using a calculated fielde. Customize the data using any three string functions
3	Create the visualization using Tableau for the “Corriander_seed_2021.csv” dataset. <ol style="list-style-type: none">a. Demonstrate the use of cascading filter, calculation filter and data source filter.b. Demonstrate the group creation, removing and renaming a group.c. Create a visualization using a calculated fieldd. Customize the data using any three number functionse. Demonstrate the creation of constant set
4	Create the visualization using Tableau for the “supermarket_sales.csv” dataset. <ol style="list-style-type: none">a. Demonstrate the use of filters (General, wildcard, condition and limits)b. Demonstrate the group creation, removing and renaming a group.c. Demonstrate the creation of constant setd. Create a visualization using a calculated fielde. Customize the data using any three string functions



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5	<p>Create the visualization using Tableau for the “supermarket_sales.csv” dataset.</p> <ol style="list-style-type: none">a. Demonstrate the use of cascading filter, calculation filter and data source filter.b. Demonstrate creating Hierarchiesc. Demonstrate the creation of computed setsd. Create the visualization by using quick table calculatione. Customize the data using any three number functions
6	<p>Create the visualization using Tableau for the “supermarket_sales.csv” dataset.</p> <ol style="list-style-type: none">a. Demonstrate the use of filters (General, wildcard, condition and limits)b. Demonstrate creating Hierarchiesc. Create the visualization by using quick table calculationd. Demonstrate the creation of constant sete. Customize the data using any three string functions
7	<p>Create the visualization using Tableau for the “supermarket_sales.csv” dataset.</p> <ol style="list-style-type: none">a. Demonstrate the use of cascading filter, calculation filter and data source filter.b. Demonstrate the group creation, removing and renaming a group.c. Demonstrate the creation of constant setd. Create a visualization using a calculated fielde. Customize the data using any three number functions

Course Outcomes

At the end of the course the student will be able to

CO1	Design and create effective data visualizations using Python.
CO2	Apply data transformations such as Joins, filtering, sorting, aggregation etc., for visualization using industry-standard software tools.
CO3	Identify opportunities for application of data visualization in various domains and communicate the results for documentation and interpretation.



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CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Assessment Tool	No. of Assessments	Marks
Lab Component	CIE and 2 Lab tests	50
Total		50