Department of Artificial Intelligence & Data Science

160 Credit Scheme

For Batch 2022 onwards

Semester-III

No.	Course Type	Code	Course Title	Credits			Total Credits	Total Hours
				L	T	P		
1	BS	23MA3BSSDM	Statistics and Discrete Mathematics	**2**	**1**	**0**	**3**	**4**
2	ES	23DC3ESCOA	Computer Organization & Architecture	**3**	**0**	**0**	**3**	**3**
3	PC	23DC3PCDSC	Data Structures	**3**	**0**	**1**	**4**	**5**
4	PC	23DC3PCDBM	Database Management Systems	**3**	**0**	**1**	**4**	**5**
5	PC	23AI3PCIAI	Introduction to AI	**3**	**0**	**1**	**4**	**5**
6	PC	23DS3PCFDS	Foundations of Data Science	**3**	**0**	**0**	**3**	**3**
7	AE	23DC3AEFWD	Full Stack Web Development	**0**	**0**	**1**	**1**	**2**
		23DS3AEDAE	Data Analytics with Excel					
		23DS3AELAT	Technical Writing					
8	NCMC	23NCMC3NS1	NSS	**0**	**0**	**0**	**0**	**1**
		23NCMC3YG1	YOGA					
		23NCMC3PE1	Physical Edu. (Sports and Athletics)					
	TOTAL			**17**	**1**	**4**	**22**	**28**

PC-15, ES-3, BS-3, AE-1

Sem	**III**		
Course Title:	**Computer Organization and Architecture**		
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

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-Hil	2012
2.	Parallel Programming for Multicore and Cluster Systems	Thomas Rauber, Gudula Runger	2nd Edition	Springer	2013

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 analyzing performance issues.

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

Semester	**III**		
Course Title:	**Data Structures**		
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**

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	2008
2.	Data Structures using C	Reema Thareja	Second	Oxford University press	2014

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. Balagurusw amy		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

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**

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.

Lab Program	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)
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 inorder 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

Sem	**III**		
Course Title:	**Database Management Systems**		
Course Code:	**23DC3PCDBM**	**Total Contact Hours: 40 hours**	
L-T-P:	**3-0-1**	**Total Credits:**	**4**

Unit No.	Topics	Hours
1	**Introduction to Database Systems:** Introduction, An Example, Characteristics of Database approach, Advantages of using DBMS approach, when not to use a DBMS. **Database System Concepts and Architecture:** Data models, Schemas and instances, Three schema architecture. **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.	8
2	**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. **Relational Databases:** Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations, Functional Dependencies	8
3	**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. **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.	8

4	**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.	8
5	**Storage Systems:** Overview of Physical Storage Media, Storage Interfaces, Magnetic Disks, Flash Memory, RAID, Disk-Block Access, Database Backup and Recovery from Catastrophic Failures **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 Query processing & operations	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	3rd Edition	McGrawHill	2014
2.	Database Systems: Design, Implementation, and Management	Peter Rob and Carlos Coronel	8th Edition	CENGAGE Learning	2009

E-Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	An Introduction to Relational Database Theory	Hugh Darwen	3rd Edition	Ventus Publishing ApS	2012	https://www.e-booksdirectory.com/details.php?ebook=3093
2.	Database System The Complete Book	Hector GarciaMolina,JeffreyD. Ullman, Jennifer Widom	Second Edition	Pearson Education	2009	https://people.inf.elte.hu/miiqaai/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 Outcomes

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

CO 1	**Apply** the concepts of database management systems for various applications.
CO 2	**Analyze** the given database concepts to its correctness.
CO 3	Design **and demonstrate** conceptual models, query and optimization.
CO 4	Ability to **conduct** experiments to **demonstrate** the various SQL query processing

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.

Lab Program	Program Details
1	Sailor Database
2	Supplier Database
3	Salesman Database
4	Movie Database
5	Employee Database

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)

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 M ovie 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
iv. 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

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

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.

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

Semester	**III**		
Course Title:	**Introduction to Artificial Intelligence**		
Course Code:	**23AI3PCIAI**	**Total Contact Hours: 40 hours**	
L-T-P:	**3-0-1**	**Total Credits:**	**4**

Unit No.	Topics	Hours
1	**Introduction to AI**: Foundations of Artificial Intelligence, History of Artificial Intelligence, The State of the Art. Intelligent Agents – Agents and Environments, Concept of rationality, The nature of environments, The structure of agents **Problem solving based on searching**: Problems solving Agents, Example problems, Searching for solutions, Uniformed Search strategies – Uniform cost search, Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First	**8**
2	**Heuristic Search Strategies:** Best-first Search, A* algorithm, Heuristic Functions **Local Search & Optimization**: Hill Climbing, Genetic Algorithms	**8**
3	**Constraint Satisfaction Problem –** Defining constraint satisfaction problems, Constraint propagation, Back tracking search for CSPs, Local search for CSPs **Game theory** – Optimal decisions in games, Alpha-Beta Search, Stochastic games, Partially observable games.	**8**
4	**Logical Agents** - Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic. **First Order Logic** - Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic. **Inference in First Order Logic** - Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.	**8**
5	**Quantifying Uncertainty** - Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use, Wumpus World Revisited.	**8**

Prescribed Text Book					
Sl. No.	**Book Title**	**Authors**	**Edition**	**Publisher**	**Year**
1.	Artificial Intelligence	Stuart J. Russell and Peter Norvig	3rd Edition	Pearson	2015

Reference Text Book					
Sl. No.	**Book Title**	**Authors**	**Edition**	**Publisher**	**Year**
1.	Artificial Intelligence	Elaine Rich, Kevin Knight	3rd Edition	Tata Mc GrawHill	2013
2	Artificial Intelligence Structure and strategies for complex problem solving	George F Lugar	5th Edition	Pearson	2011

E-Book						
Sl. No.	**Book Title**	**Authors**	**Edition**	**Publisher**	**Year**	**URL**
1.	Artificial Intelligence	Stuart J. Russell and Peter Norvig	3rd Edition	Pearson	2015	https://people.engr.tamu.edu/guni/csce421/files/AI_Russell_Norvig.pdf
2.						10 Free Must-read Books on AI - KDnuggets

MOOC Courses				
Sl. No.	**Course name**	**Course Offered By**	**Year**	**URL**
1	Knowledge-Based AI: Cognitive Systems	Udacity		https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
2	Artificial Intelligence	NPTEL		https://nptel.ac.in/courses/106105077

Course Outcomes

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

CO1	Apply basic principles of AI in solutions that require problem solving, inference, knowledge representation and learning.
CO2	Analyze search and inference algorithms in problem solving.
CO3	Demonstrate knowledge of reasoning, uncertainty and knowledge representation for solving real-world problems.
CO4	Conduct experiments to solve problems using AI techniques.

CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Assessment Tool	**No. of Assessments**	**Marks**
Internals	2	20
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Laboratory Plan

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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.

Lab Program	Unit#	Program Details
1	1	Write a program to implement Vacuum Cleaner agent for two rooms
2	1	Implement Iterative deepening search algorithm.
3	1	Solve 8 puzzle problem using BFS algorithm
4	2	Implement A* search algorithm.
5	2	Implement Tic –Tac –Toe Game using Alpha-beta pruning
6	3	Write a program to create a knowledge base using prepositional logic and show that the given query entails the knowledge base or not
7	3	Write a program to create a knowledge base using prepositional logic and prove the given query using resolution
8	3	Convert given first order logic statement into Conjunctive Normal Form (CNF).
9	3	Implement unification in first order logic
10	4	Create a knowledgebase consisting of first order logic statements and prove the given query using forward reasoning.

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

Case Studies on AI

1. Develop an Intelligent agent to administer delivery of medicines to appropriate patients
2. Implement AI agent to develop pac game
3. Use genetic algorithms to optimize cash flow for a business

Sem	**III**		
Course Title:	**Foundations of Data Science**		
Course Code:	**23DS3PCFDS**	**Total Contact Hours: 40 hours**	
L-T-P:	**3-0-0**	**Total Credits:**	**3**

Unit No.	Topics	Hours
1	**Introduction to Data Science:** Describing Data science , The data science Venn diagram, Python for Data Science , Data science case studies **Types of Data**: structured versus unstructured data, quantitative versus qualitative data, the four levels of data: nominal, ordinal, interval and ratio Total information awareness, Bonferroni's Principle, Rhine's paradox. **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.	8
2	**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 Information Gain & Entropy, Probability Theory, Probability Types, Probability Distribution Functions, Bayes' Theorem, Inferential Statistics	8
3	**Correlation Analysis:** Types of correlation, correlation coefficient. **Regression Analysis:** Linear Regression: Simple Linear Regression, Multilinear Regression,p-values, Logistic Regression, Multinomial logistic regression, Time-Series Model, Receiver Operating Characteristic	8
4	**Dealing with missing data**: single and multiple data imputation, Entropy based techniques, Monte Carlo and MCMC simulations; **Correcting inconsistent data:** Deduplication, Entity resolution, Pairwise Matching; Fellegi-Sunter Model **Dimensionality Reduction:** Eigenvalues and Eigenvectors of Symmetric Matrices:Definitions, Computing Eigenvalues and Eigenvectors, Finding Eigenpairs by Power Iteration, Eigenvector matrix Principal-Component Analysis:Example, Using Eigenvectors for Dimensionality Reduction, The matrix of distances Singular-Value Decomposition: Definition, interpretation, Dimensionality Reduction Using SVD, Why Zeroing Low Singular Values Works, Querying Using Concepts, Computing the SVD of a Matrix	8

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

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,	1st 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	**2nd**	Dreamtech Press	2016

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.	**IBM 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	**Ability** to obtain fundamental knowledge on data science
CO2	**Analyze** and visualize data for knowledge representation.
CO3	**Demonstrate** proficiency in data analysis.
CO4	Ability to **conduct** experiments to **demonstrate** the use of various data science tools

CO-PO-PSO mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO 7**	**PO 8**	**PO9**	**PO10**	**PO11**	**PO1 2**
CO1	3											
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**
Alternate Assessment Tool	**-**	**-**
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
Unit-3	Internal Choice	Two Questions to be asked for 20 Marks
Unit-4	Mandatory	One Question to be asked for 20 Marks
Unit-5	Mandatory	One Question to be asked for 20 Marks

Sem :	**3rd**		
Course Title:	**Full Stack Web development**		
Course Code:	**22CS3AEFWD**		
L-T-P:	**0-0-1**	**Total Credits:**	1

A 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.

A 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.

C CO-PO-PSO mapping

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

D Assessment Plan (for 50 marks of CIE)

Tool	Remarks	Marks
Internals	**---**	**---**
QUIZ	**---**	**---**
Lab Component	**---**	**50**
Alternate Assessment Tool	**----**	**--**
Total		**50**

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.
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.

E **Tutorial Plan** *(if applicable)*

F **Laboratory Plan** *(if applicable)*

Project Topics for Website Development:

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	• 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	• 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	• 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	• Techniques for managing and integrating data in web applications. • Database technologies (MongoDB, SQL), Integrating databases with back-end (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	• 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	• 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		

Text Book :

Supplementary texts and resources

1. **Modern Full-Stack Development: Using Type Script, React, Node.js ,** Frank Zammetti ,2020 (1st Edition) ,Apress
2. Beginning MERN Stack , Build and Deploy a Full Stack MongoDB, Express, React, Node.js App, Greg Lim ,2021

Tutorial Link:

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-javacript
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/

G SEE Exam (50 Marks)

Evaluation of Projects carried out by students from External examiner along with internal faculty.

Department of Artificial Intelligence & Data Science

160 Credit Scheme

For Batch 2022 onwards

No.	Course Type	Code	Course Title	Credits			Total Credits	Total Hours
				L	T	P		
1	BS	23MA4BSLAO	Linear Algebra and Optimization	2	1	0	3	4
2	ES	23DC4ESTOC	Theory of Computation	3	0	0	3	3
3	PC	23DC4PCOPS	Operating Systems	3	0	0	3	3
4	PC	23DS4PCCON	Computer Networks	3	0	0	3	3
5	PC	23DS4PCMLG	Machine Learning	3	0	1	4	5
6	PC	23DC4PCDAA	Design and Analysis of Algorithms	3	0	1	4	5
7	AE	23DS4AEDVZ	Data Visualization using Tools	0	0	1	1	2
		23DS4AEJUL	JULIA for Data Science					
		23DS4AEGIT	Version Controller with GIT					
8	UHV	22MA4HSUHV	Universal Human Values	0	1	0	1	2
9	NCMC	23NCMC4NS2	NSS	0	0	0	0	1
		23NCMC4YG2	YOGA					
		23NCMC4PE2	Physical Edu. (Sports and Athletics)					
	TOTAL						22	28

PC-14, ES-3, BS-3, UHV-1, AE-1

Course Title	Linear Algebra and Optimization	Course Code	23MA4BSLAO
Credits	03	L – T – P	2-1-0
Contact hours	39		

Course Objectives:

The objectives of the course are to facilitate the learners to

- Appreciate the importance of linear algebra in computer and allied engineering science.
- Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
- Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

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

- Lecture method(L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, and develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

CONTINUOUS OPTIMIZATION – 1 **[8 hours]**

Function of several variables, partial differentiation, local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-2

CONTINUOUS OPTIMIZATION-2 **[7 hours]**

Optimization using gradient descent/ascent and NR method.
Sequential search 3-point search and Fibonacci search.
Constrained Optimization, Method of Lagrange multipliers, KKT optimality conditions.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-3

INNER PRODUCT SPACES **[8 hours]**

Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt orthogonalization process, QR-factorization, least squares problem and least square error. Curve fitting – Principle of least squares, fitting a straight line and fitting a parabola.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-4

EIGENVALUES AND EIGENVECTORS [8 hours]

Introduction, Polynomials of Matrices, Cayley-Hamilton Theorem, eigen spaces of a linear transformation, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form.

Teaching-Learning Process:	Chalk and Board, Problem-based learning

UNIT-5

MATRIX DECOMPOSITION AND THEIR APPLICATIONS [8 hours]

Diagonalization, Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, rank and signature of real quadratic forms, Singular value decomposition. Dimensional reduction – PCA.

Teaching-Learning Process:	Chalk and Board, Problem based learning

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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA4BSLIA	CO 1	Apply the concepts of linear algebra in Computer and Allied Engineering Sciences.	1	3
	CO 2	Demonstrate the applications of computer science and Allied Engineering Science using modern ICT tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 1, 2 and 5 and two questions each from Units 3 and 4.

SUGGESTED LEARNING RESOURCES:

Text Books:

1. Linear Algebra and its applications, David C. Lay, Steven R. Lay, Judi J Mc. Donald, 6th Edition, 2021, Pearson Education.
2. Linear Algebra and its Applications, Gilbert Strang, 4th edition, 2005, Brooks Cole.
3. Linear Algebra: An Introduction, Richard Bronson & Gabriel B. Costa, 2nd edition, Academic press.

Reference Books:

1. Schaum's outline series -Theory and problems of linear algebra, Seymour Lipschutz, Marc Lipson, 6th edition, 2017, McGraw-Hill Education.
2. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020
3. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Pearson, 2019, Fifth Edition.
4. Mathematics for Machine learning, Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
5. Linear Algebra, Kenneth Hoffman, Ray Kunze, 2nd edition, Pearson.

E-books and online course materials:

1. https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm
2. https://www.math.ucdavis.edu/~linear/linear.pdf

Online Courses and Video Lectures:

1. https://www.coursera.org/learn/linear-algebra-machine-learning
2. https://nptel.ac.in/syllabus/111106051/

Sem	**IV**		
Course Title:	**Theory of Computation**		
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

Prescribed Text Book

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

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

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

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

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

Prescribed Text Book					
Sl. No.	**Book Title**	**Authors**	**Edition**	**Publisher**	**Year**
1.	Operating System Concepts	Abraham Silberschatz, Peter Baer	9th Edition	John Wiley & Sons	2018

		Galvin , Greg Gagne			
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	2006 & 2013	https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/index.html
2.	Operating System Concepts	Abraham Silberschatz, Peter Baer Galvin , Greg Gagne	9th 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

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
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Unit-5	Mandatory	One Question to be asked for 20 Marks

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

Semester	**IV**		
Course Title:	**Computer Networks**		
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	**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	**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**

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

E-Book						
Sl. No.	**Book Title**	**Authors**	**Edition**	**Publisher**	**Year**	**URL**
1.	An Introduction to Computer	Peter L Dordal	1st Edition	-	2020	https://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf

	Networks					
2.	A Top-Down Approach: Computer Networking	James F Kurose & Keith W Ross	8th Edition	Pearson	2021	https://gaia.cs.umass.edu/kurose_ross/online_lectures.htm

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	3	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 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

B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

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

Unit No.	Topics	Hours
1	**Machine Learning Landscape:** Introduction, Types of Machine Learning, Challenges of Machine Learning, Testing and Validating. **Supervised Learning** **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	8
2	**Support Vector Machines:** Linear SVM, Non Linear SVM, SVM Regression, Under the Hood. **Instance Based Learning:** Introduction, k-Nearest Neighbor learning	8
3	**Probabilistic Learning** 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.	8
4	**Ensemble Learning and Random Forests:** Voting Classifiers, Bagging and Pasting, Random Patches and Random Subspaces, Random Forests, Boosting, Stacking	8
5	**Unsupervised Learning Techniques** Clustering – Kmeans, DBSCAN, Other Clustering Algorithms, Gaussian Mixtures – Anomaly Detection, Selecting Clustering, Bayesian Gaussian Mixture Models, Other algorithms for anomaly and novelty detection **Reinforcement Learning:** Markov Decision Process, Introduction, Learning Task, Q Learning	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

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.

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**

Lab Program	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
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.

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

Semester	**IV**		
Course Title:	**Design and Analysis of Algorithms**		
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

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	Thomas H Cormen,	Third Edition	The MIT Press	2009

		Charles E Leiserson, Ronald L Rivest, Clifford Stein			

Reference Text Book					
Sl. No.	**Book Title**	**Authors**	**Edition**	**Publisher**	**Year**
1.	Fundamentals of Computer Algorithms	Ellis Horowitz,Satraj Sahni and Rajasekhara m	2ndEdition	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

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.

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.

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

Sem	**IV**		
Course Title:	**Data Visualization using Tools**		
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	Second Edition	O'Reilly	2017
2.	Pro Tableau: A Step by Step Guide	Seema Acharya , Subhashini Chellappan	Second 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

E-Book						
Sl. No.	**Book Title**	**Authors**	**Edition**	**Publisher**	**Year**	**URL**
1.	Data Visualization with Python and	Kyran Dale	-	O'Reilly	2016	https://github.com/jllovet/dataviz-with-py-and-js

	JavaScript					
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

Laboratory Plan *(if applicable)*

Lab-cycle-1

1. Using the sales_data.csv, create the visualization report for the following using Matplotlib:

   a. Get total profit of all months and show line plot with the following Style properties

   Generated line plot must include following Style properties: –

   · Line Style dotted and Line-color should be green

   · Show annotation

   · Add a square marker.

   · Add ticks for both X and Y axis

   b. Read Bathing soap facewash of all months and display it using the Subplot

2. Using the sales_data.csv, create the visualization report for the following using Matplotlib:

   a. Get total profit of all months and show line plot with the following Style properties

   Generated line plot must include following Style properties: –

   · Line Style dashed and Line-color should be green

   · Show legend at the lower right location

   Add ticks for both X and Y axis

   · Line width should be 2

   b. Read toothpaste sales data of each month and show it using a bar plot

3. Using the sales_data.csv, create the visualization report for the following using Matplotlib:
    a. Calculate total sale data for last year for each product and show it using a Pie chart
        · Print the total sale inside each part
        · Explode the highest sale
        · Set the start angle=60
    b. Read face cream and facewash product sales data and show it using the horizontal bar chart

4. Write a Python programming for the following:

    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

        · Add ticks for both axis
        · Show legend at the upper right corner

    b. 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)
        · Add labels and ticks
        · Use annotation

5. Write a Python programming for the following:

    a. To create a pie chart with a title of the pass percentage of subjects.

    Sample data:

    Subjects: DSC, OOP, OPS, COA, MAT, Java

    Pass percentage (%): 40, 25.6, 8.8, 30, 7.7, 60.7

        · Print percentage inside the chart
        · Use explode property

    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

6. Using the dataset planets.csv, create the visualization report for the following using Seaborn:

    a. Get the distance covered year-wise and show scatter plot with the following

properties

- Add “mass” as additional features
- Use different markers
- Control the range of marker areas with sizes

b. Read the orbital_period of each year and show it using the histogram.

7. Using the dataset planets.csv, create the visualization report for the following using Seaborn:

   a. Get the distance covered year-wise and show scatter plot with the following properties

      - Add “mass” and “method” as additional features
      - Change the default color palette
      - Display the complete legend

   b. Read the distance for each method and show it using the bar chart.

8. Using the dataset titanic.csv, create the visualization report for the following using Seaborn:

   a. Demonstrate the use of “displot”
   b. Plot the distribution using Kernel density estimation.
   c. Use lineplot for any two suitable features
   d. Generate scatter plot with different color palette

9. Using the dataset titanic.csv, create the visualization report for the following using Seaborn:

   a. Demonstrate the subplots (2x1) on scatter plots
   b. Demonstrate the use of violin plot
   c. Get different line plots for survival of passengers class wise.
   d. Create visualization for strip plot without jitter

10. Using the dataset titanic.csv, create the visualization report for the following using Seaborn:

    a. Create a visualization using categorical plot and re-order the axis contents
    b. Demonstrate the use of violin plot

c. Demonstrate the subplots (1x3) on line plots

d. Generate scatter plot with different color palette

Lab-cycle-2

I. Create the visualization using Tableau for the "Corriander_seed_2021.csv" dataset.

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 set

d. Create the visualization by using quick table calculation

e. Customize the data using any three number functions

II. Create the visualization using Tableau for the "Corriander_seed_2021.csv" dataset.

a. Demonstrate the use of cascading filter, calculation filter and data source filter.

b. Demonstrate creating Hierarchies

c. Demonstrate the creation of computed sets

d. Create a visualization using a calculated field

e. Customize the data using any three string functions

III. Create the visualization using Tableau for the "Corriander_seed_2021.csv" dataset.

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 field

d. Customize the data using any three number functions

e. Demonstrate the creation of constant set

IV. Create the visualization using Tableau for the "supermarket_sales.csv" dataset.

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 set

d. Create a visualization using a calculated field

e. Customize the data using any three string functions

V. Create the visualization using Tableau for the "supermarket_sales.csv" dataset.

a. Demonstrate the use of cascading filter, calculation filter and data source filter.
b. Demonstrate creating Hierarchies
c. Demonstrate the creation of computed sets
d. Create the visualization by using quick table calculation
e. Customize the data using any three number function

VI. Create the visualization using Tableau for the "supermarket_sales.csv" dataset.
a. Demonstrate the use of filters (General, wildcard, condition and limits)
b. Demonstrate creating Hierarchies
c. Create the visualization by using quick table calculation
d. Demonstrate the creation of constant set
e. Customize the data using any three string functions

VII. Create the visualization using Tableau for the "supermarket_sales.csv" dataset.
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 set
d. Create a visualization using a calculated field
e. 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 p communicate the results for documentation and interpretation.

CO-PO mapping

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

Proposed Assessment Plan (for 50 marks of CIE)

Assessment Tool	No. of Assessments	Marks
Internals	-	-
QUIZ/AAT	-	-
Lab Component	-	**50**
Total		**50**

Course Code	22MA3HSUHV/ 22MA4HSUHV	Course Name	Universal Human Values
Credits	01	L-T-P	0-1-0
Total Number of hours		15	

Course Objectives:

To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.

UNIT – 1

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

UNIT – 2

Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT – 3

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

UNIT – 4

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1. Understanding the harmony in the Nature
2. Holistic perception of harmony at all levels of existence.

UNIT – 5

Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

At the end of the course, the student will have the ability to

CO1	Conduct self-exploration and distinguish between values and skills, happiness and accumulation of physical facilities, the self and the body, Intension and Competence of an individual
CO2	Analyze the value of harmonious relationship based on trust and respect in personal and professional life
CO3	Examine the role of a human being in ensuring harmony in society and nature
CO4	Apply the understanding of ethics in life and profession

TEXT BOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE MATERIAL:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)