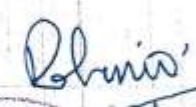_____

Curriculum Structure and Syllabus
of
Second Year B. Tech
Artificial Intelligence and Data Science
(2025 Pattern)

Course Approval Summary – Board of Studies Artificial Intelligence and

Data Science Engineering

Sl. No.	Approved By	Signature and Stamp of Authority
1	Chairman, Board of Studies, AI&DS	30/12/2025
2	Secretary, Academic Council, NMIET, Pune	
3	Chairman, Academic Council, NMIET, Pune	Director Nutan Maharashtra Institute of Engineering & Technology Talegaon Dabhade - 410507

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

VISION OF THE INSTITUTE

To be a notable institution for providing quality technical education and ensuring ethical, moral and holistic development of students.

MISSION OF THE INSTITUTE

To nurture engineering graduates with state-of-the-art competence, professionalism and problem-solving skills to serve needs of industry as well as society.

VISION OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

To be a pioneer in Artificial Intelligence and Data Science education and research, empowering students to become innovators, entrepreneurs, and socially responsible leaders who create intelligent solutions for a sustainable and inclusive future.

MISSION OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

- To deliver quality education in Artificial Intelligence and Data Science with strong theoretical and practical foundations.
- To promote research, innovation, and patents in emerging technologies for sustainable solutions.
- To strengthen industry collaboration through internships, projects, and skill-based training.
- To instill ethical values and social responsibility, applying AI for the benefit of society.

INDEX

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

COURSE-WISE CREDIT DISTRIBUTION

Sl. No.	Type of Course	No. of Courses	Total Credits	
			No.	%
1.	Basic Science Course (BSC)	8	14	8.14
2.	Engineering Core Course (ECC)	10	15	8.72
3.	Programme Core Course (PCC)	28	54	31.40
4.	Programme Elective Course (PEC)	9	20	11.63
5.	Multidisciplinary Minor (MDM)	7	13	7.56
6.	Open Elective Course (OEC)	3	8	4.65
7.	Vocational and Skill Enhancement Course (VSEC)	4	8	4.65
8.	Ability Enhancement Course (AEC)	2	4	2.33
9.	Entrepreneurship / Management Course(EMC)	2	4	2.33
10.	Value Education Course (VEC)	2	4	2.33
11.	Experiential Learning Courses	8	22	12.79
12.	Indian Knowledge System	1	2	1.16
13.	Co-curricular Courses	2	4	2.33
	TOTAL	**86**	**172**	**100**

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

SEMESTER-WISE COURSE DISTRIBUTION

Sl No.	TYPE OF COURSE	NO. OF COURSES / SEMESTER								Total
		1	2	3	4	5	6	7	8	
	COURSE DISTRIBUTION: SEMESTER WISE									
1.	Basic Science Course (BSC)	4	4	-	-	-	-	-	-	8
2.	Engineering Science Course (ESC)	6	4	-	-	-	-	-	-	10
3.	Programme Core Course (PCC)	-	2	5	5	5	5	4	2	28
4.	Programme Elective Course (PEC)	-	2	-	-	2	3	2	2	11
5.	Multidisciplinary Minor (MDM)	-	-	1	1	2	1	-	2	7
6.	Open Elective Course (OEC)	-	-	1	1	1	-	-	-	3
7.	Vocational and Skill Enhancement Course (VSEC)	1	1	1	1	-	-	-	-	4
8.	Ability Enhancement Course (AEC)	1	1	-	1	-	-	-	-	3
9.	Entrepreneurship / Management Course (EMC)	-	-	1	1	-	-	-	-	2
10.	Value Education Course (VEC)	-	-	1	1	-	-	-	-	2
11.	Experiential Learning Courses	-	-	-	1	1	1	1	1	5
12.	Indian Knowledge System	-	1	-	-	-	-	-	-	1
13.	Co-curricular Courses	1	1	-	-	-	-	-	-	2
Total		**13**	**16**	**10**	**12**	**11**	**10**	**07**	**07**	**86**

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

SEMESTER-WISE CREDIT DISTRIBUTION

Sl No.	TYPE OF COURSE	NO. OF COURSES / SEMESTER								Total
		1	2	3	4	5	6	7	8	
	COURSE DISTRIBUTION: SEMESTER WISE									
	1 Lecture hour = 1 Credit, 2 Lab Hours = 1 Credit, 1 Tutorial Hour = 1 Credit									
1.	Basic Science Course (BSC)	7	7	-	-	-	-	-	-	14
2.	Engineering Science Course (ESC)	9	6	-	-	-	-	-	-	15
3.	Programme Core Course (PCC)	-	3	10	10	10	8	8	4	53
4.	Programme Elective Course (PEC)	-	-	-	-	4	8	4	4	20
5.	Multidisciplinary Minor (MDM)	-	-	2	2	4	2	-	4	14
6.	Open Elective Course (OEC)	-	-	4	2	2	-	-	-	8
7.	Vocational and Skill Enhancement Course (VSEC)	2	2	2	2	-	2	-	-	10
8.	Ability Enhancement Course (AEC)	2	-	-	2	-	-	-	-	4
9.	Entrepreneurship / Management Course(EMC)	-	-	2	2	-	-	-	-	4
10.	Value Education Course (VEC)	-	-	2	-	-	-	-	-	2
11.	Experiential Learning Courses	-	-	-	2	2	2	8	8	22
12.	Indian Knowledge System	-	2	-	-	-	-	-	-	2
13.	Co-curricular Courses	2	2	-	-	-	-	-	-	4
Total		**22**	**22**	**22**	**22**	**22**	**22**	**20**	**20**	**172**

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

CURRICULUM STRUCTURE
Second Year B. Tech. Artificial Intelligence and Data Science

Semester – III

				Level 5.0												
				Second Year B. Tech Artificial Intelligence and Data Science												
				Semester III												
Sl. No.	Course Code	Course Type	Course Name	Credits			Teaching Scheme (Hours/Week)			Examination Scheme and Marks							
										CCE		ESE				
										UT	FA	SA				
				TH	TUT	PR	L	T	P	25	25	50	PR	OR	TW	TOTAL
1	AIDS25PCC-201	Programme Core Course	Object Oriented Programming using Java	2			2			25	25	50				100
2	AIDS25PCC-202	Programme Core Course	Foundation of Artificial Intelligence	2			2			25	25	50				100
3	AIDS25PCC-203	Programme Core Course	Object Oriented Programming using Java Lab			2			4				50		25	75
4	AIDS25PCC-204	Programme Core Course	Data Structures and Algorithm	2			2			25	25	50				100
5	AIDS25PCC-205	Programme Core Course	Data Structures and Algorithm Lab			2			4				50		25	75
6	AIDS25MDM-206	Multi-disciplinary Minor Course	Digital Electronics & Microprocessors	2			2			25	25	50				100
7	-	Open Elective Course	Open Elective Course(OEC)-I	3	1		3	1		25	25	50				100
8	-	Value Education Course	Value Education Course (VEC)-I		1	1		1	2						25	25
9	-	Vocational & Skill Enhancement Course	Vocational & Skill Enhancement Course (VSEC)-I			2			4					25	25	50
10	AIDS25EMC-210	Entrepreneurship / Management Course	Principles of Management & Entrepreneurship		1	1		1	2						25	25
	TOTAL			11	3	8	11	3	16	125	125	250	100	25	125	750
				22			29									

CCE- Comprehensive Continuous Evaluation, **ESE**- End Semester Evaluation, **TW**-Term Work, **OR**-Oral, **PR**-Practical, **TH**- Theory, **L**-Lecture, **TUT**-Tutorial, **UT**- Unit Test, **FA**–Formative Assessment, **SA** – Summative Assessment

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Basket: List of Courses – Open Elective Course -I

Course Code	Course Name	
CE25OEC-207	Computational Mathematics	
CAI25OEC-207	Probability Theory and Statistical Methods	
AIDS25OEC-207	Probability and Statistics	Choose Any one
IT25OEC-207	Numerical Statistical Analysis	
ETC25OEC-207	Vectors and Transforms	
ME25OEC-207	Applied Mathematics	

Basket: List of Courses – Value Education Course -I

Course Code	Course Name	
CSE25VEC-208	Universal Human Values	
ETC25VEC-208A	Professional Ethics for Engineers	Choose Any one
ETC25VEC-208B	Social Connect and Responsibility	

Basket: List of Courses – Vocational and Skill Enhancement Course -I

Course Code	Course Name	
AIDS25VSEC-209A	Scientific Computing with Python	
AIDS25VSEC-209B	Scientific Computing with R Programming	Choose Any one
AIDS25VSEC-209C	Web Development	

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

CURRICULUM STRUCTURE
Second Year B.Tech. Department of Artificial Intelligence and Data Science
Semester – IV

				Credits			Teaching Scheme (Hours/Week)			Examination Scheme and Marks						
										CCE		ESE				
Sr. No.	Course Code	Course Type	Course Name	TH	TUT	PR	L	T	P	UT 25	FA 25	SA 50	PR	OR	TW	TOTAL
1	CE25PCC-251	Programme Core Course	Database management System	2			2			25	25	50				100
2	CE25PCC-252	Programme Core Course	Foundation to Machine Learning	2			2			25	25	50				100
3	CE25PCC-253	Programme Core Course	Foundation to Machine learning Lab			2			4				50		25	75
4	CE25PCC-254	Programme Core Course	Computer Network	2			2			25	25	50				100
5	CE25PCC-255	Programme Core Course	Database management System lab			2			4				25		25	50
6	CE25MDM-256	Multi-disciplinary Minor Course	Processor Architecture	2			2			25	25	50				100
7	--	Open Elective Course	Open Elective Course-II	2			2			25	25	50				100
8	--	Value Education Course	Value Education Course-II	1	1		1	1							25	25
9	CE25ELC-259	Experiential Learning Course	Community Engagement Project			2			4					50		50
10	IL25EMC-260	Entrepreneurship / Management Course	Entrepreneurship Skills Development		1	1		1	2						25	25
11	IL25AEC-261	Ability Enhancement Course	Modern Indian Languages (Marathi)	1		1	1		2						25	25
TOTAL				**12**	**2**	**8**	**12**	**2**	**16**	**125**	**125**	**250**	**75**	**50**	**125**	**750**
				22			**30**									

CCE- Comprehensive Continuous Evaluation**, ESE-** End Semester Evaluation, **TW-**Term Work, **OR-**Oral, **PR-**Practical, **TH-** Theory**, L-**Lecture, **T/TUT-**Tutorial, **UT-** Unit Test, **FA**–Formative Assessment, **SA** – Summative Assessment

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Basket: List of Courses – Open Elective Course –II

Course Code	Course Name	
CE25OEC-257	Digital Marketing	Choose Any one
ETC25OEC-257	Engineering Economics	
ME25OEC-257	Digital Finance	

Basket: List of Courses – Value Education Course -II

Course Code	Course Name	
CE25VEC-258	Indian Constitution	Choose Any one
AIDS25VEC-258	Environmental Science	

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Course Syllabus

Semester-III

Program	S. Y. B. Tech. (Artificial Intelligence and Data Science)		Semester: III	
Course	Object-Oriented Programming (OOP) using Java		Code: AIDS25PCC-201	
Credit	**Teaching Scheme (Hrs./Week)**			**Examination Scheme and Marks**			

Credit	Lecture	Practical	Tutorial	UT	FA	SA	Total
02	02	-	-	25	25	50	100

Pre-requisites: Prior knowledge & good understanding of Programming and Problem-Solving concepts is essential

Course Objectives:

This course aims at enabling students to:

1. To understand the principles of object-oriented programming (OOP).
2. To Analyze Object-oriented paradigm in program design.
3. To Apply Object-oriented programming insight using Java
4. To Apply Advanced Java Programming

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

CO1: Apply fundamental Java constructs such as control statements, classes, objects, constructors, arrays, and I/O operations to develop applications.

CO2: Implement object-oriented programming concepts including inheritance, polymorphism, abstraction, and dynamic binding to design modular and reusable software.

CO3: Develop robust applications using exception handling and multi-threading techniques to ensure efficient and reliable program execution.

CO4: Build Java applications that perform database connectivity using JDBC and support CRUD operations, along with executing basic statistical analysis and data visualization tasks.

	Course Contents	
Unit	**Description**	**Duration [Hrs]**
I	**Introduction to OOP Concepts and Control Structure** Programming paradigms- Introduction to programming paradigms, Introduction to four main Programming paradigms- procedural, object oriented, functional, and logic & rule based. Need of object- oriented programming, Fundamentals of object-oriented programming: Namespaces, objects, classes, data members, methods, messages, encapsulation, data abstraction and information hiding, inheritance, polymorphism. Benefits of OOP, Java as object-oriented programming language. Overview of java Language: simple java program structure: documentation section, package statement, import statements, class definition, main method class. Implementing Java Program, JVM, Data types, Primitive Types vs. Reference type, floating point numbers, operators and expressions, Java Class Libraries, Typical Java Development Environment, and Memory Concepts.	**8**

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

	Control Statements: Selection Statements: if, if-else, nested if-else, Iteration Statements: do, while, for, for-each statement, break, and continue statements.	
II	**Inheritance and Polymorphism** Inheritance: Super classes and Subclasses, protected members, relationship between super classes and subclasses, types of Inheritance, constructors in subclasses, object class. Polymorphism: Abstract classes and methods, final methods and classes, dynamic binding, polymorphism examples and Interfaces.	**7**
III	**Exception Handling and Multithreading** Exception handling: fundamentals, Exception Types, using try-catch, Multiple try-catch clauses, Nested try statements, throw, throws, finally, Built-in Exceptions, Multi-Threading: Java Thread Model, Main Thread, Creating a Thread , Creating Multiple Threads, Using isAlive() and join() Thread Priorities, synchronization, Suspending, Resuming, and Stopping Threads.	**7**
IV	**Advanced Concepts** Database Connectivity: Basics of JDBC, Connecting Java with MySQL/PostgreSQL, CRUD Operations using JDBC, Introduction to Prepared Statements. Java in Data Science: Overview, Reading and Writing Data (CSV, JSON), Basic Statistical Operations using Apache Commons Math, Introduction to Java FX for Data Visualization	**8**
	Total	**30**

Text Books:
1. Silberschatz, A., Korth, H. F., & Sudarshan, S. "Database System Concepts", 6th Edition, 2010, McGraw-Hill Education, ISBN: 0-07-120413-X
2. Connally T., Begg C., "Database Systems", 4th Edition, 2004, Pearson Education, ISBN 8178088614
3. Chodorow, K. "MongoDB: The Definitive Guide",1st Edition, 2010, O'Reilly Media, ISBN: 978-0-596-80948-5

Reference Books:
1. Date, C. J. "An Introduction to Database Systems", 8th Edition, 2003, Addison-Wesley, ISBN: 0-201-14471-9
2. Singh, S. K. "Database Systems: Concepts, Design and Application",1st Edition, 2008, Pearson Education, ISBN: 978-81-317-6092-5
3. Chodorow, K., & Dierolf, M."MongoDB: The Definitive Guide", 2nd Edition, 2013, O'Reilly Media, ISBN: 978-1-449-34468-9
4. 4. Fowler, A. "NoSQL For Dummies", 1st Edition, 2015, John Wiley & Sons, ISBN: 1118905628

MOOC / NPTEL/YouTube Links:
1. https://www.mongodb.com/resources/basics/databases/nosql-explained
2. https://learn.microsoft.com/en-us/azure/cosmos-db/nosql/modeling-data
3. http://www.nptelvideos.com/lecture.php?id=6518

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S.Y. B. Tech. (Artificial Intelligence and Data Science)					Semester: III	
Course	**Foundation of Artificial Intelligence**					**Code: AIDS25PCC-202**	
Credit	**Teaching Scheme (Hrs./Week)**			**Examination Scheme and Marks**			
02	**Lecture**	**Practical**	**Tutorial**	**UT**	**FA**	**SA**	**Total**
	2	**-**	**-**	**25**	**25**	**50**	**100**

Pre-requisites: Prior knowledge of Discrete Mathematics, Any Programming Knowledge (Python/MATLAB/Java), Machine Learning is essential.

Course Objectives:

This course aims to enable students:

1. To understand the fundamental concepts, history, and scope of Artificial Intelligence.
2. To learn problem-solving techniques using search strategies and intelligent agents.
3. To develop the ability to apply heuristic search methods and game-playing techniques.
4. To understand knowledge representation methods and reasoning processes used in AI systems.

Course Outcomes:

After completion, students will be able to:

CO1: Describe the basic concepts of AI, history, AI problems, applications, and intelligent agents

CO2: Apply problem-solving methods and search strategies to formulate and solve AI problems.

CO3: Analyze heuristic search algorithms and game-theoretic decision-making techniques.

CO4: Apply knowledge representation and reasoning techniques for solving AI-based tasks.

	Course Contents	
Unit	**Description**	**Duration [Hrs]**
I	**Introduction AI** What is AI, History, AI problems, Classification of AI systems, AI Application (E-Commerce, & Medicine). Statistical Analysis: Relationship between attributes: Covariance, Correlation Coefficient, Chi Square. Intelligent Agent: Concept of Rationality, nature of environment, structure of agents.	7
II	**Overview to Problem Solving** Problem solving by Search- forward and backward, Problem space - State space, Blind Search - Types, Performance measurement. Problem-solving Agents, Type and Example problems.	8
III	**Heuristic Search** Heuristic search Types, Hill Climbing, Best first search, mean and end analysis, Constraint Satisfaction, A* and AO* Algorithm. Game Theory, Optimal Decisions in Games, Game playing minimax algorithm, Alpha-Beta Pruning.	7
IV	**Knowledge Representation and Reasoning Logical systems** Knowledge based systems, Propositional Logic Constraints, Predicate Logic, First Order Logic, Inference in First Order Logic, Ontological Representations and	8

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

	applications. Foundation of reasoning and sample application, Reasoning with defaults, Reasoning about knowledge.		
	Total Hrs		**30**

Text Books:
1. Russell, S. and Norvig, P., Artificial Intelligence: A Modern Approach, 3rd Edition, 2010, Prentice Hall. Rich, E. and Knight, K., Artificial Intelligence, 3rd Edition, 1991, McGraw-Hill.

Reference Books
1. Luger, G. F., Artificial Intelligence: Structures and Strategies for Complex Problem Solving, 4th Edition, 2002, Pearson Education.
2. Poole, D. and Mackworth, A., Artificial Intelligence: Foundations of Computational Agents, 1st Edition, 2010, Cambridge University Press.
3. Padhy, N. P., Artificial Intelligence and Intelligent Systems, 1st Edition, 2009, Oxford University Press.
4. Charniak, E. and McDermott, D., Introduction to Artificial Intelligence, 1st Edition, 1985, Addison-Wesley.

Online Sources:
1. NPTEL Artificial Intelligence: Search Methods for Problem solving https://onlinecourses.nptel.ac.in/noc22_cs67/preview

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S. Y. B. Tech (Artificial Intelligence and Data Science)		Semester: III	
Course	Object Oriented Programming Lab		Code	AIDS25PCC-203
Credits	Teaching Scheme (Hrs./Week)		Examination Scheme and Marks	

Credits	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	2	-	25	-	50	75

Pre-requisites: Prior knowledge of basic knowledge of Core Java programming and object-oriented concepts is required is essential.

Course Objectives:

This course aims at enabling students to:

1. To Understand and apply core Object-Oriented Programming concepts such as Classes, Objects, Inheritance, Polymorphism, and Abstraction in Java.
2. To Utilize Java Collections to store and manage groups of data efficiently.
3. To Handle exceptions using try-catch blocks to write robust Java programs.
4. To Perform file operations including reading, writing, and appending data to files for effective data management.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Use Java classes and objects and apply constructors to set their values.
CO2: Apply encapsulation and inheritance principles to design secure and reusable code.
CO3: Demonstrate polymorphism via method overloading and overriding for flexible program behaviour.
CO4: Implement exception handling and file handling techniques to ensure robust data processing.

Guidelines for Laboratory Conduction

The instructor is expected to conduct **Four assignments from each group (A, B), Two assignments from C and One Mini Project from D.** The instructor may set multiple sets of assignments and distribute them among batches of students.

Guidelines for Students Journal and term work assessment

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory Concept in brief, algorithm, flowchart, test cases, Test Data Set (if applicable), mathematical model (if applicable), conclusion/analysis.

Continuous assessment of laboratory work should be done based on overall performance of student.

Assessment of the student should be based on predefined rubrics finalized during course meetings.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

statement. The supplementary and relevant questions may be asked at the time of evaluation to test the students for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Suggested List of Experiments/Assignments	
Sl. No	**Problem Statement**
Group A	
1	Implement a robust Java calculator program that captures user input dynamically, processes mathematical expressions using conditional logic and looping constructs, and ensures efficient error handling.
2	Develop a Java program for an E-commerce order processing where some products are initialized through multiple constructors, users can input some product details manually, the system computes total order cost dynamically, applies discount policies based on conditions, and presents a detailed invoice summarizing the purchase.
3	Write a Java program that demonstrates the overloading method to compute power and absolute of a number for various data types and utilizes the static method from Math class for the same operation
4	Write a Java program to implement a Library Management System where books can be added, issued, and returned. The system should track the total number of books using a static field and allow users to view book details, issue or return books, and check the total book count using static methods
5	Develop a Java program that performs various operations on arrays, including displaying elements, finding the maximum and minimum elements, calculating the sum and average of elements, and searching for a specific element within the array.
6	Develop a Java program that implements a simple hotel room booking system using two-dimensional arrays. The system allows users to: View available and booked rooms, Book a room by selecting a floor and room number and exit the system when finished.
GROUP B	
7	Create a Java program demonstrating single inheritance where a subclass extends a super class and calls its methods.
8	Implement an interface in Java and create multiple classes that implement the interface, demonstrating polymorphism.

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

9	Write a Java program to create an abstract class with an abstract method and extend it in a subclass that provides an implementation.
10	Develop a Java application that simulates an ATM machine. Implement functionalities like checking account balance, withdrawing, and depositing money. Use try, catch, and finally blocks to handle potential exceptions such as insufficient funds (throwing Arithmetic Exception) and invalid input (throwing Illegal Argument Exception). Ensure that the application continues to run smoothly after handling exceptions.
11	Develop a Java application that simulates an online shopping system. Implement functionalities such as adding items to the cart, calculating the total price, and processing payments. Use *try,* catch, and finally blocks to handle exceptions like Number Format Exception for invalid input and Arithmetic Exception for any calculation errors.
12	Develop a Java application that monitors stock prices in real-time using two threads. One thread should fetch the stock prices from an API, and the other should display the prices. Use *Thread .sleep()* to simulate the delay in fetching prices and *join()* to ensure both threads complete before displaying the results. Implement thread synchronization to handle simultaneous access to shared resources.
13	Create a multi-threaded Java application that simulates a basic chat system. Each user (thread) sends and receives messages. Use is *Alive()* to check the status of threads and *join()* to ensure proper synchronization. Implement thread priorities to handle high-priority messages and demonstrate thread suspension, resumption, and stopping
	GROUP C
14	Create a Java application that connects to a MySQL/PostgreSQL database to manage employee information. Implement functionalities like adding, updating, deleting, and viewing employee records using JDBC. Use prepared statements to prevent SQL injection and handle exceptions gracefully.
15	Develop a Java application that connects to a MySQL/PostgreSQL database to manage student information. Implement CRUD operations for student records using JDBC. Use prepared statements to handle SQL queries securely and ensure proper transaction management.
16	Create a Java application that reads weather data from a CSV file and performs basic statistical operations using Apache Commons Math. Use JavaFX to create interactive charts and graphs to visualize temperature trends, humidity levels, and other weather parameters.
17	Develop a Java application that reads patient data from a CSV file and calculates basic statistics such as average age, median heart rate, and standard deviation of blood pressure using the Apache Commons Math library. Implement functionality to visualize the data using JavaFX charts
	GROUP D (Mini Project)

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

18	Banking system having the following operations:
	    Create an account
	    Deposit money
	    Withdraw money
	    Honor daily withdrawal limit
	    Check the balance
	    Display Account information.

19	Banking system having the following operations:
	    Create an account
	    Deposit money
	    Withdraw money
	    Honor daily withdrawal limit
	    Check the balance
	    Display Account information.

Reference Books:

1. Herbert Schildt, Java: The Complete Reference, 12th Edition, 2021, McGraw-Hill (updated for Java SE 17).
2. Herbert Schildt, Java: A Beginner's Guide, 8th Edition, 2021, McGraw-Hill.
3. E. Balagurusamy, Programming with Java, 7th Edition, 2023, McGraw-Hill.
4. Kathy Sierra & Bert Bates, Head First Java, 3rd Edition, 2022, O'Reilly Media.
5. Patrick Naughton & James Gosling, The Java Programming Language, 1st Edition, 1996, Addison-Wesley.
6. Brian Goetz et al., Java Concurrency in Practice, 1st Edition, 2006, Addison-Wesley.

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S.Y. B. Tech. (Artificial Intelligence and Data Science)		Semester: III	
Course	Data Structures and Algorithm		Code	AIDS25PCC-204

Credit	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
02	Lecture	Practical	Tutorial	UT	FA	SA	Total
	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of fundamental concepts of algorithms and problem-solving.

Course Objectives:

This course aims at enabling students:

1. To understand the fundamental concepts of data structures, algorithms, and abstract data types.
2. To develop the ability to design and analyse algorithms for efficiency in terms of time and space.
3. To implement linear and nonlinear data structures for problem solving.
4. To apply sorting, searching, hashing, and graph techniques to solve computational problems.
5. To introduce advanced algorithmic strategies like greedy methods and dynamic programming.

Course Outcomes:

After completion, students will be able to:

CO1: Describe fundamental data structures, algorithms, and complexity notations.

CO2: Apply appropriate data structures (arrays, linked lists, stacks, queues) to solve problems

CO3: Analyze model performance using evaluation metrics and validation techniques.

CO4**:** Build and evaluate ML models for real-world problems using appropriate tools.

Course Contents		
Unit	**Description**	**Duration [Hrs]**
I	**Introduction to DSA & Algorithm Analysis** Introduction to Data Structures & ADTs - Algorithms and characteristics - Time & Space Complexity - Big-O, Ω, Θ notations - Recurrence Relations Memory allocation: stack, heap	7
II	**Linear Data Structures** Arrays, Linked Lists (SLL, DLL, CLL) - Stack ADT: operations, expression conversion & evaluation - Queue ADT: simple, circular, priority, deque - Applications of stacks & queues	8
III	**Non-linear Data Structures** Trees: Binary Tree, BST, Traversals - AVL Trees & Rotations - Heap & Heap Sort - Graphs: Representation, BFS, DFS - Shortest Path (Dijkstra), MST (Prim, Kruskal)	8
IV	**Searching, Sorting & Advanced Algorithms** Linear & Binary Search - Sorting: Bubble, Selection, Insertion, Merge, Quick, Radix - Hashing: functions, collisions, chaining, open addressing - Greedy Algorithms - Dynamic Programming - Case studies	7
	Total	30

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Text Books:

1. Ellis Horowitz & Sartaj Sahni — Fundamentals of Data Structures in C, 2nd Edition, 2008, Publisher: Universities Press (India) Pvt. Ltd., ISBN-10: 8173716056, ISBN-13: 978-8173716058
2. Mark Allen Weiss — Data Structures and Algorithm Analysis in *C++*, 4th Edition, 2013, Publisher: Pearson, ISBN-10: 013284737X, ISBN-13: 978-0132847377
   Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest & Clifford Stein — Introduction to Algorithms, 3rd Edition, 2009, Publisher: MIT Press, ISBN-10: 9780262033848, ISBN-13: 978-0262033848

Reference Books:

1. Robert Lafore — Data Structures & Algorithms in Java, 2nd Edition, 2002, Publisher: Sams Publishing (or equivalent reprints), ISBN-10: 0672329786, ISBN-13: 978-0672329784
2. Seymour Lipschutz — Data Structures (Schaum's Outline), 2nd Edition, 2014, Publisher: McGraw-Hill Education, ISBN-10: 0071811938, ISBN-13: 978-0071811933
3. Narasimha Karumanchi — Data Structures and Algorithms Made Easy: Data Structure and Algorithmic Puzzles, (5th/Updated Edition) 2016, Publisher: Career Monk Publications, ISBN-10: 819324527X, ISBN-13: 978-8193245279

E book:
1. https://opendsa-server.cs.vt.edu/OpenDSA/Books/Everything/html/index.html

Online Sources:
1. MIT OpenCourseWare – Introduction to Algorithms
   https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-fall-2011/
2. Coursera – Data Structures & Algorithms Specialization
   https://www.coursera.org/specializations/data-structures-algorithms
3. https://nptel.ac.in/courses/106/102/106102064/

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S.Y. B. Tech. (Artificial Intelligence and Data Science)				Semester: III		
Course	Data Structures and Algorithm Lab				Code: AIDS25PCC-205		
Credit	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
02	Lecture	Practical	Tutorial	TW	PR	OR	Total
	-	4	--	25	50	-	75

Pre-requisites Prior knowledge of C programming, basic problem-solving and mathematics skills.

Course Objectives:

This course aims at enabling students:

1. To understand basic and advanced data structures and algorithm analysis.
2. To implement linear and non-linear data structures in programs.
3. To analyse time and space complexity of algorithms.
4. To apply searching, sorting, greedy, and dynamic programming techniques to solve problems.

Course Outcomes:

After completion, students will be able to:

CO1: Explain fundamental concepts of data structures and algorithm analysis.

CO2: Implement linear data structures such as arrays, linked lists, stacks, and queues

CO3: Implement non-linear data structures like trees, heaps, and graphs.

CO4: Apply searching, sorting, hashing, greedy, and dynamic programming techniques.

Course Contents

Suggested List of Experiments/Assignments

Sl. No.	Problem Statement
GROUP A (Minimum of 4 assignments to be solved)	
1	Study of Time and Space Complexity; demonstration of Big-O
2	Implement 1D, 2D Arrays and basic operations (insert, delete, search)
3	Implement Singly, Doubly, and Circular Linked Lists
4	Implement Stack ADT using array and linked list; Expression conversion & evaluation
5	Implement Queue ADT: simple, circular, priority queue, de-queue
6	Case Study: File system directories modelled using trees
GROUP B (Minimum of 5 assignments to be solved)	
7	Implement Binary Search Tree operations and traversals

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

8	Implement AVL Tree with Rotations (LL, RR, LR, RL)
9	Implement Min-Heap / Max-Heap and Heap Sort
10	Implement Graph representation, BFS and DFS traversal
11	Implement Searching (Linear, Binary), Sorting (Merge/Quick), and Hashing techniques
12	Case Study Ideas: Google Maps shortest-path navigation using Dijkstra

Text Books:

1. Ellis Horowitz & Sartaj Sahni — Fundamentals of Data Structures in C, 2nd Edition, 2008, Universities Press (India) Pvt. Ltd., ISBN-10: 8173716056, ISBN-13: 978-8173716058
2. Mark Allen Weiss — Data Structures and Algorithm Analysis in C++, 4th Edition, 2013, *Pearson Education*, ISBN-10: 013284737X, ISBN-13: 978-0132847377
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest & Clifford Stein — Introduction to Algorithms (CLRS), 3rd Edition, 2009, *MIT Press*, ISBN-10: 0262033844, ISBN-13: 978-0262033848

Reference Books

1. Seymour Lipschutz — Data Structures (Schaum's Outline Series), 2nd Edition, 2014, McGraw-Hill Education, ISBN-10: 0071811938, ISBN-13: 978-0071811933
2. Robert Lafore — Data Structures and Algorithms in Java, 2nd Edition, 2002, Sams Publishing, ISBN-10: 0672329786, ISBN-13: 978-0672329784
   (Alternate: Data Structures and Algorithms in C++, 1st Edition, 1998, Sams Publishing, ISBN-10: 0672324539, ISBN-13: *978-0672324536*)
3. Narasimha Karumanchi — Data Structures and Algorithms Made Easy, 5th Edition, 2016, CareerMonk Publications, ISBN-10: 819324527X, ISBN-13: 978-8193245279

E Sources:

1. Programiz – DSA
   https://www.programiz.com/dsa
2. Khan Academy – Algorithms
   https://www.khanacademy.org/computing/computer-science/algorithms
3. Data Structures and Algorithms Design — offered by IIT Kanpur NPTEL+1
   https://nptel.ac.in/courses/106104697 NPTEL

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program:	S.Y. B. Tech. (Artificial Intelligence and Data Science)		Semester: III	
Course:	Digital Electronics and Microprocessor		Code: AIDS25MDM-206	
Credit	Teaching Scheme (Hrs./Week)		Examination Scheme and Marks	
02	Lecture	Practical	Tutorial	UT	FA	SA	Total
	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of Basic electronics system is essential

Course Objectives:

This course aims at enabling students:
1. To introduce the fundamental concepts of digital logic, number systems, and Boolean algebra.
2. To develop the ability to simplify logical expressions and design basic digital circuits.
3. To understand the architecture and working of microprocessors (8085/8086).
4. To learn basic instruction sets, addressing modes, and assembly language programming.

Course Outcomes:

After completion, students will be able to:

CO1: Apply Boolean algebra and K-map techniques to simplify digital circuits.
CO2: Design and analyse combinational and sequential logic circuits.
CO3: Explain the architecture, flags, registers, and memory organization of 8085/8086.
CO4**:** Analyse multiprocessor architectures, memory models, inter-processor communication
      mechanisms, and cache-coherence protocols for efficient parallel system design

Course Contents		
Unit No.	**Description**	**Duration [Hrs]**
I	**Logic Gates & Boolean Algebra** Basic concepts of Boolean algebra, DeMorgan's theorems, Boolean identities, Logic gates, IC packages; Universal building blocks; SOP & POS expressions; Simplification using Karnaugh Map (K-Map).	7
II	**Combinational & Sequential Digital Circuits** Adders, subtractors, multiplexers, demultiplexers, encoders, decoders; Flip-flops (SR, JK, D, T); Registers, Counters (Async/Sync), Timing diagrams.	6
III	**Introduction to Microprocessor Architecture &8085 Instruction** Microcomputer block diagram, Microprocessor evolution; Architecture of 8085: registers, flags, ALU; Architecture of 8086: block diagram, memory segmentation; Memory devices: RAM, ROM, EPROM, EEPROM, PLA. Machine & Assembly language, Instruction format, addressing modes; Types of instructions; 8085, 8085 Instruction set; Flowcharts, loops, subroutines, macros; Assembler directives & labels	8
IV	**Multiprocessor Architecture** Multiprocessor Architecture UMA, NUMA, COMA MPP Processor. Loosely and Tightly coupled multiprocessors, characteristics of multiprocessors &	9

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

	multiprocessing, Inter Processor communication network, Time shared bus, Crossbar switch, Interleaved memories S access, C access. Cache coherency and bus snooping and directory-based protocols. Massively Parallel Processors (MPP), Inter Processor Communication and Synchronization.	
	Total	30

Text Books:
1. R. S. Sedha — A Textbook of Applied Electronics*, 2nd/Revised Edition, 2008,* S. Chand & Company Ltd., ISBN-10: 8121927838, ISBN-13: 978-8121927833
2. Ramesh S. Gaonkar — Microprocessor Architecture, Programming & Applications with 8085**,** 5th Edition (commonly cited), 2002, Penram International Publishing (India), ISBN-10: 8187972882, ISBN-13: 978-8187972884
3. Douglas V. Hall — Microprocessors and Interfacing: Programming and Hardware, 2nd Edition, 2009, McGraw-Hill Education, ISBN-10: 0070601671, ISBN-13: 978-0070601673
4. M. Morris Mano — Digital Logic and Computer Design, (Pearson India edition), 2016/2017, Pearson Education India, ISBN-10: 933254252X, ISBN-13: 978-9332542525

Reference Books:

1. A. P. Godse & D. A. Godse — Digital Electronics
2. Kenneth J. Ayala — 8086 Microprocessor: Architecture, Programming & Interfacing (or similar titles on 8086/8051), Pearson / Cengage editions vary (e.g., 3rd Edition ~2000; ISBN often 978-8131505994 for some versions).
3. Barry B. Brey — The Intel Microprocessors, 8th Edition, 2009, Pearson Education, ISBN-10: 0136022725**,** ISBN-13: 978-0136022724
4. Floyd & Jain — Digital Fundamentals, Pearson, (edition varies, e.g., 10th Edition ~2013), ISBN often 978-9332541092 for Indian editions or similar.

MOOC / NPTEL/YouTube Links:
1. Digital Electronics: NPTEL: Digital Circuits – by Prof. S. Srinivasan https://nptel.ac.in/courses/108105113/?utm_source=chatgpt.com
2. Neso Academy: Digital Logic Tutorials, Microprocessor 8085 & 8086 https://onlinecourses.nptel.ac.in/noc25_ee49/preview?utm_source=chatgpt.com
3. Digital Electronics & Microprocessor (8085 programming) https://onlinecourses.swayam2.ac.in/cec21_cs16/preview?utm_source=chatgpt.com

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S.Y. B. Tech (Open Elective Course-I)			Semester: III			
Course	Computational Mathematics			Code:		CE25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior knowledge of algebra, trigonometry, and calculus from First-Year Engineering Mathematics.

Course Objectives: This course aims at enabling students:
1. To develop foundational knowledge of logic, sets, functions, relations, and combinatory.
2. To model and analyze computational problems using discrete mathematical structures.
3. To understand conceptual clarity and knowledge of Statistical methods and probability.
4. To understand Numerical techniques to approximate solutions for interpolation, integration, and ordinary differential equations.
5. To understand different transform methods like Fourier/Z transforms.

Course Outcomes: After completion of the course, the students will be able to:
CO1: Apply propositional/predicate logic and proof techniques for problem solving.
CO2: Solve counting problems using combinatory and recurrence relations.
CO3: Apply correlation and regression methods to analyze experimental data in reliability, probability, testing, and quality control.
CO4: Apply numerical methods for interpolation, differentiation, integration, and solving differential equations using single-step and multi-step methods.
CO5: Apply transforms to engineering systems related to signals, circuits, and control applications.

Course Contents		
Unit	**Description**	**Duration [Hrs]**
I	**Logic, Proof Techniques & Sets** Propositional logic, truth tables, Predicate logic, quantifiers Logical implications, inference rules Proof techniques: direct, contradiction, contrapositive, Mathematical induction Sets: set operations, algebra of sets Functions: injective, surjective, bijective	9
II	**Relations, Recurrence & Combinatory** Recurrence relations (basic introduction) Relations: definition, properties, equivalence relations, partial orders Combinatory: Permutations & combinations, Pigeonhole principal Inclusion–exclusion principle	9
III	**Statistics & Probability** Introduction to Data Science, Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation: Karl Pearson's correlation, Spearman's rank correlation,	9

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

	Regression analysis, and Reliability of regression estimates. Probability, Probability density function, and Central limit theorem, Probability distributions: Binomial, Poisson, Normal, and Test of hypothesis: Chi-square test	
IV	**Numerical Methods** Interpolation: Finite Differences, Newton's and Lagrange's interpolation formulae, Numerical differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of ordinary differential equations: Euler's method, Modified Euler's method, Runge-Kutta 4th order method, introduction to Predictor-Corrector methods.	**9**
V	**Fourier and Z-Transforms** Fourier Transform: Introduction to time-domain and frequency-domain representation of signals. Complex exponential form of Fourier series. Fourier integral representation. Fourier Transform and inverse Fourier Transform. Properties of Fourier Transform such as linearity, time shifting, frequency shifting, and scaling. Fourier sine and cosine transform with inverses. Z-Transform: Discrete-time signals and systems. Definition of Z-transform and region of convergence (ROC). Z-transform of basic sequences. Properties of Z-transform. Inverse Z-transform using standard pairs and partial fraction method. Applications of Z-Transform: Application of Z-transform in solving linear difference equations, analysis of discrete-time systems, stability analysis, and modeling of simple digital filters., Fourier sine and cosine transforms and their inverses.	**9**
	Total	**45**

Text Books:
1. Rosen, K. H., "Discrete Mathematics and Its Applications", 8th Edition-2019, McGraw-Hill Education, ISBN: 978-1-259-67651-2.
2. Kolman, B., Busby, R. C., & Ross, S., "Discrete Mathematical Structures", 6th Edition-2009/2010, Pearson/Prentice Hall, ISBN: 978-0-13-229751-6.
3. Lipschutz, S., & Lipson, M., Schaum's Outline of Discrete Mathematics, Revised 3rd Edition-2009, McGraw-Hill Education, ISBN: 978-0-07-161586-0.
4. Grimaldi, R. P., "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition- 2004 (reprints 2013), Pearson/Addison-Wesley, ISBN: 978-0-321-21103-3.
5. Ramana, B. V., Higher Engineering Mathematics, Tata McGraw-Hill, 2006. ISBN: 978-0-07-063419-0.

Reference Books:
1. Kenney, J. F. and Rosen, K. H., Discrete Mathematics, 1st Edition, McGraw-Hill Education, 2012. ISBN: 978-0-07-338309-5

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

2. Biggs, N. L., Discrete Mathematics, 2nd Edition, Oxford University Press, 2003.ISBN: 978-0-19-850717-8

3. Graham, R. L., Knuth, D. E. and Patashnik, O., Concrete Mathematics: A Foundation for Computer Science, 2nd Edition, Addison-Wesley, 1994. ISBN: 978-0-201-55802-9

4. Deo, N., Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall of India, 1974. ISBN: 978-0-13-363473-0

5. Epp, S. S., Discrete Mathematics with Applications, 4th Edition, Cengage Learning, 2011. ISBN: 978-0-495-39132-6

6. Kreyszig, E., Advanced Engineering Mathematics, Wiley Eastern Ltd., New Delhi (Indian Edition), 1999 (Reprinted). ISBN: 978-81-224-0883-6

7. Jain, M. K., Iyengar, S. R. K. and Jain, R. K., Numerical Methods for Scientific and Engineering Computation, 7th Edition, Khanna Publishers, 2013. ISBN: 978-81-7409-205-9

MOOC / NPTEL/YouTube Links:

1. NPTEL / SWAYAM Course: Discrete Mathematics by IIT Ropar
   https://onlinecourses.nptel.ac.in/noc20_cs82/preview

2. NPTEL / SWAYAM Course: Discrete Mathematics for CS by IIT Kanpur
   https://onlinecourses.nptel.ac.in/noc25_cs27/preview

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S.Y. B. Tech (Open Elective Course-I)			Semester: III			
Course	Probability Theory and Statistical Methods			Code:		CAI25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior knowledge of basic understanding of algebra and arithmetic operations is essential.

Course Objectives: This course aims at enabling students:
1. To introduce the fundamental concepts of probability, random variables, and distributions required to model real-world uncertainty.
2. To develop the ability to analyse discrete and continuous probability models and interpret their applications.
3. To provide understanding of statistical measures, sampling techniques, and the behaviour of sample data.
4. To explain estimation methods, hypothesis testing, and inference techniques used for data-driven decision making.
5. To enable students to apply probability and statistical tools for solving practical engineering and computational problems.

Course Outcomes: After completing this course, students will be able to:
CO1: Explain random variables, probability distributions, and their properties.
CO2: Apply standard discrete and continuous distributions to solve problems.
CO3: Analyze statistical measures and perform hypothesis testing for decision-making.
CO4: Apply point estimates, interval estimates, and MLE for parameter estimation.
CO5: Evaluate stochastic processes and Markov chain behaviors in AI-related scenarios.

Course Contents		
Unit	**Description**	**Duration [Hrs]**
I	**Fundamentals of Probability & Random Variables** Sets, events, sample space, mutually exclusive events, independent events, conditional probability, Bayes' theorem, random variables (discrete and continuous), PMF, PDF, CDF, expectation, variance, moments, joint distributions, marginal distributions, conditional distributions, independence of random variables, Markov's inequality, Chebyshev's inequality, Chernoff bounds, Weak Law of Large Numbers, Strong Law of Large Numbers, Central Limit Theorem. **Case Studies (Select any one):** Spam classification using Bayes' theorem, weather prediction using conditional probability, joint probability in manufacturing defect analysis, network traffic modelling using Central Limit Theorem.	10

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

II	**Probability Distributions** Bernoulli distribution, Binomial distribution, Geometric distribution, Poisson distribution, Poisson process, Uniform distribution, Exponential distribution, Normal distribution, mean and variance of distributions, Introduction of moment generation, applications in AI/ML and queuing systems. **Case Studies (Select any one):** Call center arrival modelling using Poisson distribution, defect detection in manufacturing using binomial distribution, waiting time analysis using exponential distribution, sensor reading variations modeled using normal distribution.	**8**
III	**Hypothesis Testing** Parameter and statistic, null hypothesis, alternative hypothesis, Type I error, Type II error, significance level, p-value, power of a test, large sample tests (mean, difference of means, proportion, difference of proportions), small sample tests (t-test for mean, t-test for difference of means), chi-square test, F-test for variances, hypothesis testing for real-world decision making. **Case Studies (Select any one):** A/B testing for e-commerce click-through rate improvement, medical data testing for treatment effectiveness, comparison of accuracy between two ML models, evaluating impact of teaching method using student score data.	**10**
IV	**Estimation – Point, Interval & MLE** Point estimation, interval estimation, confidence intervals for mean, confidence intervals for proportion, confidence intervals for binomial, Poisson and normal parameters, properties of estimators (unbiasedness, consistency, efficiency), Maximum Likelihood Estimation, MLE for binomial parameters, MLE for Poisson parameters, MLE for exponential distribution, MLE for normal distribution parameters. **Case Studies (Select any one):** MLE-based click-through rate estimation, estimation of failure rate of electronic components using exponential distribution, estimation of customer arrival rate in retail using Poisson distribution, confidence interval estimation for OTT movie rating averages.	**9**
V	**Stochastic Processes & Markov Chains** Introduction to stochastic processes, branching processes, Markov chains, transition probability matrix, state classification, recurrent states, transient states, absorbing states, stationary distributions, applications of Markov chains in AI, introduction to martingales and stopping times. **Case Studies (Select any one):** Google PageRank using Markov chains, customer loyalty state transition modelling, weather forecasting using Markov model, reinforcement learning grid-world transition modelling.	**8**
	Total	**45**

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Text Books:
1. R. A. Johnson, Miller and Freund's "Probability and Statistics for Engineers", Pearson Publishers, 9 th Edition, 2017.
2. John E. Freund, Benjamin M. Perles, "Modern Elementary Statistics", 12th Edition, Pearson, 2013. 3. Hamdy A. Taha, "Operations Research: An Introduction", Pearson, 2017, Tenth Edition.
3. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, S.Chand & Co, 2020.
4. Kantiswarup, P.K.Gupta and Manmohan Singh, "Operations Research", Sultan Chand & Sons, 2014.

**Reference Books*:*
1. Sheldon M. Ross: "Introduction to Probability and Statistics for Engineers and Scientists ", Academic Press.
2. A. Papoulis & S. U. Pillai: Probability, Random Variables, and Stochastic Processes McGraw-Hill
3. J. S. Milton & J. C. Arnold: Probability and Statistics in the Engineering and Computer Sciences McGraw-Hill

e-sources:
1. NPTEL – Stochastic Processes (IIT Bombay)
   https://nptel.ac.in/courses/111102014
2. University of Cambridge – Stochastic Processes Notes
   https://www.statslab.cam.ac.uk/~rrw1/markov/M.pdf

Program	S.Y. B. Tech (Open Elective Course-I)			Semester: III			
Course	**Probability and Statistics**			Code:		AIDS25OEC-207	
Credits	**Teaching Scheme (Hrs./Week)**			**Examination Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**UT**	**FA**	**SA**	**Total**
4	**3**	**-**	**1**	**25**	**25**	**50**	**100**

Pre-requisites: Prior knowledge of basic understanding of algebra and arithmetic operations, Fundamental concepts of probability.

Course Objectives: This course aims at enabling students:

1. To introduce the basic concepts of random variables and probability distributions.
2. To develop the ability to apply standard discrete and continuous distributions to real-world problems.
3. To analyze fundamental statistical measures and distribution properties.
4. To provide knowledge of hypothesis testing methods for decision-making.
5. To enable students to analyze real-life situations using statistical reasoning and case studies.

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

CO1: Demonstrate understanding of Set Theory concepts and their relevance to probability.

CO2: Interpret random variables**,** probability distribution functions, and basic probability concepts.

CO3: Apply standard discrete and continuous probability distributions (Binomial, Poisson, Uniform, Exponential, and Normal) to solve simple engineering problems.

CO4: Analyze statistical measures such as mean, quantiles, and to study distribution properties.

CO5: Evaluate hypotheses for population parameters and interpret results using real-life case studies.

	Course Contents	
Unit	**Description**	**Duration [Hrs]**
I	**Introduction to Set Theory** Basics of set Theory: Introduction to sets and algebra of sets, Random Experiment, Sample Space, Events, Complementary Events, Union and Intersection of Two Events, Difference Events, Exhaustive Events, Mutually Exclusive Events, Equally Likely Events, Independent Events.	**8**
II	**Introduction to Probability** Probability Theory: Mathematical & Statistical definition of Probability, Need of probability theory in Data science, Axiomatic definition of probability, Addition Theorem, Multiplication Theorem, Theorems of Probability, Conditional Probability, Inverse Probability, Joint Probability, Total Probability and Bayes Theorem. **Case Study**: Use of probability in real-life situations, like weather forecasting, sports betting, sales forecasting etc.	**7**

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

III	**Introduction to Statistics** Introduction, Types of Sampling, Purposive Sampling, Random Sampling, Simple Sampling, Stratified Sampling, Parameter and Statistic, Sampling Distribution 54 Sampling with and Without Replacement, Population Parameters, Sample Statistics. Introduction, Arithmetic Mean, Simple and weighted mean for raw data, Discrete frequency distribution, Continuous frequency distribution, Properties of A.M., Merits & Demerits of A.M. Median, Mode for raw data, Merits and demerits of Median and Mode. **Case Study**: Create measures of central tendency for a real-life example dataset, such as the payroll dataset or titanic dataset. Case study of sampling for any real-world problem like exit poll statistics.	**10**
IV	**Descriptive Statistics** Measures of Dispersion, Skewness and Kurtosis: Dispersion, Characteristics for an Ideal Measure of Dispersion, Measures of Dispersion, Range, Quartile Deviation, Mean Deviation, Standard Deviation and Root Mean Square Deviation, Coefficient of Dispersion, Coefficient of Variation, Skewness, Kurtosis. Correlation and Regression: Bivariate Distribution, Scatter diagrams, Correlation, Karl Pearson's coefficient of correlation, Rank correlation, Regression, Regression Coefficients, Lines of Regression. **Case study**: Create measures of dispersion for a real-life example dataset like student's dataset, iris detection etc.	**10**
V	**Probability Distributions & Hypothesis Testing** Random Variables: Distribution function, PMF, PDF, basic properties; mean, median, quantiles, Markov and Chebyshev inequalities. Standard Distributions: Bernoulli, Binomial, Poisson, Uniform, Exponential, Normal – definitions and simple applications. Moment concepts (introduction) and basic characteristics of the above distributions. Hypothesis Testing: Statistical hypothesis, null and alternative hypotheses, level of significance, Type I & II errors, tests for mean and proportion. **Case Study**: Case studies based on binomial distribution and hypothesis testing for real-life decision problems.	**10**
	Total	**44**

Text Books:

1. A. M. Mood, F. A. Graybill, D. C. Boes, Introduction to the Theory of Statistics, McGraw-Hill. 3rd Edition
2. Robert V. Hogg, Joseph McKean, Allen T. Craig, Introduction to Mathematical Statistics, Pearson, 8th Edition
3. S. C. Gupta and V. K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons. 11th Edition

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Reference Books:

1. Sheldon Ross, A First Course in Probability, Pearson, 9th Edition
2. William Mendenhall, Statistics for Engineering and the Sciences, CRC Press, 13th Edition
3. J.E. Freund, Mathematical Statistics, Pearson, 7th Edition

e-sources:

1. NPTEL Courses (IIT Bombay / IIT Kanpur), https://nptel.ac.in/courses/111105090
2. Probability and Statistics for Engineers, https://nptel.ac.in/courses/111102160

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S.Y. B. Tech (Open Elective Course-I)			Semester: III			
Course	Numerical Statistical Analysis			Code:		IT25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior knowledge of Engineering Mathematics, Algebra, Calculus, and Programming Concepts is essential.

Course Objectives: This course aims at enabling students:
1. To solve algebraic and transcendental equations using numerical methods.
2. To apply interpolation, curve fitting, numerical differentiation, and numerical integration techniques.
3. To analyze probability theory, random variables, and standard probability distributions.
4. To utilize statistical tools for sampling, correlation, regression, and hypothesis testing.
5. To develop analytical skills for engineering problems using numerical and statistical techniques.

Course Outcomes:

After completion of the course, the students will be able to:

CO1: Apply numerical techniques to solve algebraic and transcendental equations with convergence analysis.

CO2: Use interpolation, curve fitting, numerical differentiation, and numerical integration effectively.

CO3: Apply probability concepts and apply standard probability distributions to engineering problems.

CO4: Perform sampling, regression analysis, correlation and statistical data interpretation.

CO5: Conduct hypothesis testing such as t-test, z-test, chi-square, ANOVA & construct confidence intervals.

Course Contents		
Unit	Description	Duration [Hrs]
I	**Numerical Solution of Equations** Types of Errors: Absolute, Relative, Percentage error Roots of algebraic & transcendental equations, Bisection Method, Regula Falsi Method, Newton–Raphson Method, Secant Method, and Convergence of iterative methods.	9
II	**Interpolation & Curve Fitting** Finite differences, Interpolation: Newton Forward & Backward Interpolation, Lagrange's Interpolation, Newton's Divided Difference Formula, Curve fitting: Least Squares Method, Fitting Straight Line, Parabola, and Exponential Curves.	9
III	**Numerical Differentiation & Integration** Numerical differentiation using Newton's formulas, Maxima & minima using numerical differentiation, Numerical Integration: Trapezoidal Rule,	9

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	Simpson's 1/3 Rule, Simpson's 3/8 Rule, Error analysis for numerical differentiation & integration.	
IV	**Probability & Statistical Distributions** Basic Probability Theory, Bayes' Theorem, Random Variables, Discrete & Continuous Probability Distributions: Binomial Distribution, Poisson Distribution, Normal Distribution, Moments, Skewness & Kurtosis.	**9**
V	**Sampling, Regression & Hypothesis Testing** Sampling Techniques & Sampling Distribution, Correlation: Karl Pearson coefficient, Regression Analysis: Linear regression & multiple regression, Hypothesis Testing: t-test, z-test, Chi-square test, ANOVA (One-way), Confidence intervals.	**9**
	Total	**45**

Text Books:

1. S.S. Sastry – Introductory Methods of Numerical Analysis, PHI, 5th edition
2. Erwin Kreyszig – Advanced Engineering Mathematics, Wiley, 10th edition
3. Gupta & Kapoor – Fundamentals of Mathematical Statistics, Sultan Chand, , 11th edition

Reference Books:

1. Jain, Iyengar, Jain – Numerical Methods for Scientific and Engineering Computation, New Age, 6th edition
2. William Navidi – Engineering Statistics, McGraw Hill, 2nd edition
3. Richard Johnson – Statistics & Data Analysis, Pearson, 6th edition

e-Sources:

1. NPTEL: Numerical Methods (IIT Bombay / IIT Kharagpur)
   https://nptel.ac.in/courses/111/102/111102128/

e-Books:

1. https://www.aerostudents.com/courses/applied-numerical analysis/IntroductoryMethodsOfNumericalAnalysis.pdf

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S.Y B. Tech. (Open Elective Course-I)			Semester: III			
Course	Vectors and Transforms			Code:		ETC25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior knowledge of Univariate Calculus, Multivariate Calculus is essential.

Course Objectives: This course aims at enabling students:
1. To develop a strong foundational understanding of transform techniques to analyze and solve engineering and communication-related problems.
2. To Provide conceptual clarity in formulating and solving differential equations arising in various engineering applications.
3. To Equip students with numerical methods for interpolation, numerical integration, and solving ordinary differential equations with practical computational approaches.
4. To Enable students to understand, differentiate, and integrate vector fields, and apply these concepts to engineering and physical systems.

Course Outcomes: After completion of the course, the students will be able to:
CO1: Apply transforms such as Laplace transform, to solve problems related to signal processing and control systems.
CO2: Apply Integral transforms such as, Fourier transform to solve problems related to signal processing and control systems.
CO3: Apply transforms such as Z-Transform to solve problems related to signal processing and control systems.
CO4: Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.
CO5: Perform vector differentiation and integration, analyze the vector fields and apply to Electromagnetic fields.

	Course Contents	
Unit	**Description**	**Duration [Hrs]**
I	**Laplace Transform** Definition – conditions for existence; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives; Evaluation of integrals by using Laplace transform; Transforms of some	9

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	special functions- periodic function, Heaviside unit step function, Dirac delta function.	
II	**Inverse Laplace Transform** Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of linear differential equations.	**9**
III	**Fourier and Z-Transforms** Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral representation, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms and their inverses. Z-Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses, Solution of difference equations	**9**
IV	**Numerical Methods** Interpolation: Finite Differences, Newton's and Lagrange's interpolation formulae, Numerical differentiation. Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error. Solution of ordinary differential equations: Euler's method, Modified Euler's method, Runge-Kutta 4th order method, introduction to Predictor-Corrector methods.	**9**
V	**Vector Differential and Integral Calculus** Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities. Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Electro-magnetic fields	**9**
	Total	**45**

Text Books:
1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill), 1st Edition.
2. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning), 2nd Edition.

Reference Books:
1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 10 Edition.
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication),44th Edition.
3. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York, First Edition.
4. Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, 4/e, Tata McGraw HillEditions, 2002, ISBN 0-07-047437-0.
5. Dr. B. S. Garewal, Numerical Methods in Engineering and Science, 7/e, Khanna Publishers, ISBN 81-74009-205-6
6. Thomas' Calculus by George B. Thomas (Addison-Wesley, Pearson), 1st Edition.

e-Sources:
1. https://onlinecourses.nptel.ac.in/noc23_ma54/
2. https://nptel.ac.in/courses/111106111

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Program	S.Y. B. Tech (Open Elective Course-I)			Semester: III			
Course	Applied Mathematics			Code		ME25OEC-207	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
4	3	-	1	25	25	50	100

Pre-requisites: Prior Knowledge of Univariate Calculus**,** Multivariate Calculus**,** Fourier series, Collection, classification, and representation of data is essential.

Course Objectives: This course aims at enabling students:

1. To develop conceptual understanding of Laplace Transform techniques and their applications in engineering problems.
2. To impart knowledge of Inverse Laplace Transform methods for solving differential equations and system analysis problems.
3. To introduce Fourier Transform techniques for analysis of signals and systems in the frequency domain.
4. To familiarize students with statistical methods and probability theory for modeling and analysis of engineering data.
5. To provide foundations of vector calculus, including vector fields and their differentiation and integration, for engineering applications.

Course Outcomes: After learning the course, the students should be able to:

CO1: Apply transforms such as the Laplace transform to solve problems related to mechanical systems.

CO2: Apply transforms such as the Inverse Laplace transform to solve problems related to mechanical systems, such as Differential Equations, mass, and spring systems.

CO3: Apply Integral transforms, such as the Fourier transform to solve problems related to mechanical systems

CO4: Apply Statistical methods like correlation and regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control.

CO5: Perform vector differentiation and integration, analyze the vector fields and apply to magnetic fields

	Course Contents	

Unit	Description	Duration [Hrs]
I	**Laplace Transform** Definition – conditions for existence; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside unit step function, Dirac delta function.	9
II	**Inverse Laplace Transform** Introductory remarks; Inverse transforms of some elementary functions;	9

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	General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of linear differential equations.	
III	**Fourier Transforms** Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral representation, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms, and their inverse Fourier transform, inverse Fourier sine transforms, inverse Fourier cosine transforms.	**9**
IV	**Statistics & Probability** Introduction to Data Science, Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation: Karl Pearson's correlation, Spearman's rank correlation, Regression analysis, and Reliability of regression estimates. Probability, Probability density function, and Central limit theorem, Probability distributions: Binomial, Poisson, Normal, and Test of hypothesis: Chi-square test and t- test	**9**
V	**Vector Differential and Integral Calculus** Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities. Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stokes' theorem. Applications to problems in Electro-magnetic fields	**9**
	Total	**45**

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill) 1st Edition
2. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning) 2nd Edition

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 1st Edition.
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication), 1st Edition.
3. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill , New York, 2nd edition.
4. Thomas' Calculus by George B. Thomas (Addison-Wesley, Pearson), 1st Edition.
5. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross.
6. Jason Brownlee, 'Statistical Methods for Machine Learning', Machine learning Mastery, 1st Edition.

e-sources:

1. https://nptel.ac.in/courses/111107098
2. https://nptel.ac.in/courses/111105041

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S.Y. B. Tech (Value Education Course-I)			Semester: III			
Course	Universal Human Values			Code		CSE25VEC-208	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	2	1	-	-	25	25

Pre-requisites: Basic knowledge of Social Values, Communication is essential.

Course Objectives: The course aims to:
1. To help the students develop a holistic, humane world-vision, and appreciate the essential complementarity between values and skills to ensure mutual happiness and prosperity
2. To elaborate on 'Self-exploration' as the process for Value Education.
3. To facilitate the understanding of harmony at various levels starting from self and going towards family and society.
4. To elaborate on the salient aspects of harmony in nature and the entire existence.

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Recognize the concept of self-exploration as the process of value education and see they have the potential to explore on their own right.

CO2: Explore the human being as the coexistence of self and body to see their real needs / basic aspirations clearly.

CO3: Explain relationship between one self and the other self as the essential part of relationship and harmony in the family.

CO4: Interpret the interconnectedness, harmony and mutual fulfilment inherent in the nature and the entire existence and draw ethical conclusions in the light of Right understanding

Course Contents		
Unit	Description	Duration [Hrs]
I	**Introduction to Value Education** Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - the Basic Human Aspirations and their Fulfilment, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity - Current Scenario, Method to Fulfil the Basic Human Aspirations	4
II	**Harmony in the Human Being** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure self-regulation and Health	4
III	**Harmony in the Family and Society** Harmony in the Family - the Basic Unit of Human Interaction "Trust' - the Foundational Value in Relationship, 'Respect' - as the Right Evaluation, Values	4

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	in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	
IV	**Harmony in the Nature (Existence)** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence, Professional Ethics in the light of Right Understanding, Strategies for Transition towards Value-based Life and Profession	**3**
	Total	**15**

The subject instructor supposed conduct the activities based on the topic covered during the tutorial sessions. The few activities should be individual or in group. The students supposed to submit the properly written documents.

	Suggested List of during Practical Sessions
1	Introduce yourself in detail. What are your life goals? How do you make goals for your life? How do you distinguish between right and wrong? What are your major accomplishments and faults in life? Observe and study them
2	Man-made issues such as energy and material resource depletion, pollution, global warming, ozone depletion, deforestation, and soil degradation pose a threat to the survival of life on Earth. What is the source of these ailments and what is the solution, in your opinion?
3	There is rapidly growing danger due to nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression, and suicidal attempts. What do you think is the root cause of these threats to human happiness and peace? What is the solution in your opinion?
4	Our "Natural Acceptance" ability allows us to choose what is right or wrong for ourselves. We are not educated to listen to our "Natural Acceptance," which can be confused by perceptual biases and sensory stimuli. Explore the following: (i) What is your natural level of respect for yourself and others? (ii) What is "naturally acceptable" to you: nurturing or exploiting others? Is your lifestyle consistent with your natural acceptance or divergent from it?
5	Share a personal experience when you demonstrated deliberate devotion to values in a challenging scenario
6	Identify any two major problems confronting society now and investigate the underlying causes. Can these be handled based on natural acceptance of human values? If so, how should one move in this approach given the current situation?
7	Having awareness about nature, its four orders and their mutual fulfilment. Activities to be performed- written assignment, chart making.
8	List down all your desires, observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.
9	Form small groups in the class and in that group initiate dialogue and ask the eight questions related to trust. The eight questions are: 1a. Do I want to make myself happy?

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	2a. Do I want to make the other happy?
	3a. Is the other want to make him happy?
	4a. Is the other want to make me happy?
	Intention (Natural Acceptance)
	1b. Am I able to make myself always happy?
	2b. Am I able to make the other always happy?
	3b. Is the other able to make him always happy?
	4b. Is the other able to make me always happy?
	What is the answer? (Competence)
	Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate your intention & competence as well as the others' intention & competence.
10	1. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under- evaluation, over-evaluation or otherwise evaluation.
	2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.
11	Write a note in the form of story, poem, skit, essay, narration, dialogue to educate a child. Evaluate it in a group.
	Develop three chapters to introduce social science-its need, scope and content in the primary education of children
12	List down units (things) around you. Classify them in four orders. Observe and explain the mutual fulfilment of each unit with other orders.
	List what do you take from nature; and what do you give back to nature? Are you a source of harmony in Nature?

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), 978-81- 957703-6-6 (e-book)
2. *Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-5-9 (Printed Copy), 978-81-957703-0-4 (e-Book)*

Reference Books:

1. Nagaraj, 1999, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak
2. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
3. N. Tripathy, 2003, Human Values, New Age International Publishers.
4. E. G. Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press

e-Sources:

1. Jeevan Vidya: Ek Parichaya — A. Nagaraj (1999)
   https://uhvparivar.org/publications/otherbooks/Jeevan-Vidya-ek-Parichay.pdf

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e-Books:
1. A Foundation Course in Human Values and Professional Ethics https://uhvparivar.org/publications/uhvbooks/UHV-FCV-3E-Textbook.pdf
MOOC / NPTEL/YouTube Links:
1. Swayam Course on "Understanding Human Being Nature and Existence Comprehensively" by Dr. Kumar Sambhav https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
2. NPTEL Course on "Exploring Human Values: Visions of Happiness and Perfect Society" by Prof. A. K. Sharma IIT Kanpur https://nptel.ac.in/courses/109104068
3. UHV Lecture Series – Prof. R. R. Gaur https://www.youtube.com/playlist?list=PLz0n_SjOttT0LlwM1zVfPVTz3wGM5seXm

Program	S.Y. B. Tech. (Value Education Course-I)		Semester: III			
Course	**Professional Ethics for Engineers**	**Code:**	**ETC25VEC-208A**			
Credits	**Teaching Scheme (Hrs./Week)**			**Examination Scheme and Marks**		
	Lecture	**Practical**	**Tutorial**	**PR**	**OR**	**TW**	**Total**
2	-	2	1	-	-	25	25

Pre-requisites: Prior knowledge of business management is essential

Course Objectives: This course aims at enabling students:
1. To provide the students an understanding of the meaning of ethics in engineering profession.
2. To introduce an awareness of ethical duties and responsibilities of engineers in the practice of them careers.
3. To provide a sociological understanding of the social impact of technology and engineering.
4. To examine some of the classical cases as well as contemporary ethical issues in engineering profession.

Course Outcomes: After completion of course, the students will be able to:
CO1**:** Practice the moral values that ought to guide the Engineering profession.
CO2: Discover of the set of justified moral principles of obligation, ideals that ought to be endorsed by the engineers and apply them to concrete situations.
CO3: Know the definitions of risk and safety also discover different factors that affect the perception of risk.
CO4: Appreciate the Ethical issues and Know the code of ethics adopted in various professional bodies and industries.

	Course Contents	
Unit	**Description**	**Duration [Hrs]**
I	**Ethics in Engineering** Understanding basic concepts Ethics- Engineering Ethics- Engineering as Profession – Difference between occupation and professions- Professional Ethics - Codes of Ethics in Engineering profession- Moral dilemmas and moral autonomy in Engineering profession.	4
II	**Engineering as Social Experimentation** Engineering as Experimentation-Engineers as responsible Experimenters-A balanced outlook on Law.	3
III	**Social Impact of Technology and Engineering** Ethos of science and engineering- Ethical leadership in engineering and society, social responsibility of scientist/ researchers, Intellectual property and society, Cross cultural issues in engineering research.	4
IV	**Major Issues in Engineering Ethics and Environment-**	4

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	Ethics and sustainable engineering- Computer ethics- Analysing ethical problems in research- Ethics in collaborative research- Engineers as expert consultants and advisors- Corporate Social Responsibility (CSR).	
	Total	**15**

Course Contents	
Sl. No.	**Suggested List of Experiments/Assignments**
1	Study of basic ethical concepts including values, morals, rights, duties, and ethical reasoning frameworks relevant to engineering practice.
2	Study of engineering as a profession with emphasis on professional roles, responsibilities, accountability, and distinction between occupation and profession.
3	Study of professional ethics and codes of ethics as prescribed by recognized professional engineering bodies, highlighting ethical conduct and compliance.
4	Study of moral dilemmas in engineering practice through case studies to develop ethical reasoning and decision-making skills.
5	Study of engineering as social experimentation focusing on risk, safety, uncertainty, and the responsibility of engineers as responsible experimenters.
6	Study of law and ethics in engineering practice to understand regulatory compliance and the need for a balanced ethical and legal outlook.
7	Study of social, environmental, and sustainability impacts of technology and engineering in the context of societal well-being..
8	Study of research ethics and intellectual property rights including issues related to plagiarism, authorship, innovation, and societal benefit.
9	Study of computer ethics and ethics in collaborative engineering work covering data privacy, cybersecurity, and professional integrity.
10	Study of corporate social responsibility (CSR), ethical leadership, and sustainable practices in engineering organizations.

Text Books:
1. Naagarazan, R.S., "Professional Ethics and Human Values "New age International, 3rd Edition.
2. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall 4th edition.

Reference Books:
1. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice all of India, New Delhi, 2004, 1st Edition.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases", Wadsworth Thompson Learning, United States, 2000, 2nd Edition.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003, 4th Edition.

e-Sources:

1. https://youtu.be/ag1fHF7aL0A?si=vlNPA0Ea7ZjKAT3S
2. https://youtu.be/ag1fHF7aL0A?si=_T2VV3q_iYG4rj8L

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S. Y. B. Tech. (Value Education Course-I)		Semester: III			
Course	Social Connect and Responsibility		Code:	ETC25VEC-208B		
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks		
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	2	1	25	-	-	25

Course Objectives: This course aims at enabling students:

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

Course Outcomes: After completion of the course, the student will be able to:

CO1: Perform tree plantation and adoption activities and document plant characteristics, relevance, and cultural significance.

CO2: Demonstrate understanding of local heritage and crafts through field visits and digital documentation.

CO3: Explain principles of organic farming and wet waste management and relate them to sustainable campus practices.

CO4: Analyze water conservation practices in community settings and prepare evidence-based documentation.

CO5: Explore and document local culinary heritage, indigenous materials, and food lore through field-based interactions.

Course Contents

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage student's interactive sessions, open mic, reading groups, storytelling sessions, and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed:

Unit	Description	Duration [Hrs]
I	**Plantation and adoption of a tree** Plantation of a tree that will be adopted for four years by a group of B. Tech. students. They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature. carried out by the project groups.	3
II	**Heritage walk and crafts corner** Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms.	3
III	**Organic farming and waste management**	3

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	Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus	
IV	**Water Conservation** knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.	**3**
V	**Food Walk** City's culinary practices, food lore, and indigenous materials of the region used in cooking	**3**
	Total	**15**

Course Contents	
Sl. No.	**Suggested List of Assignment/Experiments**
1	**Tree Plantation & Adoption Activity** Students will plant a sapling on campus or a designated location and adopt it for four years. They must record initial environmental conditions, plant type, and growth indicators.
2	**Documentary/Photo Blog on Adopted Plant** Each group will prepare a short documentary or a photo blog about the adopted tree covering: • Plant origin • Botanical features • Usage in daily life Cultural, folklore, and literary significance
3	**Heritage Walk Documentation** Students will participate in a heritage walk within the city to study historical sites, traditional architecture, and community spaces. They will document observations with photographs and short descriptions.
4	**Crafts Corner Study & Documentation** Visit a local crafts workshop (e.g., pottery, weaving, metalwork) to interact with craftsmen and understand techniques, tools, and cultural relevance. Prepare a photo blog or documentary on evolution and practice of the craft.
5	**Organic Farming Exposure Visit** Students will visit an organic farm or agricultural field to learn about: • Organic farming techniques • Soil preparation • Bio fertilizers • Crop rotation • Pest control methods A reflective report will be prepared based on observations.
6	**Wet Waste & Compost Management Practical** Study wet waste collection, segregation, and composting processes in nearby villages or campus. Students will carry out small-scale composting using daily biodegradable waste.

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7	**Water Conservation Practices Survey** Survey nearby villages/campus to document traditional and modern water conservation practices such as: • Rainwater harvesting • Check dams • Greywater reuse • Percolation pits Prepare a photo blog or documentary presenting current practices and recommendations.
8	**Food Walk & Culinary Culture Mapping** Conduct a food walk to explore local dishes, ingredients, indigenous cooking materials, and culinary traditions. Students will document: • History behind specific dishes • Food lore Traditional preparation methods

Textbooks:
1. Agricultural Sustainability: Strategies for Organic, Climate-Smart, and Resource-Conserving Farming*, Shravanthi et al., First edition, 2025.*
2. Hydrological Measurements for Watershed Research – *Wasi Ullah et al., First Edition.*
3. Perspectives in Environmental Studies – *Kaushik & Kaushik, First Edition,2018.*

e-sources:
1. https://www.youtube.com/watch?v=iaQjEDYyWKw
2. https://onlinecourses.nptel.ac.in/noc23_hs155/preview

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S.Y. B. Tech (Artificial Intelligence and Data Science)			Semester: III			
Course	Scientific Computing with Python			Code		AIDS25VSEC-209A	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	25	-	50

Pre-requisites: Prior knowledge of python programming including variables, loops, functions, and file handling is essential.

Course Objectives: This course aims at enabling students:
1. To introduce students to Python programming concepts used in scientific and engineering applications.
2. To develop the ability to use NumPy for efficient numerical computation and array-based problem solving.
3. To perform data handling, preprocessing, and analysis using Pandas.
4. To Provide hands-on experience in visualizing scientific and real-world data using Matplotlib and Seaborn.
5. Build analytical skills to model, interpret, and solve scientific problems using Python tools.
6. Encourage students to apply computational methods to real-world datasets and develop mini analytical projects.

Course Outcomes: After completion of the course, the students will be able to:
CO1: Understand the fundamentals of Python programming for scientific computing.
CO2: Apply NumPy operations for numerical computation, matrix manipulation, and vectorized processing.
CO3: Analyze datasets using Pandas by performing data cleaning, transformation, and aggregation operations.
CO4: Create different types of scientific and statistical visualizations using Matplotlib and Seaborn.

Course Contents	
Sl. No.	**Suggested List of Experiments/Assignments**
1	Write a Python program to demonstrate python data types (int, float, complex, str, list, tuple, dict, set, frozenset, bool, NoneType) and its operations using its built-in functions and math functions on Jupyter Notebook and Python IDE. Tool: Python basics (math module)
2	Create 1D, 2D NumPy arrays and perform indexing, slicing, reshaping, and mathematical. **Functions:** np.array, np.arange, np.linspace, np.reshape, np.sum, np.mean
3	Apply vectorized operations, broadcast rules, and universal functions. **Functions:** np.add, np.sqrt, np.exp, broadcasting features
4	Generate random numbers, simulate distributions, and compute statistics. **Functions:** np.random.rand, np.random.randn, np.random.randint, np.random.normal
5	Create Series, DataFrames, import/export CSV files, and perform basic operations. **Functions:** pd.Series, pd.DataFrame, df.head, df.tail, df.describe, df.to_csv

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

6	Handle missing values, replace data, filter rows & columns, sort and group values. **Functions:** df.isnull, df.fillna, df.dropna, df.sort_values, df.groupby
7	Plot line, bar, scatter, and histogram using Matplotlib. **Functions:** plt.plot, plt.bar, plt.scatter, plt.hist, plt.xlabel, plt.ylabel
8	Multi-plot figures, subplots, styling, legends, and grid. **Functions:** plt.subplot, plt.legend, plt.grid, plt.title
9	Create statistical plots using Seaborn. **Functions:** sns.lineplot, sns.barplot, sns.histplot, sns.boxplot, sns.scatterplot
10	Load a real-world dataset and perform summary statistics & visual analysis. **Tools:** Pandas, Matplotlib, Seaborn **Activites:** Missing values detection, correlation matrix (sns.heatmap)
11	Solve matrix equations, find eigenvalues, inverse, transpose. **Functions:** np.linalg.solve, np.linalg.inv, np.linalg.eig

12	**Mini Project – Data Analysis & Visualization**
	Aim: Students choose a dataset (weather, sports, sales, etc.) and perform:
	   a. Cleaning with Pandas
	   b. Analysis with NumPy
	   c. Visualization with Matplotlib/Seaborn
	   d. Prepare a brief report

Reference Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, 2020, Green Tea Press,
2. "Scientific Computing with Python (SciPy Lecture Notes)", SciPy Community, Online Publication, Latest Edition, 2024.
3. Robert Johansson, "Numerical Python: A Practical Techniques Approach", 3rd Edition, 2023. Apress,

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S.Y. B. Tech (Artificial Intelligence and Data Science)		Semester: III		
Course	Scientific Computing with R Programming		Code	AIDS25VSEC-209B	
Credits	Teaching Scheme (Hrs./Week)		Examination Scheme and Marks		
	Lecture	Practical	Tutorial	TW	OR	PR	Total

Credits	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	25	-	50

Pre-requisites: Prior knowledge of Basics of Computer and Basics of Mathematics is essential.

Course Objectives: This course aims at enabling students:
1. To understand R syntax, data types, and core programming concepts
2. To use control structures (loops, conditions) and vectorized operations
3. To create Professional Data Visualizations by using ggplot2 to produce high-quality plots
4. To understand numerical algorithms (root finding, optimization, ODEs)

Course Outcomes:

After learning the course, the students will be able to:

CO1: Implementation of install R and perform basic operations by using functions.

CO2: Implement numeric functions and loops in R language.

CO3: Perform data manipulation using tidyr and linear algebra.

CO4: Implement parallel computing using functions of R-language.

Course Contents	
Sl. No.	Suggested List of Experiments/Assignments (All are Compulsory)
1	R Basics & Environment Setup: Install R and RStudio. Use basic R operations (arithmetic, variables, functions). Working with vectors, matrices, factors, lists, and data frames. Write a simple script that reads a CSV file and summarizes it.
2	Implement R- Control Flow & Functions: Create custom functions with default parameters. Use if / else, for, and while loops. Vectorized vs. non-vectorized code (performance comparison). Implement a numeric function (e.g., factorial, Fibonacci)
3	Data Manipulation with tidyverse: Use dplyr for filtering, joining, grouping, and summarizing data. Data reshaping with tidyr. Import/export data in different formats (CSV, Excel, RDS)
4	Implement Scientific Visualization R: Create plots using ggplot2 (scatter, line, histogram, density, boxplot), multi-panel figures with facet_wrap(), Customize themes and annotations, Produce a publication-quality figure
5	Implement the bisection method and Newton–Raphson method. Compare convergence behavior on nonlinear equations. Test methods on functions of your choice
6	Implement optimization by using optim() for single-variable and multi-variable optimization. Implement gradient descent manually. Apply optimization to a real dataset (e.g., fitting a nonlinear model)

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7	Implementation Gaussian elimination by using R's built-in solvers (solve (), eigen decomposition, SVD). Condition numbers and numerical stability experiments
8	Solve ODEs. Implement Euler's method and RK4 manually using deSolve package. Compare numerical solutions to analytical solutions where possible
9	Generate random variables from various distributions, Monte Carlo integration and estimate π using random sampling and Simulate of a simple physical or probabilistic system (e.g., random walk)
10	Implement Parallel computing by using parallel or for each and Profiling code using Rprof() or bench. Compare the speed difference.

Reference Books:
1. Robert L. Kabacoff – "R in Action", 2nd edition, 2025. Dreamtech Press, ISBN: 9789351198079
2. Hadley Wickham and Garrett Gorlemund, "R for Data Science", 1st edition-2025, Kindle and Paperback Publisher. ISBN: 978-0-12-381479-1

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S. Y. B. Tech. (Artificial Intelligence and Data Science)		Semester: III	
Course	Web Development		Code	AIDS25VSEC-209C
Credits	Teaching Scheme (Hrs./Week)		Examination Scheme and Marks	

Credits	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	25	25	-	50

Pre-requisites: Knowledge of Basics of Computer and Basics of Mathematics is essential

Course Objectives:
This course aims at enabling students:
1. Understand Internet basics, including protocols, client-server architecture, and network security essentials.
2. Develop structured web pages using HTML, CSS, and Bootstrap for responsive front-end design.
3. Implement interactivity with JavaScript and DOM manipulation techniques.
4. Build dynamic web applications using PHP for back-end logic and server-side processing.

Course Outcomes:
After learning the course, the students should be able to:
CO1: Explain the fundamentals of Internet architecture, protocols, and client-server interactions.
CO2: Design responsive web pages using HTML, CSS, and Bootstrap frameworks
CO3: Apply JavaScript and DOM to create dynamic and interactive web content
CO4: Develop server-side functionality using PHP for dynamic content generation and form handling.

Course Contents	
Sl. No.	**Suggested List of Experiments/Assignments (All are Compulsory)**
1	Create a simple HTML page displaying personal details using text formatting tags.
2	Design a web page that includes an image, hyperlink, and a nested table.
3	Create a form with fields: name, email, gender, date of birth, and submit button.
4	Apply internal, external, and inline CSS to style a web page with headings and tables.
5	Develop a responsive web page using Bootstrap Grid and Components.
6	Write a JavaScript program to validate form inputs (e.g., email, empty fields).
7	Create a web page that uses JavaScript to display dynamic content using DOM.
8	Write a JavaScript program for a simple calculator using functions and switch-case.
9	Design a PHP script to display "Welcome" message and current date & time.

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

10	Write a PHP program to accept form input and display it using the POST method.

Reference Books:

1. Jeffrey C. Jackson — Web Technologies: A Computer Science Perspective, 2nd Edition, Pearson Education, 2007, ISBN: 978-0131856035.
2. Robert W. Sebesta — Programming the World Wide Web, 4th Edition, Pearson Education, 2008, ISBN: 978-0136036005.
3. Marty Hall & Larry Brown — Core Web Programming, 2nd Edition, Pearson Education, 2001, ISBN: 978-0130897930.
4. H. M. Deitel, P. J. Deitel & A. B. Goldberg — Internet & World Wide Web: How to Program, 3rd Edition, Pearson Education, 2006, ISBN: 978-0131752429.
5. Chris Bates — Web Programming: Building Internet Applications, 3rd Edition, Wiley India, 2006, ISBN: 978-8126506415.
6. Xue Bai, Bradley Kjell, Dave Mercer & Don Gosselin — The Web Warrior Guide to Web Programming, Thomson/Course Technology, 2003, ISBN: 978-0619062699

e-source:

1. Books: https://www.w3.org/html/
2. https://developer.mozilla.org/en-US/docs/AJAX?utm_source=chatgpt.com
3. https://developer.mozilla.org/en-US/docs/AJAX

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MOOCs Courses link:
1. http://www.nptelvideos.in/2012/11/internet-technologies.html
2. https://freevideolectures.com/course/2308/internet-technology/25video   IIT, Kharagpur
3. https://www.digimat.in/nptel/courses/video/106105191/L01.html
4. http://www.nptelvideos.com/php/php_video_tutorials.php

Curriculum: S.Y. B.Tech. Artificial Intelligence and Data Science

Program	S. Y. B. Tech (Entrepreneurship Management Course)			Semester: III			
Course	Principles of Management and Entrepreneurship			Code		IL25EMC-210	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	2	1	25	-	-	25

Pre-requisites: Prior knowledge of Engineering Environment, Communication Skills, Mathematical and Analytical Skills are essential.

Course Objectives: This course aims at enabling students:
1. To introduce the fundamental concepts, functions, and principles of management
2. To develop the ability to plan, organize, lead, and control organizational activities
3. To familiarize with the concept of entrepreneurship
4. To develop skills for identifying business opportunities
5. To create awareness about MSME policies, institutional support systems, startup ecosystem

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

CO1: Explain fundamental principles, functions of management with the role and responsibilities of manager.

CO2: Design and develop the plan, strategies, organizational structure and HR processes.

CO3: Apply motivational theories for leadership in organizational situations

CO4: Identify entrepreneurial traits and competencies

CO5: Create the opportunities to Utilize government and financial support systems through business plans.

Course Contents		
Unit	**Description**	**Duration [Hrs]**
I	**Theory of Management** Meaning, Nature, Scope and Importance of Management, Functions of Management – Planning, Organizing, Staffing, Directing, Controlling, Levels of Management – Top, Middle and Lower, Roles of a Manager (Mintzberg's Managerial Roles), Evolution of Management Thought: Classical Theory (Fayol, Taylor), Behavioral Approach, Modern Approaches (System, Contingency), Social and Ethical Responsibilities of Managers.	3
II	**Planning and Techniques in Management** Planning – Nature, Process, Types of Plans, MBO (Management by Objectives), Decision Making – Types, Steps, Techniques, Organizing – Concept, Types of Organization Structures (Functional, Divisional, Matrix), Span of Control, Delegation of Authority, Centralization vs Decentralization, Staffing – Manpower Planning, Recruitment, Selection and Training	3
III	**Leadership and Control**	3

	Leadership – Meaning, Importance, Qualities of a Leader, Leadership Styles – Autocratic, Democratic, Laissez-faire, Transformational, Motivation – Meaning, Importance, Motivation Theories – Maslow, Herzberg, McGregor Theory X & Y, Communication – Process, Types, Barriers, Effective Communication Techniques, Controlling – Concept, Steps, Techniques of Control, Budgetary and Non-Budgetary Controls.	
IV	**Introduction to Entrepreneurship and Business Plan** Concept and Meaning of Entrepreneurship, Characteristics and Competencies of Successful Entrepreneurs, Types of Entrepreneurs – Innovative, Imitative, Serial, Social, Women Entrepreneurs, Entrepreneurial Process – Idea Generation to Enterprise Launch, Creativity and Innovation – Techniques and Tools, Barriers to Entrepreneurship – Personal, Social, Situational. Micro, Small & Medium Enterprises (MSMEs) – Definition, Importance, Opportunities, Business Environment – Internal & External Factors, Market Survey, Feasibility Study & Project Identification, Business Plan Preparation & Project Report Components. & External Factors, Market Survey, Feasibility Study & Project Identification, Business Plan Preparation & Project Report Components. Institutional Support for Entrepreneurship: MSME-DI, DIC, NSIC, SIDBI, NABARD, KVIC, NIESBUD, EDII, Start-up India, Make in India, Atal Innovation Mission. Financial Support: Seed Funding, Angel Investors, Venture Capital, Bank Loans	**6**
	Total	**15**

Sl. No.	Suggested List of Experiments/Assignments
1.	Case Study on Functions of Management in a Real-World Organization
2.	Preparation of Vision, Mission, and Objectives for a Startup Idea
3.	Case Study on Evolution of Management Thought – Classical to Modern Approaches
4.	Case Study on Motivation Strategy Development for Employee Productivity Improvement
5.	Business Communication Activity – Drafting Official Letters, Memos, and Emails
6.	Decision-Making Exercise Using Decision Tree or SWOT Analysis
7.	Preparation of a Basic Business Plan for a Startup
8.	Market Survey and Opportunity Identification for New Ventures
9.	Preparation of Project Report for an Entrepreneurial Idea
10.	Group Activity: Role Play on Leadership and Team Management

Text Books
  1) Stephen Robins, Mary Coulter, David Decenzo. Fundamental of Management, 11th Edition, Pearson, 2020, ISBN 13: 978-0-13-517515-6

2) Richard L. Hughes, Robert C. Ginnett, Gordon J. Curphy. Leadership, 09th Edition, Mc Graw Hill, 2022, ISBN-13. 978-9355320704

3) Bygrave, W.D., Zacharakis, A., & Corbett, A.C. Entrepreneurship, 6th Edition, Wiley, 2025. ISBN: 9781394262809.

Reference Books

1) Jennifer M. George. Contemporary Management, 1st Edition, Mc Graw Hill, 2024, ISBN13: 9781264948390

2) Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.

3) Osterwalder, Alexander & Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, 1st Edition, Wiley, 2010. ISBN: 9780470876411.

MOOC / NPTEL/YouTube Links

1. https://www.coursera.org/learn/entrepreneur-guide-beginners
2. https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3. https://onlinecourses.nptel.ac.in/noc20_ge08/preview

Course Syllabus

Semester-IV

Program:	S. Y. B. Tech. (Artificial Intelligence and Data Science)				Semester: IV		
Course:	Database Management Systems					Code	AIDS25PCC-251
Credit	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
02	02	-	-	25	25	50	100

Pre-requisites: Knowledge of Database Management Systems is essential.

Course Objectives:
This course aims at enabling students:
- To introduce the fundamental concepts and architectures of Database Management Systems.
- To develop skills in SQL/PL-SQL for effective data definition, manipulation, and control.
- To apply systematic database design principles including ER modeling and normalization.
- To understand transaction management, concurrency control, and emerging database technologies.

Course Outcomes: After completion of course, the students will be able to:
Upon successful completion of this course, students will be able to:
CO1: Design database schemas and ER models for real-world applications.
CO2: Execute SQL and PL/SQL queries for data retrieval, manipulation, and procedural operations.
CO3: Normalize relational schemas and apply integrity constraints for efficient database design.
CO4: Apply transaction management, concurrency control, and NoSQL concepts in modern data systems.

	Course Contents	
Unit	**Description**	**Duration [Hrs]**
I	**Database Foundations & ER Modelling** Purpose of DBMS, Data Models, DBMS Architecture, DBMS languages.ER Model: Entities, Attributes, Relationships, Keys, Constraints.ER Diagrams, Extended ER, converting ER/EER to relational tables. Case Study: Design a database using ER modeling and convert it to relational tables.	**8**
II	**SQL & PL/SQL Programming** SQL Data Types, DDL, DML, DCL, TCL, CREATE/INSERT/UPDATE/DELETE/ALTER/DROP. SELECT, Joins, Views, Aggregation, Set Operations, Predicates, Nested Queries.PL/SQL: Procedures, Functions, Triggers, Roles, Privileges. Case Study: Implement Unit I database using SQL & PL/SQL.	**7**
III	**Relational Model, Normalization & Query Processing** Relational Model: Attributes, Domains, CODD's Rules, Integrity constraints: Domain, Referential, Enterprise, Normalization: 1NF to BCNF, Functional Dependencies, Decomposition. Introduction to Intelligent Query Processing. Case Study: Normalize Unit I database schema.	**7**

		Transaction Management & NoSQL Databases	
IV		Transactions: States, ACID properties, Schedules, Serializability, Concurrency Control (Locks, Timestamps), Deadlocks, Recovery: Shadow paging, Logging, Checkpoints. NoSQL Types: Key-Value, Document, Graph, Wide-Column; BASE properties. MongoDB CRUD, Indexing, Aggregation, Replication, Sharding. Graph Databases (Neo4j), Cosmos DB. Case Studies: PostgreSQL Transaction Management & NoSQL unstructured data processing.	**8**
		Total	30

Text Books:

1. Silberschatz, A., Korth, H. F., & Sudarshan, S. — Database System Concepts, 6th Edition, McGraw-Hill Education, 2010, ISBN: 0-07-120413-X / 978-0073523323.
2. Connolly, T., & Begg, C. — Database Systems: A Practical Approach to Design, Implementation and Management, 4th Edition, Pearson Education, 2002, ISBN: 8178088614 / 978-8178088617.
3. Chodorow, Kristina — MongoDB: The Definitive Guide, 3rd Edition, O'Reilly Media, 2022, ISBN: 978-1491954461.
4. Sadalage, Pramod J., & Fowler, Martin — NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley Professional, 2012, ISBN: 0321826620 / 978-0321826626.

Reference Books

1. C. J. Date — An Introduction to Database Systems, Addison-Wesley, 8th Edition, 2004, ISBN: 0201144719 / 978-0201144710.
2. S. K. Singh — Database Systems: Concepts, Design and Applications, Pearson Education, 2011, ISBN: 978-81-317-6092-5.
3. Kristina Chodorow & Michael Dierolf — MongoDB: The Definitive Guide, O'Reilly Media, 1st Edition, 2010, ISBN: 978-1-449-34468-9.
4. Adam Fowler — NoSQL for Dummies, John Wiley & Sons, 1st Edition, 2015, ISBN: 1118905628 / 978-1118905628.

MOOC / NPTEL/YouTube Links: -

1. https://www.mongodb.com/resources/basics/databases/nosql-explained
2. https://learn.microsoft.com/en-us/azure/cosmos-db/nosql/modeling-data
3. https://onlinecourses.nptel.ac.in/noc22_cs91/preview
4. http://www.nptelvideos.com/lecture.php?id=6518

Program:	S.Y. B. Tech. (Artificial Intelligence and Data Science)				Semester: IV	
Course:	Foundation to Machine Learning				Code	AIDS25PCC-252
Credit	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks		
02	Lecture	Practical	Tutorial	UT	FA	SA	Total
	2	--	--	25	25	50	100

Pre-requisites: Prior knowledge of Mathematics/Statistics is essential.

Course Objectives:

This course aims at enabling students:
1. To understand the foundational concepts, types, and applications of Machine Learning.
2. To learn supervised and unsupervised learning algorithms.
3. To develop skills in pre-processing, training, evaluating, and tuning ML models.
4. To explore techniques for model selection, validation, and performance improvement.

Course Outcomes:

After completion, students will be able to:

CO1: Explain fundamental concepts, types, and applications of Machine Learning.

CO2: Apply data pre-processing techniques and implement ML algorithms on datasets.

CO3: Analyze model performance using evaluation metrics and validation techniques.

CO4: Build and evaluate ML models for real-world problems using appropriate tools.

Course Contents		
Unit	**Description**	**Duration (Hrs)**
I	**Introduction to Machine Learning & Regression** Introduction to ML, Applications, Types of Learning (Supervised, Unsupervised, Reinforcement), Feature Selection, Feature Reduction using PCA, Regression Models: Linear, Polynomial, Ridge, Lasso, ElasticNet, Gradient Descent Algorithm.	7
II	**Supervised Learning** – **Classification** K-Nearest Neighbor, Decision Tree Classification, Random Forest, Support Vector Machine (SVM), Evaluation Metrics: SSE, MSE, R^2, Confusion Matrix, Precision, Recall, F-score, ROC Curve, Cross-validation.	8
III	**Unsupervised Learning** **Clustering** Introduction to Clustering & Applications, Hierarchical Clustering (Agglomerative, Divisive), Partitioning Clustering (K-Means), Elbow Method, Association Rule Learning.	7
IV	**Reinforcement Learning, Ensemble Learning & ANN** Reinforcement Learning concepts, Feedback Learning, Function Approximation, Ensemble Methods: Bagging, Boosting, Stacking, Introduction to ANN: Perceptron Model, Multi-Layer Perceptron (MLP), Backpropagation Algorithm.	8
	Total	30

Text Books:
1. Ethem Alpaydin — Introduction to Machine Learning, 4th Edition, MIT Press, 2020, ISBN: 978-0262043793.
2. Aurélien Géron — Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd Edition, O'Reilly Media, 2022, ISBN: 978-1098125974.

Reference Books
1. Tom M. Mitchell — Machine Learning, McGraw-Hill Education, 1st Edition, 1997, ISBN: 978-0070428072.
2. Christopher M. Bishop — Pattern Recognition and Machine Learning, Springer, 1st Edition, 2006, ISBN: 978-0387310732.
3. Trevor Hastie, Robert Tibshirani & Jerome Friedman — The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd Edition, Springer, 2009, ISBN: 978-0387848570.

Online Sources:
1. https://scikit-learn.org
2. https://www.kaggle.com/learn
3. https://developers.google.com/machine-learning
4. https://nptel.ac.in/courses/106/105/106105152

Program:	S.Y. B. Tech. (Artificial Intelligence and Data Science)		Semester: IV	
Course:	Foundation to Machine Learning Lab		Code	AIDS25PCC-253
Credit	**Teaching Scheme (Hrs./Week)**		**Examination Scheme and Marks**	

02	Lecture	Practical	Tutorial	TW	PR	OR	Total
	-	2	-	-25	-	50	75

Pre-requisites: Prior knowledge of basic Python programming, Knowledge of Mathematics, Understanding of ML / AI fundamentals

Course Objectives:

This course aims at enabling students:
1. Apply data pre-processing and visualization techniques.
2. Implement supervised, unsupervised, and advanced ML models.
3. Implement AI search algorithms and intelligent agents.
4. Develop small AI/ML projects using real datasets.

Course Outcomes:

CO1: Perform data preprocessing, handling missing values, scaling, and encoding.
CO2: Implement supervised, unsupervised learning and dimensionality reduction machine learning algorithms.
CO3: Implement AI search algorithms & problem-solving agents.
CO4**:** Develop mini-projects using ML/AI techniques.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. Use of open-source software is encouraged. Based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus. Operating System recommended: - 64-bit Open-source Linux or its derivative Programming tools recommended: - MYSQL/Oracle, ERD plus, ER Win

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of the student. Each Laboratory assignment assessment of the student should be based on predefined rubrics finalized during course meetings.

Guidelines for Practical Examination

Problem statements must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage, transparent evaluation and fair approach, and hence will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of student's academics.

Course Contents		
Suggested List of Experiments/Assignments		
Sl. No.	**Problem Statement**	
Group A (Minimum 5 Assignments to be performed)		
1	Implement Linear Regression & evaluate model	
2	Implement Data Visualization & EDA using Pandas, Matplotlib, Seaborn libraries.	
3	Classify the email using the binary classification method. Email Spam detection has twostates: a) Normal State – Not Spam, b) Abnormal State – Spam. Use K-Nearest Neighbors and Support Vector Machine for classification. Analyze their performance. Dataset link: The emails.csv dataset on the Kaggle https://www.kaggle.com/datasets/balaka18/email-spam-classification-dataset-csv	
4	Predict the price of the Uber ride from a given pickup point to the agreed drop-off location. Perform following tasks: 1. Pre-process the dataset. 2. Identify outliers. 3. Check the correlation. 4. Implement linear regression and random forest regression models. 5. Evaluate the models and compare their respective scores like R2, RMSE, etc. Dataset link: https://www.kaggle.com/datasets/yasserh/uber-fares-dataset	
5	Implement K-Nearest Neighbors algorithm on diabetes.csv dataset. Compute confusion matrix, accuracy, error rate, precision and recall on the given dataset. Dataset link: https://www.kaggle.com/datasets/abdallamahgoub/diabetes	
6	Implement K-Means clustering/ hierarchical clustering on sales_data_sample.csv dataset. Determine the number of clusters using the elbow method. Dataset link: https://www.kaggle.com/datasets/kyanyoga/sample-sales-data	
Group B (Minimum 2 Assignments/Mini Projects to be performed)		
7	**Mini Project -** Use the following dataset to analyze ups and downs in the market and predict future stock price returns based on Indian Market data from 2000 to 2020. Dataset Link: https://www.kaggle.com/datasets/sagara9595/stock-data	
8	**Mini Project** - Build a machine learning model that predicts the type of people who survived the	

	Titanic shipwreck using passenger data (i.e. name, age, gender, socio-economic class, etc.). Dataset Link: https://www.kaggle.com/competitions/titanic/data
9	**Mini Project** - Develop a application for signature identification by creating your own dataset of your college student

Text Books:

1. Aurélien Géron — Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd Edition, O'Reilly Media, 2022, ISBN: 978-1098125974.
2. Tom M. Mitchell — Machine Learning, 1st Edition, McGraw-Hill Education, 1997, ISBN: 978-0070428072.
3. Stuart Russell & Peter Norvig — Artificial Intelligence: A Modern Approach, 4th Edition, Pearson Education, 2021, ISBN: 978-0134610993.

Reference Books

1. Christopher M. Bishop — Pattern Recognition and Machine Learning, Springer, 1st Edition, 2006, ISBN: 978-0387310732.
2. Ian Goodfellow, Yoshua Bengio & Aaron Courville — Deep Learning, MIT Press, 1st Edition, 2016, ISBN: 978-0262035613.
3. Jiawei Han, Micheline Kamber & Jian Pei — Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann (Elsevier), 2011, ISBN: 978-0123814791.

Online Sources:

Machine Learning – NPTEL

1. Machine Learning (IIT Madras)
   https://nptel.ac.in/courses/106/106/106106202
2. Applied Machine Learning
   https://nptel.ac.in/courses/112/107/112107289

Program	S. Y. B. Tech (Artificial Intelligence and Data Science)			Semester: IV			
Course	**Computer Network**			Code		**AIDS25PCC-253**	
Credits	**Teaching Scheme (Hrs./Week)**			**Examination Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**UT**	**FA**	**SA**	**Total**
2	**2**	**-**	**-**	**25**	**25**	**50**	**100**

Pre-requisites: Knowledge of Digital Electronics and Computer Organization is essential.

Course Objectives: This course aims at enabling students to:

1. To introduce the fundamental concepts and architecture of computer networks.
2. To explain the design issues, framing methods and multiple access protocols at the data link layer.
3. To elaborate IP addressing and routing protocols concept.
4. To study transport and application layer protocols.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Explain fundamental concepts of network architectures, transmission media, and layered communication models.

CO2: Apply framing, error control techniques for reliable communication.

CO3: Compare routing algorithms and protocols to determine efficient path in a network.

CO4: Apply transport- and application-layer protocols to implement basic socket-programming

Course Contents		
Unit	**Description**	**Duration [Hrs]**
I	**Introduction of Computer Networks** Overview of computer networks: Definition, Goals, Functions, applications Network topologies and types: LAN, MAN, WAN, Network components: Hub, Bridge, routers, switches, Gateway, Access point Network Architectures: Client-Server, Peer to Peer. Reference models: OSI, TCP/IP Transmission media: Guided and unguided Line Coding Schemes: Manchester and Differential Manchester Encodings, Frequency Hopping (FHSS) and Direct Sequence Spread Spectrum (DSSS)	**8**
II	**Data Link Layer and MAC Protocols** Introduction, functions. Design Issues: Services to Network Layer, Framing, Data link layer protocols -Stop & Wait, Go-Back-N, Selective Repeat, Error detection and correction techniques - CRC, parity, checksum, Hamming code. MAC protocols -Ethernet, ALOHA, CSMA/CD, CSMA/CA	**7**
III	**Network Layer and Routing** Introduction, Switching techniques: Circuit, packet, and message switching IP Protocol: Classes of IP (Network addressing),Subnetting, IPv4 and IPv6 addressing scheme, NAT, CIDR Network layer Protocols: ARP, RARP, ICMP,	**8**

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	IGMP, Routing concepts and algorithms - Static Routing, Dynamic Routing, Distance Vector, Link State, Routing Protocols: RIP, OSPF, BGP, MPLS	
IV	**Transport Layers and Application Layer** Introduction, Transport layer protocols: TCP, UDP, and their features, Socket Programming (TCP/UDP), Quality of services Elements of transport layer protocols: Addressing, connection establishment, connection release, flow control and buffering, multiplexing, congestion control. Connection Establishment, Flow and congestion control, Application layer Protocol: HTTP/HTTPS, FTP, SMTP, DNS, POP, IMAP, MIME, SNMP, TELNET, DHCP.	7
	Total	**30**

Text Books:

1. Andrew S. Tanenbaum & David J. Wetherall — Computer Networks**,** 6th Edition, Pearson Education India*,* 2021, ISBN: 978-0136764052**,** 0136764053.
2. Behrouz A. Forouzan — Data Communications and Networking**,** 5th Edition, Tata McGraw-Hill Education, 2013, ISBN: 978-1259064753**,** 1259064751**.**

Reference Books:

1. James F. Kurose & Keith W. Ross — Computer Networking: A Top-Down Approach, 8th Edition, Pearson Education, 2021, ISBN-10: 0136681557, ISBN-13: 978-0136681557.
2. Larry L. Peterson & Bruce S. Davie — Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann Publishers, 2012, ISBN: 978-0123852069.
3. Douglas E. Comer & M. S. Narayanan — Computer Networks and Internets, 5th Edition, Pearson Education, 2013, ISBN: 978-9332535994.

e-sources:
1. http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf
2. http://eti2506.elimu.net/Introduction/Books/Data Communications and Networking By Behrouz A.Forouzan.pdf

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MOOC / NPTEL/YouTube Links:
1. Computer Network and Internet Protocol, Prof. Soumya Kanti Ghosh | IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc25_cs15/preview.
2. https://www.mooc-list.com/tags/computer-networking
3. https://www.coursera.org/courses?query=computer%20network
4. http://nptel.ac.in/courses/106105081/1

Program	S. Y. B. Tech (Artificial Intelligence and Data Science)		Semester: IV	
Course	Data Base Management System Laboratory		Code	AIDS25PCC-255

Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	2	-	25	-	50	25

Pre-requisites: Prior knowledge of Data Structure is essential.

Course Objectives: This course aims at enabling students to:
1. Understand fundamental concepts, architectures, and components of Database Management Systems.
2. Develop the ability to formulate SQL queries and implement PL/SQL for data manipulation and processing.
3. Apply systematic database design techniques including ER modelling, normalization, and transaction management.
4. Explore modern trends in data management including NoSQL databases for scalable and unstructured data applications.

Course Outcomes:

After learning the course, the students should be able to:

CO1: Design and implement relational databases using ER models.
CO2: Write and execute SQL queries, PL/SQL procedures, functions, triggers, and cursors.
CO3: Normalize database schemas and apply transaction management concepts efficiently.
CO4: Use NoSQL databases (MongoDB) for handling unstructured, semi-structured data and performing analytics.

Guidelines for Laboratory Conduction

The instructor is expected to conduct **Any Ten Assignments of given List**. The instructor may set multiple sets of assignments and distribute them among batches of students.

Guidelines for Students Journal and term work assessment

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory Concept in brief, algorithm, flowchart, test cases, Test Data Set (if applicable), mathematical model (if applicable), conclusion/analysis.
Continuous assessment of laboratory work should be done based on overall performance and Laboratory assignments performance of student. Each Laboratory assignment assessment should be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each Laboratory assignment assessment include timely completion performance, innovation, efficient codes, punctuality and neatness.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to test the students for advanced learning, understanding of the fundamentals, effective and efficient implementation. So encouraging efforts, transparent evaluation and fair approach of the evaluator will not create any uncertainty or doubt in the minds of the students. So, adhering to these principles will consummate our team efforts to the promising start of the student's academics.

Course Contents

Suggested List of Experiments (Minimum 10 Assignments to be performed)

Sl. No.	Problem statement
1	Database Creation & ER to Relational Mapping: Create a database, design an ER diagram, convert to relational tables, and implement with constraints.
2	SQL – DDL Commands Use CREATE, ALTER, DROP to define and modify database tables.
3	SQL – DML Commands: Perform INSERT, UPDATE, DELETE, and SELECT operations.
4	SQL Queries Using WHERE, ORDER BY, GROUP BY, HAVING: Write filtering, sorting, grouping, and conditional grouping queries.
5	Joins – INNER, LEFT, RIGHT, FULL OUTER JOIN: Retrieve data from multiple tables using various join types.
6	Subqueries & Set Operations Use nested queries, IN, EXISTS, UNION, INTERSECT, EXCEPT.
7	Views & Indexing: Create and manipulate views; apply indexing for optimization.
8	PL/SQL Procedures & Functions: Create stored procedures and functions for computations.
9	PL/SQL Triggers: Implement BEFORE/AFTER triggers for audit and validation.
10	Cursors in PL/SQL: Use explicit cursors for row-by-row data processing.
11	MongoDB – CRUD, Indexing & Aggregation: Work with NoSQL data operations and analytics.
12	Case Study: Social media/E-commerce Analytics in MongoDB: Import dataset and perform aggregation-based analysis.

Reference Books:

1. Abraham Silberschatz, Henry F. Korth & S. Sudarshan — Database System Concepts, 6th Edition, McGraw-Hill Education, 2010, ISBN: 978-0073523323.
2. Thomas Connolly & Carolyn Begg — Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition, Pearson Education, 2015, ISBN: 978-0132943269.
3. Ivan Bayross — SQL, PL/SQL: The Programming Language of Oracle, 5th Edition, BPB Publications, 2010, ISBN: 978-8183331630.
4. Steven Feuerstein — Oracle PL/SQL Programming, 6th Edition, O'Reilly Media, 2014, ISBN: 978-1449324452.

5. Kristina Chodorow — MongoDB: The Definitive Guide, 3rd Edition, O'Reilly Media, 2022, ISBN: 978-1491954461.
6. Pramod J. Sadalage & Martin Fowler — NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley Professional, 2012, ISBN: 978-0321826626.
7. C. J. Date — An Introduction to Database Systems, 8th Edition, Addison-Wesley, 2004, ISBN: 978-0321197849.
8. Raghu Ramakrishnan & Johannes Gehrke — Database Management Systems, 3rd Edition, McGraw-Hill Education, 2003, ISBN: 978-0072465631.

Program:	S. Y. B. Tech. (Artificial Intelligence and Data Science)		Semester: IV	
Course:	Processor Architecture		Code	AIDS25MDM-256

Credit	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
02	02	-	-	25	25	50	100

Pre-requisite: Prior knowledge of semiconductor devices, digital electronics, and Introductory programming (Python/C) is essential.

Course Objectives:

This course aims to enable students to:
1. To provide fundamental knowledge of MOSFET operation, CMOS logic design, and core VLSI design methodologies.
2. To introduce the VLSI design flow, fabrication steps, layout concepts, and performance issues such as delay, power, and area.
3. To enable students to understand how Artificial Intelligence and Machine Learning can be applied to optimize VLSI physical design, timing, power, and area.
4. To expose learners to AI-based solutions in VLSI testing, verification, yield prediction, and emerging AI-assisted EDA design environments.

Course Outcomes:

After completion, students will be able to:

CO1: Explain MOSFET fundamentals, CMOS logic design, and basic VLSI principles.

CO2: Describe the VLSI design flow, fabrication steps, layout rules, and PPA (Power, Performance, Area) issues.

CO3: Apply AI/ML models to analyze or predict timing, power, congestion, and other VLSI physical design metrics.

CO4: Analyze AI-based testing, verification, and yield prediction methods for improving VLSI system reliability.

Course Contents		
Unit	Description	Duration [Hrs]
I	**Overview of Raspberry Pi** Introduction to Raspberry Pi, Comparison of various Rpi Models, Understanding SoC architecture and SoCs used in Raspberry Pi, Pin Description of Raspberry Pi , On-board components of Rpi. Booting up RPi- operating System and Linux Commands, Linux- Introduction, Architecture, File System, Raspbian Operating System - Introduction, Tools like Leaf pad Editor, Installing Raspbian on Pi, First boot and Basic Configuration of Pi.	8

II	**RPi using Python and Sensing Data using Python** Introduction, Python vs. Other Languages, Applications of Python.Understanding Python Interpreted Languages: Variables, Keywords, Operators and Operands, Data Types in Python, Importing Libraries, Flow Control, Conditional Statement, Loops. Sensors Interfacing: Temperature and Humidity Sensor DHT11, Motion Sensor ,PIR Sensor	7
III	**Current Trends in Processor Architecture** Introduction to Controller Architecture, ARM & RISC :ARM and RISC design philosophy, Introduction to ARM processor & its versions ARM 7, ARM 9, ARM 11, Features& advantages of ARM processor, Suitability of ARM processor in embedded applications, ARM 7 dataflow model, Programmers model. CPSR & SPSR registers, Modes of operation	7
IV	**AI in VLSI Testing, Verification & Yield** Introduction to AI/ML in chip design ML in floor planning, placement quality prediction, congestion estimation , Overview of AI-assisted EDA tools and workflows , ML for fault detection, fault classification, and test pattern, optimization Anomaly detection in post-silicon data Process variation modelling and reliability prediction (NBTI, HCI, electro-migration), Yield estimation using classification/regression models, Surrogate models for replacing expensive SPICE simulations, Emerging topics: compute-in-memory, approximate computing, AI-driven HDL generation	8
	Total	30

Text Books:
1. Neil H. E. Weste & David Harris — CMOS VLSI Design: A Circuits and Systems Perspective, 4th Edition, Pearson Education, 2010, ISBN: 978-0321547743.
2. S. M. Sze & Kwok K. Ng — Physics of Semiconductor Devices, 3rd Edition, Wiley-Interscience, 2007, ISBN: 978-0471143239.
3. Simon Monk — Programming the Raspberry Pi: Getting Started with Python, 2nd Edition, McGraw Hill Professional, 2021, ISBN: 978-1260461602.
4. Derek Molloy — Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux, 1st Edition, Wiley Publications, 2016, ISBN: 978-1119188686.

Reference Books
1. Jan M. Rabaey, Anantha Chandrakasan & Borivoje Nikolić — Digital Integrated Circuits: A Design Perspective, 2nd Edition, Pearson Education, 2003, ISBN: 978-0130909960.
2. Sanjay K. Chaturvedi — VLSI Design Methodologies, 1st Edition, Oxford University Press, 2018, ISBN: 978-0199482337.
3. Soha Hassoun & Tsutomu Sasao — Logic Synthesis and Verification, 1st Edition, Springer, 2001, ISBN: 978-0792372823.
4. Yiran Chen & Kaushik Roy — Machine Learning and AI for VLSI Design, 1st Edition, CRC Press, 2019, ISBN: 978-1138555483.
5. Andrew B. Kahng, Igor L. Markov, Jens Lienig & Jin Hu — VLSI Physical Design: From Graph Partitioning to Timing Closure, 1st Edition, Springer, 2011, ISBN: 978-9048195903.

Online Sources:
1.https://learning.cadence.com
2.https://www.synopsys.com/education
3.https://nptel.ac.in/courses/117104094
4.https://www.coursera.org

Program	S. Y. B. Tech (Open Elective Course-II)		Semester: IV	
Course	Digital Marketing		Code	CE25OEC-257A

Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	S A	Total
2	2	-	-	25	25	5 0	100

Pre-requisites: General awareness of marketing terms such as target audience, branding, product, pricing, etc.

Course Objectives: This course aims at enabling students:
1. To Provide the basic Concepts of Digital marketing and the road map for successful Digital marketing strategies.
2. To know the importance of Social Media Platforms importance in Digital Marketing
3. To understand the technological importance of Search Engine Optimization (SEO)
4. To develop skills for creating, managing, and optimizing digital marketing campaigns across various channels.
5. To enable students to analyze digital consumer behavior and create effective online strategies.

Course Outcomes:

After completion of the course, the students will be able to:

CO1: Explain the basic Concepts of Digital marketing

CO2: Apply digital marketing tools for suitable applications

CO3: Examine the various social media and design Advertising campaigns

CO4: Apply SEO, SEM, and content creation techniques to improve online visibility.

Course Contents		
Unit	Description	Duration [Hrs]
I	**Introduction to Digital Marketing** Fundamentals of Digital marketing & Its Significance, Traditional marketing Vs Digital Marketing, Evolution of Digital Marketing, Digital Marketing Landscape, Key Drivers, The Digital users in India, Digital marketing Strategy-Consumer Decision journey Digital advertising Market in India, Skills in Digital Marketing, Digital marketing Plan. **Case study**: Launching a Tech Startup's Mobile App —"SmartBudget"	7
II	**Digital Marketing strategy** **strategy** used in Digital Marketing, PPC and online marketing through social media, Social Media Marketing, Google web-master and analytics overview, Email Marketing, Mobile Marketing Display adverting, Buying Models, different type of ad tools, Display advertising terminology, types of display ads, different ad formats **Case study: Social Media Marketing, Platforms: Instagram, YouTube Shorts, LinkedIn**	8

III	**Social Media Marketing** Fundamentals of Social Media Marketing& its significance, Necessity of Social media Marketing Facebook Marketing: Facebook for Business, Facebook Insight, Different types of Ad formats, setting up Facebook Advertising Account, Facebook audience & types, Designing Facebook Advertising campaigns, Facebook Avatar, Apps, Live, Hashtags **Case study**: App Store Optimization (ASO)	**8**	
IV	**Search Engine Optimization (SEO)** Introduction to SEO, How Search engine works, SEO Phases, History Of SEO, How SEO Works, Googlebot (Google Crawler), Types of SEO technique, Keyword Planner tools Social media Reach- Video Creation & Submission, Maintenance- SEO tactics, Google search Engine **Case study: Provide REAL outputs like a mini-project** Marketing plan, Keyword research sheet Google Ads mock screenshot FB Ads audience design Social media creative poster 1 reel script	**7**	
	Total	**30**	

Text Books:
1. 1.Dave Chaffey & Fiona Ellis-Chadwick, "Digital Marketing", 8th Edition, Pearson, 2022, ISBN: 9781292738086.
2. 2. Rajan Gupta & Supriya Madan, "Digital Marketing", Dreamtech Press, 2023, ISBN: 9789355511522.

Reference Books:
1. Klaus Solberg Søilen, "Digital Marketing", Springer, 2024, ISBN: 9783031695186.
2. Dionne Solomons et al., "eMarketing: The Essential Guide to Marketing in a Digital World", 6th Edition, 2020, ISBN: 9780639707808.

MOOC/ NPTEL/YouTube Links:
1. NPTEL Course, By Dr. Tejinderpal Singh, Panjab University Chandigarh
   https://onlinecourses.swayam2.ac.in/ugc19_hs26/preview

Program	S.Y. B. Tech. (Open Elective Course-II)		Semester: IV	
Course	Engineering Economics	Code	ETC25OEC-257	
Credits	Teaching Scheme (Hrs./Week)		Examination Scheme and Marks	

Credits	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	2	25	25	50	100

Pre-requisites: Prior knowledge of economics & mathematics is essential.

Course Objectives: This course aims at enabling students:
1. To enable the students to understand the economic theories which may be applied to maximize return and the economic environment in which they have to operate.
2. To introduce fundamental economic principles relevant to engineering analysis and decision-making.
3. To develop the ability to apply time-value-of-money concepts for evaluating engineering alternatives.
4. To Learn cost estimation, depreciation, and break-even analysis for effective financial planning in engineering projects.

Course Outcomes: After successful completion of the course, learner will be able to:

CO1: Identify the core concepts of economics and recognize its potential in addressing modern day socio-economic challenges

CO2: Compare and analyze alternatives based on present, annual, rate of return, benefit over cost analyses, time value of money in evaluation of investments and projects in real life and the impact of economic factors on feasibility of real-life projects.

CO3: Analyze and predict the economic impact of engineering solutions to make financially prudent decisions in everyday life.

CO4: Evaluate the role of economics to give knowledge to the students about various costs for determining the manufacturing of a product.

Course Contents		
Unit	**Description**	**Duration [Hrs]**
I	**Introduction** Nature and significance of economics, Goods and Utility, Basic Concept of Demand and Supply, Elasticity of Demand- Price elasticity of Demand, Cross elasticity of Demand, Production - Production Function, Production Process and Factors of Production, Market - Introduction to Monopoly, Perfect Competition, Oligopoly and Monopolistic Competition, Cost Concepts, E-commerce.	8
II	**Money- its evaluation and function, Bank** Commercial Bank and Central Bank and brief idea about function of banking system. Tax and Subsidy, Type of Tax- Direct and Indirect, Monetary and fiscal policy, Inflation and Business cycle, IPR & WTO, International trade, terms of Trade, Gain from International Trade, Free Trade vs. Protection, Dumping, and Balance of Payment	8

III	**Role of Science, Engineering and Technology In economic Development** Some of the burning problems of rural and slum areas in India and how engineering and technology may be used to alleviate them, example of Green Revolution and White revolution. Reasons for their success and can we replicate them. Sustainable Development		**8**
IV	**Elementary Economic Analysis; Interest formulas and their Applications** Calculations of economic equivalence, Bases for Comparison of Alternatives: Present Worth Method, Future worth method, Annual equivalent, Internal Rate of return; Evaluating Production Operations, Business Risk Management.		**8**
	Total		**32**

Text Books:
1. A Textbook of Engineering Economics: The Principles and Applications, D. R. Kiran, BS Publications, 2021.
2. Engineering Economics Test & Cases, D N Dwivedi, Dr H L Bhatia & Dr S N Maheshwari, Vikas Publishing House Pvt. Ltd.

Reference Books:
1. Principles of Engineering Economics with Applications, Zahid A. Khan, Arshad N. Siddiquee, Brajesh Kumar, Mustufa H. Abidi 2nd edition, Cambridge University.
2. Practical Applications of Engineering Economics, Kal R. Sharma, Momentum Press. Engineering Economics, R. Panneerselvam, PHI Learning Private Ltd.

e-sources:
https://youtu.be/-5q7RB1GWEA

Program	S.Y. B. Tech (Open Elective Course-II)			Semester: IV			
Course	Digital Finance			Code:		ME25OEC-258A	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	UT	FA	SA	Total
2	2	-	-	25	25	50	100

Pre-requisites: Prior knowledge of Finance and Economics**,** Cyber Security & Digital Payments is essential.

Course Objectives:

 This course aims at enabling students:

1. To understand the evolution of digital finance and the role of big data in modern financial systems.
2. To gain insight into digital payment ecosystems and ongoing transformations in digital banking.
3. To acquire foundational knowledge of blockchain technology, cryptocurrencies, and decentralized finance.
4. To explore applications of artificial intelligence, machine learning, and data analytics in financial services

Course Outcomes:

After completion of the course, students will be able to:

   CO1: Explain the basics of digital finance, big data, and regulatory frameworks.

   CO2: Analyze digital payments, FinTech trends, and neo-banking models.

   CO3: Illustrate blockchain, cryptocurrencies, and DeFi systems.

   CO4: Discuss the role of AI/ML for financial analytics.

   CO5: Apply cybersecurity and compliance strategies for digital finance.

	Course Contents	
Unit	**Description**	**Duration [Hrs]**
I	**Digital Finance Fundamentals & Big Data** **Evolution & Fundamentals of Digital Finance:** Evolution of digital finance and the shift from traditional to digital systems. Introduction to FinTech and technological transformations in financial services. Overview of regulatory frameworks and compliance in the digital era. **The Rise of Big Data in Finance:** Role of big data in shaping financial decision-making and risk management. Leveraging data science for personalization and modern financial services **Case Study:** DBS Bank's Digital Transformation	**8**
II	**Digital Payment Systems & Digital Banking Transformation**	**8**

	Digital Payment Ecosystems: Historical evolution and digitalization of payment systems (ECS, RTGS, NEFT, IMPS, UPI, mobile wallets, contactless payments), Attributes of a well-functioning payment system and the role of banks. **Fintech Innovations & Disruption:** FinTech startups, challenger banks, and peer-to-peer lending models, FinTech applications across banking, NBFCs, insurance, lending, audit, and compliance, Regulatory guidelines (e.g., RBI guidelines) and risks associated with new payment models. The Future of Digital Banking: How traditional banks are adapting and the rise of neo-banks, Digital banking trends and evolving customer expectations **Case Study:** Unified Payments Interface (UPI) in India	
III	**Blockchain, Cryptocurrencies & Decentralized Finance** **Blockchain Technology:** Fundamentals of blockchain and underlying cryptographic techniques, Smart contracts and decentralized finance (DeFi) applications. Cryptocurrencies & Digital Assets: Overview and evolution of cryptocurrencies (Bitcoin, Ethereum, etc.), Central Bank Digital Currencies (CBDCs) and other emerging digital assets. **Advanced Applications & Case Studies:** Impact of blockchain on payments, lending, and financial settlements, Real-world case studies and disruptive potential in global finance **Case study:** The Sand Dollar (Bahamas' CBDC)	**9**
IV	**Artificial Intelligence, Machine Learning in Financial Analytics** **AI & Machine Learning in Finance:** Predictive analytics in stock markets, trading, and algorithmic/high frequency trading, Credit risk analysis and automated decision-making using AI. Data Analytics & Financial Applications: Data sourcing, cleaning, processing, and visualization for financial data, Sentiment analysis and AI-driven portfolio management. **Practical Projects & Case Studies:** Hands-on projects: building stock price prediction models, fraud detection systems, and credit score prediction models, Real-world applications in digital lending and wealth management **Case study:** Thread programming Using Pthreads, POSIX	**9**
	Total	**30**

Text Books:

1. Chris Skinner — Digital Finance: Big Data, Startups, and the Future of Financial Services, 1st Edition, Wiley, Hoboken, NJ, USA, 2016, ISBN: 978-1118900005.

2. Jeffry H. M. T. — Introduction to FinTech, 1st Edition, Pearson Publications, Noida, India, 2018, ISBN: 978-9352865127.

3. Don Tapscott & Alex Tapscott — Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies Is Changing the World, 1st Edition, Penguin Random House, New York, NY, USA, 2016, ISBN: 978-1101980132.

4. Marcos López de Prado — Machine Learning for Asset Managers, 1st Edition, Cambridge University Press, Cambridge, UK, 2020, ISBN: 978-1108750073.

5. Parag K. Patel — FinTech: The Impact and Role of Financial Technology, 1st Edition, Wiley Publications, Hoboken, NJ, USA, 2023, ISBN: 978-1394217649.

Reference Books:

1. Rohit Ghose — Future Money: FinTech, AI and Web3, Kogan Page, London, UK, 2024, ISBN: 978-1398610736.
2. Yves Hilpisch — Artificial Intelligence in Finance: A Python-Based Guide, 1st Edition, O'Reilly Media, Sebastopol, CA, USA, 2020, ISBN: 978-1492055433.
3. Marcos López de Prado — Advances in Financial Machine Learning, 1st Edition, Wiley, Hoboken, NJ, USA, 2018, ISBN: 978-1119482081.
4. Susanne Chishti & Janos Barberis — The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs, and Visionaries, 1st Edition, Wiley, Hoboken, NJ, USA, 2016, ISBN: 978-1119218871.
5. Daniel Drescher — Blockchain Basics: A Non-Technical Introduction in 25 Steps, 1st Edition, Apress, Berkeley, CA, USA, 2017, ISBN: 978-1484226032.
6. Brian Hines — Digital Finance: Security Tokens and Unlocking the Real Potential of Blockchain, 1st Edition, Wiley, Hoboken, NJ, USA**,** 2020, ISBN: 978-1119612075**.**

E- Books:

1. P. H. Beaumont, Digital Finance: Big Data, Start-ups, and the Future of Financial Services, 1st edition. London, U.K.: Routledge, 2019. Link: https://download.e-bookshelf.de/download/0015/1963/23/L G-0015196323-0047264745.pdf
2. N. Urbach and M. Roglinger, Big Data and Artificial Intelligence in Digital Finance, 1st edition. Cham, Switzerland: Springer, 2022 Link: https://library.oapen.org/bitstream/id/fefe46c7-4495 49ba-bcab-9cf1851e81e6/978-3-030-94590-9.pdf
3. L. Perlman, An Introduction to Digital Financial Services, 1st edition., 2018. Link: https://www.academia.edu

MOOC/NPTEL/YouTube Links:

1. https://www.my-mooc.com/en/mooc/introduction-to-fintech/

2. https://mooc.besideproject.eu/courses/blockchain-use-cases-in-digital-finance/

3. https://www.coursera.org/specializations/digital-transformation-financial-services

Program	S.Y. B.Tech (Value Education Course-II)			Semester: IV			
Course	Indian Constitution			Code:		CE25VEC-258	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	1	-	1	-	-	25	25

Pre-requisites: Prior knowledge of and Indian history, civics, and societal structure to comprehend constitutional principles and governance frameworks is essential.

Course Objectives: This course aims at enabling students:

1. To acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
2. To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
3. To channelize students' thinking towards basic understanding of the constitutional principles and statutory institutions.
4. To enable students to critically evaluate constitutional provisions and apply them to contemporary social, political, and administrative contexts.

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

CO1: Identify and explore the basic features and modalities about Indian constitution.
CO2: Differentiate and relate the functioning of Indian Parliamentary System at the center and state level.
CO3: Analyze the administrative structure of various branches of government.
CO4: Examine different aspects of Indian Legal System and its related bodies.

	Course Contents	
Unit	Description	Duration [Hrs]
I	**Introduction to Constitution** Meaning & Constitutionalism, Introduction to Constitution: Meaning of the constitution law and constitutionalism, making of constitution, Salient features and characteristics of the Constitution of India, Preamble, Fundamental Rights, Directive Principles of State Policy, Fundamental Duties and itslegal status, Citizenship. **Case Study :** The Kesavananda Bharati Case (1973) – Basic Structure & Constitutionalism	4
II	**System of Government- Center & State level and local level** Structure and Function of Central Government, President, Vice President, Prime Minister, Cabinet, Parliament, Supreme Court of India, Judicial Review, Federal structure, and distribution of legislative and financial powers between the Union and the States, local self-government. **Case Study :** S.R. Bommai v. Union of India (1994) – Misuse of President's Rule	4

III	**Government: Union & State** Executive & Legislature, composition, powers and functions, Local Self Governments – Panchayat Raj Institutions & Urban Local Bodies (Municipalities). Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women **Case Study:** Indira Gandhi v. Raj Narain (1975) – Executive Accountability(Powers of Election Commission, Executive accountability, Free & fair elections)	**4**
IV	**Constitution Functions** Indian Federal System and its characteristics, Federal structure & distribution of legislative and financial powers between the Union and the States. Centre & State Relations, President's Rule, Constitutional Amendments and powers, Constitutional Functionaries, Emergency Provisions, Assessment of working of the Parliamentary System in India. **Case Study:** GST & Federal Structure (2017–2023)	**3**
	Total	**15**

Text Books:

1. E 1. Durga Das Basu, "Introduction to the Constitution of India", 24th edition,2020, Prentice Hall of India, New Delhi, ISBN-109388548868
2. Clarendon Press, Subhash C, Kashyap, ― "Our Constitution: An Introduction to India's Constitution and constitutional Laws", 5th edition, 2014, NBT, ISBN-9781107034624

Reference Books:

1. Maciver and Page, "Society: An Introduction Analysis", 4th edition-2007, Laxmi Publications, ISBN-100333916166
2. PM Bhakshi, "The constitution of India, Universal Law Publishing - An imprint of Lexis Nexis", 14th edition-2017, ISBN-108131262375.
3. Indian Constitution by Subhash C. Kashyap, National Book Trust, New Delhi.
4. Constitution of India and Professional Ethics, Dr. G. B. Reddy & Mohd. Suhaib, Dreamtech Press.

e-Books:

1. The full text of the Constitution of India (latest version) — available for download in English (and other Indian languages). Legislative Dashboard+2legislative.gov.in+2
2. Updated 2024 edition (English + Hindi Diglot) — PDF version. S3WaaS
3. Official publication with all amendments (as on May 2022) — PDF version. S3WaaS
4. A simple introductory book: The Constitution of India — An Introduction (by NCERT) — which gives a good basic overview. NCERT

MOOC / NPTEL/YouTube Links:

1. Constitution Law and Public Administration in India (NPTEL-NOC, IIT Madras) — comprehensive course covering constitutional law + public administration.
   https://onlinecourses.nptel.ac.in/noc20_lw03/preview
2. Playlist on YouTube: "Constitutional Studies" (NPTEL) lectures by law professors covering fundamentals, history, structure, rights etc.
   https://www.youtube.com/playlist?app=desktop&list=PLyqSpQzTE6M-Zj2GBVpJ3c7cfvMTcKrPL&utm_source=chatgpt.com

Program	S. Y. B. Tech.			Semester: IV			
Course	Environmental Studies			Code		AIDS25VEC-258	
Credit	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
02	-	1	1	-	-	25	25

Pre-requisites: Prior **k**nowledge of Multidisciplinary nature of environmental studies; components of environment — atmosphere, hydrosphere, lithosphere and biosphere.is essential.

Course Objectives: This course aims at enabling students to:
1. To gain an understanding of the Environment where we live
2. To Comprehend the importance of water
3. To educate about Air and Noise pollution
4. To explain the concepts of E- waste and Green Computing

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

CO1: Analyze the impacts of different types of environmental pollution on ecosystems and physical resources.

CO2: Describe the sources and effects of water, air, and noise pollution on human health and the environment.

CO3: Identify sources and types of e-waste and analyze basic e-waste management practices.

CO4: Apply green computing principles to promote environmental sustainability and reduce ecological impact.

Course Contents		
Unit	**Description**	**Duration [Hrs]**
I	**Environmental pollution** Environment and its importance, Definition, Types. Effect of environmental pollution on Plants, Non-living things.	3
II	**Water Pollution** Definition, Sources of water Pollution, Types of waste Water-Domestic and industrial wastewater	4
III	**Air pollution** Definition, Sources/causes of air pollution. Atmospheric layers, Effects on human. Noise Pollution: Definition of Noise Pollution, Types of Noise Pollution	4
IV	**E-waste management** Definition of E-waste, Sources of E-waste, Types of E-waste Green computing: Definition, Objectives of Green Computing, Necessity, Environmental benefits	4
Total		15

Curriculum S.Y. B.Tech. Artificial Intelligence and Data Science

Tutorial Conduction and Term work Guidelines (Set of Suggested Activities)	
1	Report/Presentation on the effect of Environmental Pollution on any world famous Structure/ monument.
2	Report/Presentation on importance of different sources of water available nearby them.
3	Report/Presentation based on the data collected from the local authorities on air pollution and noise pollution.
4	Report/Presentation on the E-Waste generated in the campus.
5	Time-series analysis of natural resource consumption of a given country using publicly available data

Text Books:
1. Bharucha, E., Textbook of "Environmental Studies", University Press (2005), 1st Edition ISBN-10:8173715408
2. 'Environmental Science: A Global Concern' Cunningham W.P. & Saigo S.W. 5th edition (1 July 1998) WCB, McGraw Hill
3. "The text book of Environmental studies", Dr. P. D. Raut, Shivaji University, 2013.
4. "A Text Book of Environmental Studies", Dr. D. K. Asthana, S. Chand.
5. "Environmental Pollution, monitoring and control", S. M. Khopkar, New Age Publication.
6. Mahua Basu," Environmental Studies", Cambridge University Press, ISBN-978-1-107-5317-3

Reference Books:
1. Bharucha, E., - "Textbook of Environmental Studies", Universities Press (2005), ISBN-10:8173715408
2. Mahua Basu,- "Environmental Studies‖, Cambridge University Press", ISBN-978-1-107-5317-3

e-Sources:
https://onlineethics.org/cases/life-and-environmental-science-ethics-case-studies

Program	S. Y. B. Tech. (Artificial Intelligence and Data Science)		Semester: IV	
Course	Community Engagement Project		Code	AIDS25VSEC-259

Credit	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
02	-	4	-	-	50	-	50

Pre-requisites: Prior knowledge of social and ethical responsibilities, Teamwork and communication skills is essential.

Course Objectives: This course aims at enabling students:
1. To establish a mutually beneficial relationship between the college and the community.
2. To engage with their local community, fostering empathy, teamwork, and problem
3. To understand challenges faced by the local community and the role of engineering in addressing those challenges.
4. To evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact

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

CO1: Identify local community needs and challenges by engaging with stake holders and evaluating real-world problems.

CO2: Implement practical, creative, and context-specific solutions using engineering principles to address community issues.

CO3: Evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations.

CO4: To apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.

Course Contents

Guidelines for Laboratory Conduction

- A group of 3 to 4 students could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay/college premise.
- Each group /practical batch is allotted to a faculty member of the department as a mentor.
- A division of 60 students can have 3 batches of minimum 20 students. Practical load of 4 hours to be allocated to each batch.
- The group of students will be associated with a government official / village authority /NGOs etc. concerned, allotted by the district administration, during the duration of the project.
- The Community Engagement Project should be different from the regular programmes of NSS/NCC /Green Club/Hobby Clubs, Special Interests Groups etc.
- An activity book has to be maintained by each of the students to record the activities under taken/involved and will be countersigned by the concerned mentor/HoD.
- Project report shall be submitted by each student/group of students.
- Students' groups can conduct an awareness programme on Health and Hygiene or in Organic Farming or in Fisheries or in advocating prohibition of liquor or about renewable energy, e waste management or any other activity in an area of their studies and as per his/her aptitude.

Guidelines for Oral Examination
- An internal evaluation shall also be conducted by a committee constituted by the HoD. Evaluation to be done based on the active participation of the student and marks could be awarded by the mentor/HoD.   - Oral Examination shall consist of presentation and demonstration of the project work carried out by the project groups.
Suggestive list of topics under Community Engagement Project
The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a student/group of students shall,   - Use/ miss-use of cell phones   - Career orientation of youth   - Water facilities and drinking water availability   - Health and hygiene of the school going students, home makers and old personals   - Health intervention and awareness programmes   - Horticulture   - Herbal and Nutrition   - Traditional and Modern health care methods   - Food habits   - Air /Sound /Water pollution   - Plantation and Soil protection   - Renewable energy and Solar Systems   - Yoga awareness and practice   - Health care awareness programmers and their impact   - Organic farming   - Food adulteration   - Incidence of Diabetes and other chronic diseases   - Blood groups and blood levels   - Chemicals in daily life   - Music and dance   - Women education and empowerment
Project Scope
- Conduct workshops or awareness drives on topics like digital literacy, environmental sustain ability, mental health, or career planning for local stakeholders.   - Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).   - Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.   - Promote health through awareness programs on hygiene, nutrition, and exercise.   - Teach basic computer or technical skills to students, staff, or the community
Proposal Submission

CEP Group should submit a two-page project proposal, preferably prior to the term commencement outlining the following:

- Title of the project
- Aim, Objective and expected outcome
- Plan of execution (timeline and activities).
- Place of the CEP and involvement of any local authority, NGP
- Required resources (if any).
- Get approval from the designated faculty mentor.

Learning Resources

Reference Books:
1. Waterman, A. "Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects"-,2nd Edition-2015, Routledge, ISBN: 978-1-63220-570-4
2. Beckman, M., and Long, J. F. "Community-Based Research: Teaching for Community Impact",1st Edition-2016, Stylus Publishing, ISBN: 978-1-62036-355-3

Program	S.Y. B.Tech (Entrepreneurship Management Course)			Semester: IV			
Course	Entrepreneurship Skills Development			Code:		IL25EMC-260	
Credits	Teaching Scheme (Hrs./Week)			Examination Scheme and Marks			
	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	-	2	1	-	-	25	25

Pre-requisites: Prior knowledge of Engineering Environment, Communication Skills, Mathematical and Analytical Skills are essential.

Course Objectives: This course aims at enabling students:
1. To Introduce the fundamental principles of entrepreneurship, forms of business organizations, and the start-up ecosystem.
2. To Enable students to identify, evaluate, and select viable business opportunities using structured techniques.
3. To Familiarize students with business models, financial planning, and market validation strategies.
4. To Expose students to key marketing strategies, customer acquisition techniques, and branding essentials for start-ups.
5. To Develop students' entrepreneurial mind-set and their ability to communicate and pitch business ideas effectively using structured storytelling techniques.

Course Outcomes: After completion of the course, the students will be able to:
CO1: Describe the role of entrepreneurship in economic growth and the startup ecosystem
CO2: Apply creative techniques to viable business ideas based on customer needs
CO3: Develop a basic business model using tools like the Business Model Canvas through market research
CO4: Implement basic marketing strategies for start-ups.
CO5: Deliver a concise business pitch using storytelling and effective communication techniques

Course Contents		
Unit	Description	Duration [Hrs]
I	**Introduction to Entrepreneurship** Entrepreneurship: Definition and evolution, Role of entrepreneurship in economic development, Role in job creation, GDP, and innovation. Characteristics of an Entrepreneur: Key traits: Risk-taking, innovation, pro-activeness, Leadership, perseverance, and resilience. Types of Entrepreneurships: Startup entrepreneurship, Social entrepreneurship, Intrapreneurship (corporate entrepreneurship), Lifestyle and small business entrepreneurship, Forms of Business Organization – Sole proprietorship, partnership, private limited, public limited. Entrepreneurial Mindset: Growth mindset and adaptability, Creativity and problem-solving, Opportunity recognition and initiative-taking. Overview	3

	of the Startup Ecosystem: Key stakeholders: Incubators, accelerators, angel investors, VCs, Government support schemes (Startup India, Atal Innovation Mission, etc.), Global vs. Indian startup ecosystems	
II	**Idea Generation & Opportunity Recognition** Creativity Techniques for Idea Generation: Definition and importance of creativity in entrepreneur- ship. Brainstorming: Rules of effective brainstorming. Individual vs. group brainstorming. Mind Mapping: Visual idea structuring using central themes and branches. Tools (manual and digital) for mind mapping. Understanding Customer Needs and Pain Points: Customer pain points and their identification, Problem-solution fit: Linking pain points to possible solutions. Observational techniques, user inter- views, and empathy mapping. Evaluating Opportunities: Difference between an "idea" and an "opportunity." Basic filters: Desir- ability, feasibility, and viability. Tools: SWOT Analysis, Opportunity Matrix, Industry trends, market gaps.	3
III	**Business Model Development** Introduction to Business Model Canvas: Definition and purpose of a business model, Overview of the Business Model Canvas by Osterwalder, Benefits of using BMC for startups. Key Components of BMC: Value Proposition: Defining what unique value the product/service of- fers. Addressing customer pain points. Customer Segments: Identifying target customers. Creating customer personas Revenue Models: Direct sales, subscriptions, freemium, licensing, etc. Basic Market Research for Validation: Importance of market research in early-stage business de- velopment. Designing effective surveys and customer feedback forms. Conducting basic interviews and analyzing responses. Introduction to MVP (Minimum Viable Product) and feedback loops.	3
IV	**Customer Acquisition, Pitching & Funding Sources** Search Engine Optimization (SEO): Basics of how search engines work, Keyword research and content optimization, On-page vs. off-page SEO Importance of Digital Presence – Website essentials, blogs, and analytics tools. Customer Acquisition Strategies: Understanding the Customer Journey – Awareness, interest, de- cision, action. Early-Stage Customer Acquisition Tactics: Word-of-mouth & referrals, Influencer mar- keting (micro-influencers), Email marketing basics, building a landing page and collecting lead. Crafting an Elevator Pitch: Definition and purpose, Key elements: Problem, solution, value propo- sition, target audience, Delivery tips: Clarity, brevity, confidence Overview of Funding Sources: Public & private capital sources, venture capital, debt financing. Bootstrapping: Meaning, benefits, and risks, Angel investors: Role, expectations, approach, Brief on incubators,	6

		government schemes, crowdfunding.	
	Total		**15**

Practical's/ Assignments

Sl. No.	Title	Objective	Description
1	Entrepreneurial Mindset Reflection	To encourage students to explore their personal views on entrepreneurship and recognize the key characteristics of an entrepreneurial mindset by studying the journey of a real-world entrepreneur.	**Write a reflective essay** (500–600 words) based on the following: Explain what entrepreneurship means to you personally. Identify an entrepreneur (Indian or global) whom you admire and explain the reasons for your admiration. Highlight specific mindset traits (e.g., risk-taking, resilience, innovation, adaptability) that contributed to this entrepreneur's success. Reflect on how these traits align with your own strengths or indicate areas you wish to develop.
2	Idea Generation Challenge	To foster creativity, structured brainstorming, and the ability to identify potential business opportunities based on real-world problems.	**Generate 10 Business Ideas** Use any structured brainstorming technique Ideas can be tech-based, social impact, service-based, or product-based Select One Idea- Choose the most promising idea from your list Write a 1-page Concept Summary, include the following: Problem Identified: Describe the specific problem or pain point your idea addresses. Solution Overview: Briefly describe your business idea. Target Audience: Identify the group of people or organizations that would benefit. Market Potential: Discuss the viability and scalability of the idea.
3	Business Model & Customer Validation	To help students p a clear, structured ss model and test its ptions through customer rsations. The goal is to iow to validate ideas h real-world feedback fine the business concept	**Part A: Business Model Canvas** 1. Choose a business idea (from Assignment 2 or a new one). 2. Create a Business Model Canvas with all 9 key blocks: Customer Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key

		ingly.	Activities, Key Partnerships, Cost Structure 3. Present the BMC in visual or tabular format. **Part B: Customer Interviews & Insights** 1. Identify 2–3 potential customers from your target segment. 2. Conduct brief interviews (5–10 minutes each) to gather insights on: Their pain points Their reaction to your proposed solution Willingness to pay or use your product/service 3. Summarize findings in a 1–1.5 page report that includes: Key customer quotes or paraphrased insights A revised Value Proposition or Customer Segment block (if needed) A short reflection: key learnings and potential changes to your idea.
4	Business Launch Plan – Marketing & Financial Snapshot	To develop a practical understanding of how marketing stratey and financial planning go hand-in-hand in launching a startup. Students will define a basic marketing campaign and align it with estimated costs, pricing, and projected revenue.	You are preparing to launch your business idea. Prepare a combined Marketing and Financial Snapshot including the following **Part A: Marketing Campaign Plan** • Define your target market by identifying primary customers. • Design a mini-campaign using one or more of the following channels: Social media (e.g., Instagram, LinkedIn) Print/digital flyers Email marketing • Describe the campaign content, including the message or offer to be promoted. • Optionally, create 1–2 sample marketing materials. Write a 300-word explanation outlining your marketing strategy and expected impact. **Part B: Financial Snapshot** 1. Startup Costs – Estimate your initial costs (fixed + variable) 2. Pricing Strategy – State your pricing model and justification

			3. Break-even Analysis – Basic cost vs. sales estimate
			4. 6-Month Revenue Projection – Expected sales and income
			Format: Use a simple table or spreadsheet (optional)
5	Elevator Pitch Video	To help students develop confidence and clarity in presenting their business idea in a short, compelling format. The exercise simulates real-world investor or networking scenarios where entrepreneurs must grab attention quickly.	**Prepare a 90-second elevator pitch for your business idea** (the same or refined idea used in earlier assignments). Your pitch should cover the following elements: The Problem – Problem Identification The Solution – Description of your product/service. Value Proposition – The unique value proposition. Target Audience – Audience for your idea. Call to Action – E.g. request for support, funding, feedback, etc. **Deliver Your Pitch:** Record a video and submit it with written version of your pitch. Ensure clear speech, confident body language (for video), and persuasive tone. **Reflection (Short Write-up):** Share what you learned about communicating your idea Describe challenges or rewards you experienced in the process

Text Books:

1. Bygrave, W.D., Zacharakis, A., & Corbett, A.C. "Entrepreneurship", 6th Edition-2025, Wiley, ISBN: 9781394262809.
2. Drucker, Peter F. "Innovation and Entrepreneurship: Practice and Principles", Reprint Edition-2006, Harper Business, ISBN: 9780060851132.
3. Osterwalder, Alexander & Pigneur, Yves. "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers", 1st Edition-2010, Wiley, ISBN: 9780470876411.

Reference Books:

1. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition-2011, Crown Business, ISBN: 9780307887894.
2. Kawasaki, Guy. The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone

Starting Anything, Portfolio (Penguin Random House),2015. ISBN: 9781591847847

MOOC/NPTEL/YouTube Links:

1. https://onlinecourses.nptel.ac.in/noc20_ge08/preview
2. https://onlinecourses.nptel.ac.in/noc21_mg70/preview
3. https://onlinecourses.nptel.ac.in/noc20_mg35
4. https://www.coursera.org/learn/entrepreneur-guide-beginners
5. https://wadhwanifoundation.org/
6. https://www.youtube.com/@wadhwani-foundation/videos

Program	S.Y. B.Tech (Ability Enhancement Course)		Semester: IV	
Course	Modern Indian Language (Marathi)	Code:	IL25AEC-261	
Credits	Teaching Scheme (Hrs./Week)		Examination Scheme and Marks	
	Lecture	Practical	Tutorial	PR	OR	TW	Total

Credits	Lecture	Practical	Tutorial	PR	OR	TW	Total
2	1	2	-	-	-	25	25

Pre-requisites : --

अभ्यासक्रमाची उद्दिष्टे :
   १. प्रात भौषिक कौशल्यांची क्षमता विकसित करणे.
   २. प्रसारमाध्यमांतिल संज्ञापनातिल स्वरूप आणि स्थान स्पष्ट करणे.
   ३. व्यक्तिमत्व विकास आणि भाषा यांतील सहसंबंध स्पष्ट करणे.
   ४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांचे परस्पर संबंध स्पष्ट करणे.
   ५. प्रसारमाध्यमांसाठी लेखनक्षमता विकसित करणे.

अभ्यासक्रम परिणाम (COs)
अभ्यासक्रम यशस्वीपणे पूर्ण केल्यानंतर विद्यार्थी खालील परिणाम साध्य करू शकतील:
CO1: शैक्षणिक व व्यावसायिक वातावरणात प्रातभाषिक संवाद कौशल्ये प्रभावीपणे प्रदर्शित करणे.
CO2: प्रसारमाध्यमांच्या संज्ञापनातील रचना, भूमिका आणि महत्त्व स्पष्टपणे समजावून सांगणे.
CO3: व्यक्तिमत्व विकास आणि भाषाज्ञान यांतील परस्पर संबंधांचे विश्लेषण करणे.
CO4: लोकशाहीतील जीवनशैली व प्रसारमाध्यमे यांच्यातील परस्पर संबंधांचे मूल्यांकन करणे.
CO5: विविध प्रसारमाध्यमांसाठी अचूक, संरचित आणि प्रभावी लेखन तयार करणे.

Course Contents		
Unit	**Description**	**Duration [Hrs.]**
१.	भाषा आणि व्यक्तिमत्व विकास : सहसंबंध लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे	७
२.	**प्रसारमाध्यमांसाठी लेखन** वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितसंपादन नभोवाणीसाठी भाषणाची संहितालेखन दूरचित्रवाणीसाठी माहितीपटासाठी संहितालेखन	७
३.	भाषा, जीवन व्यवहार आणि नवमाध्यमे, सामाजिक माध्यमे नवमाध्यमे आणि समाजमाध्यमांचे प्रकार : ब्लॉग, फेसबुक, ट्विटर नवमाध्यमे आणि समाजमाध्यमांविषयक साक्षरता, दक्षता, वापर आणि परिणाम	७
४.	वेबसाइट आणि ब्लॉग, ट्विटरासाठी लेखन व्यावसायिक पत्रव्यवहार	७
	Total	२८

संदर्भ ग्रंथ :

१. सायबर संस्कृती, डॉ. रमेश वसखेडे

२. उपयोगित मराठी, संपादक डॉ. केतकी मोडक, संतोष शेंगई, सुजाता शेंगई

३. ओळख माहिती तंत्रज्ञानाची, टिमोथी जे. ओ'लिरी

४. संगणक, अच्युत गोडबोले, मोज प्रकाशन, मुंबई

५. इंटरनेट, डॉ. प्रभोध चौबे, मनोरमा प्रकाशन, मुंबई

६. व्यावहारिक मराठी, डॉ. ल. रा. नसराबादकर, फडके प्रकाशन, कोल्हापूर

७. आधुनिक माहिती तंत्रज्ञानाच्या विश्वात, शिक्षापूंकर दीपक, मराठे उज्ज्वल, उत्कर्ष प्रकाशन, पुणे

Sl. No.	Suggested List of Experiments/Assignments
	Course Contents
1	Read a specific column (Sports, political, finance, editorial, education, international news etc) in the daily Marathi newspapers, summarize and present in the practical. A summary should be added as part of the journal. "दैनिक मराठी वर्तमानपत्रांमध्ये विशिष्ट कॉलम (क्रीडा, राजकीय, वित्त, संपादकीय, शिक्षण, आंतरराष्ट्रीय बातम्या इ.) वाचा, सारांश द्या आणि व सादरीकरण करा. त्या संदर्भातील सगळा सारांश जर्नल मध्ये जमा करावा."
2	Write blogs and posts on social media up to 200 words on recent development in their field of study. "सोशल मीडियावर त्यांच्या अभ्यासाच्या क्षेत्रातील अलीकडील विकासावर 200 शब्दांपर्यंत ब्लॉग लिहा, आणि पोस्ट करावा"
3	Professional letter / report writing. a. Write letter to the principal for organizing NSS camp in nearby village. Preparation of the budget, permission letters and report submission in the University "जवळच्या गावात एनएसएस शिबिर आयोजित करण्यासाठी मुख्याध्यापकांना पत्र लिहा. विद्यापीठात बजेट, परवानगी पत्रे आणि अहवाल सादर करणे." b.Write a letter for internship sponsorship to any organization. कोणत्याही संस्थेला इंटर्नशिप प्रायोजकत्वासाठी पत्र लिहा."
4	Book Review – Students are expected to read any novel, fiction or literature book of their choice and write a review on post it on social media of their choice. "पुस्तक पुनरावलोकन - विद्यार्थ्यांनी त्यांच्या आवडीचे कोणतेही कादंबरी, काल्पनिक कथा किंवा साहित्य पुस्तक वाचावे आणि त्यावर पुनरावलोकन लिहून ते त्यांच्या आवडीच्या सोशल मीडियावर पोस्ट करावे अशी अपेक्षा आहे."
5	Participation in Competitions (in college/outside the college) debate, declamation, elocution – A Report should be submitted स्पर्धेमध्ये (महाविद्यालयात/महाविद्यालयाबाहेर) सहभाग वादविवाद, भाषण, वक्तृत्व – अहवाल सादर करावा.
6	Group Activity: Road show, skit play, one-act play गट क्रियाकलाप : रोड शो, स्किट प्ले, एकांकिका
7	Participation in Purushottam karandam, Firodia karandak, Dajikaka Gadgil Karandak and Shreetej Karandak. पुष्कोतम करंडक, फिरोदिया करंडक, दाजीकाका गाडगीळ करंडक आणि श्रीतेज करंडक या स्पर्धेमध्ये सहभाग नोंदवावा.
8	Marathi film Review – Social Marathi movie available and write a review on post it on social media of their choice.

	मराठी चित्रपट पुनरावलोकन – सामाजिक आशयावर आधारित मराठी चित्रपट उपलब्ध आहे आणि त्या चित्रपटाची समीक्षा करून त्यावर सारांश लिहावा व तो वर्तमानपत्रे किंवा सोशल मीडियावर पोस्ट करावा पसंतीच्या सोशल मीडियावर पोस्ट करा.

संदर्भ ग्रंथ :

१. सायबर संस्कृती, डॉ. रमेश वसखेडे

२. उपयोगित मराठी, संपादक डॉ. केतकी मोडक, संतोष शेंगई, सुजाता शेंगई

३. ओळख माहिती तंत्रज्ञानाची, टिमोथी जे. ओ'लिरी

४. संगणक, अच्युत गोडबोले, मोज प्रकाशन, मुंबई

५. इंटरनेट, डॉ. प्रभोध चौबे, मनोरमा प्रकाशन, मुंबई

६. व्यावहारिक मराठी, डॉ. ल. रा. नसराबादकर, फडके प्रकाशन, कोल्हापूर

७. आधुनिक माहिती तंत्रज्ञानाच्या विश्वात, शिक्षापूंकर दीपक, मराठे उज्ज्वल, उत्कर्ष प्रकाशन, पुणे